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REDUCE ŞI AJUTĂ LA PREVENIREA PROBLEMELOR GINGIVALE ÎN 4 SĂPTĂMÂNI PENTRU A ÎNTRERUPE CICLUL GINGIVITEI

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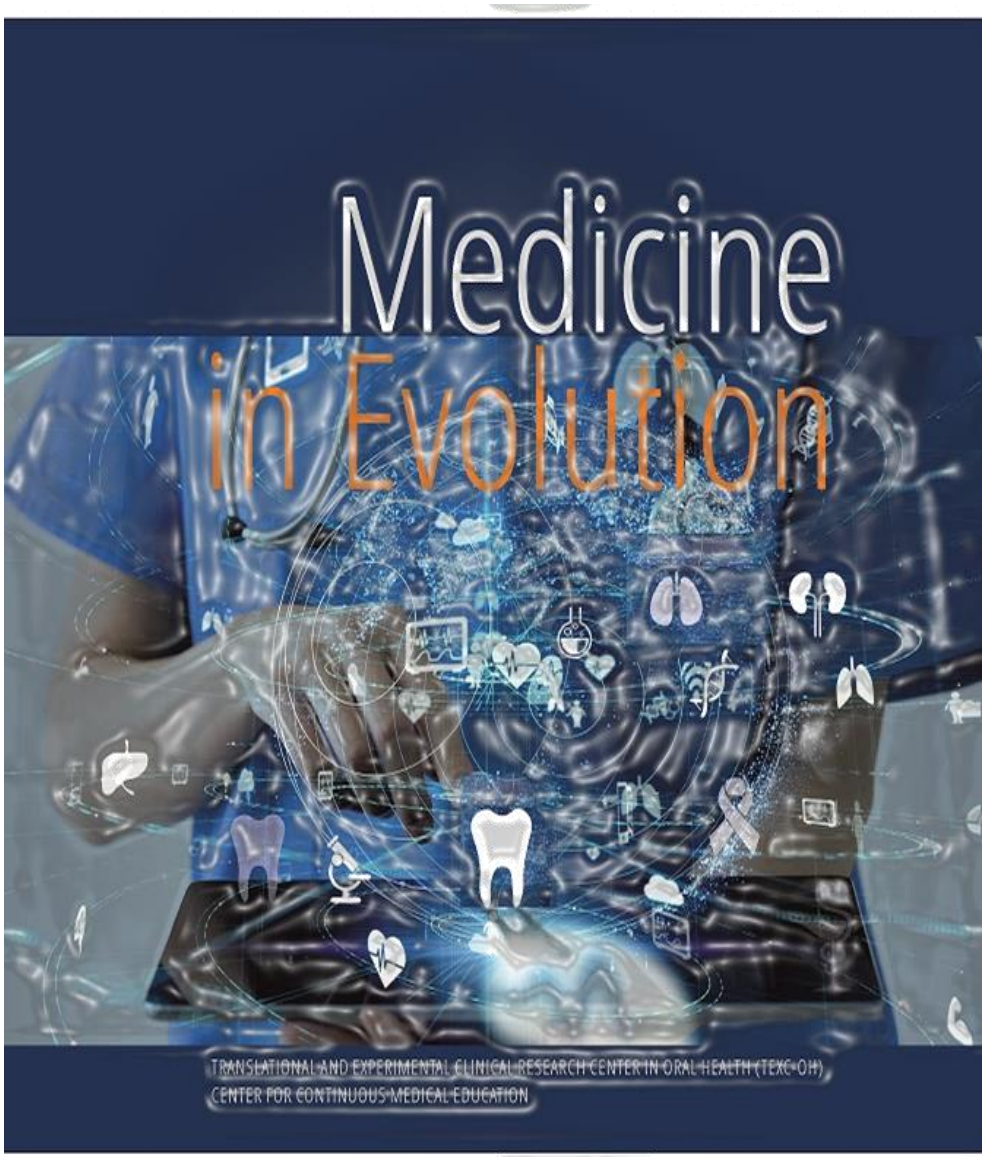
MEDICINE IN EVOLUTION



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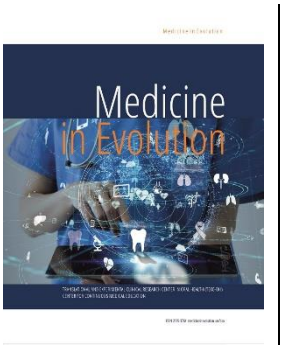

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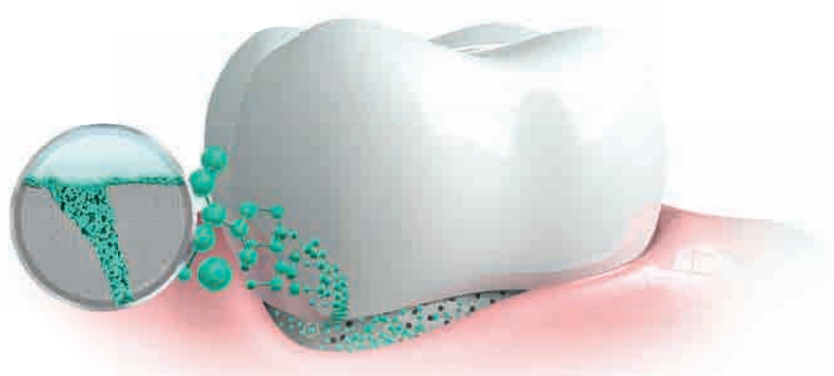
Calmarea **imediată* și de durată** a durerii din sensibilitatea dentară[1,2]



- În contact cu saliva, se formează un strat bogat în calciu, care obturează instant[1,*] tubulii dentinari deschiși
- Stratul rămâne intact în timp, chiar după expunerea la acizi, asigurând calmarea de durată a durerii din sensibilitatea dentară[2,3]

93% dintre pacienți confirmă calmarea durerii din sensibilitatea dentară[4]

93% dintre pacienți — confirmă reducerea hipersensibilității dentinare[4]

91% dintre pacienți — apreciază recomandarea medicului stomatolog[4]

Calmarea imediată* a durerii din sensibilitatea dentară[1]

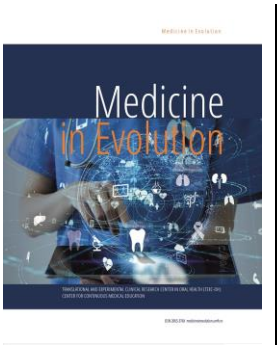
Calmarea imediată* și de durată începe cu recomandarea dumneavoastră**

*Pentru calmare imediată, aplicați direct cu degetul pe dintele sensibil și masați ușor pentru 1 minut;
**Doar în legătură cu pasta de dinți

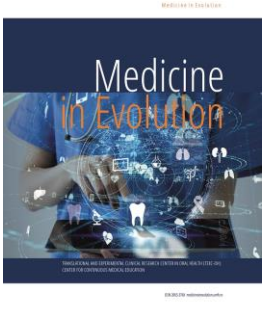
Referințe: 1. Nathoo S, et al. J Clin Dent. 2009;20(Spec Iss):123 –130; 2. Docimo R, et al. J Clin Dent. 2009;20(Spec Iss): 17– 22.; 3. Report Deon Hines-0003, 2016; 4. Studiu Ipsos cu privire la utilizarea produsului elmex® SENSITIVE PROFESSIONAL Repair & Prevent, efectuat în Polonia, rezultate după 2 săptămâni de utilizare, cu 325 de participanți (2017).

CONTENTS

ARTICLES



Post covid Follow up on Diabetic Patient



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Abstract

Aim and objectives: This study aimed to explore insulin necessity in hospitalized patients with non-insulin-dependent diabetes mellitus (DM) for the first six months after COVID-19 infection. A pro-inflammatory and pro-coagulative status probably contribute to the risk of worse outcomes in diabetes. Material and Methods: A number of 78 non-insulin necessitate diabetic patients with COVID-19 infection which needed oxygen therapy were included in the research. There were collected parameters routinely assessed to detect the possible predictors of diabetic patient evolution in SARS-CoV-2 infection. Results: The evolution of insulin necessity for 78 patients with non-insulin-dependent DM at admission was towards transformation into insulin-dependent DM at 6 months after discharge in 30 cases (38.5%), while the rest of the patients remained on oral antidiabetic drugs (48 patients, 61.5%). Conclusions: At hospitalized diabetic patient with covid-19 infection under corticotherapy, statistically significant differences were noted in HbA1c and aPTT level at 3 and 6 months after discharge.

Keywords: corticotherapy, COVID-19 infection, diabetes mellitus

INTRODUCTION

Since the initial COVID-19 outbreak in China, much attention has focused on people with diabetes because of poor prognosis in those with infection. Studies have shown that COVID-19 does not affect all population groups equally. In diabetic patients' evolution three important factors are age, race, and ethnicity.

In a study conducted by Yang at all it has been reported that patients infected with SARS-CoV2 suffered from hyperglycemia, which might be caused by SARS-Cov 2 damaging the pancreatic islets though ACE2 [1,2]. ACE2 is known as being a protein that permits the attachment of SARS-Cov2 virus to pancreatic cell. Loss of beta cell identity through the differentiation, degranulation and upregulation of inflammatory stress is potential underlying mechanism of pancreatic insulin secretion dysfunction [3].

Preexisting disease and a pro-inflammatory and pro-coagulative state all probably contribute to the risk of worse outcomes [4]. Data about monitoring post COVID-19 infection at patients with diabetes is limited at present. In a study conducted by C. Yuchen and all. for patients with diabetes and COVID-19, increasing odds of in-hospital death were associated with older age and elevated CRP (C-reactive protein), whereas risk factors for poor prognosis were lower albumin and higher CRP [5]. A better glycemic control among people living with diabetes could reduce the severity of the COVID-19 symptoms and the outcome of patient evolution in post covid. COVID-19 is associated with low-grade inflammation, which in turn, may induce or exacerbate insulin resistance [6]. The management of diabetes in the context of COVID-19 infection, using corticosteroids, is difficult. It must be dynamic because all the variables change from one day to the next [7,8].

Aim and objectives

This study aimed to explore evolution of hospitalized patients with non-insulin-dependent diabetes mellitus (DM) compare to insulin dependent patients for the first six months following COVID-19 infection.

MATERIALS AND METHODS

Data collection

Our clinical retrospective observational study has been conducted in the Medical Department of Pelican Clinical Hospital Oradea between 01.01.2021- 30.06.2021 and we selected a number of 98 diabetic patients who were admitted for SARS-CoV 2 infection.

Inclusion/ exclusion criteria

All patients with SARS-CoV2 infection and diabetes admitted in the Medical Department of Pelican Clinical Hospital Oradea between 01.01.2021-30.06.2021 were screened. Inclusion criteria were diabetic patients with COVID-19 infection which needs oxygen therapy, age above 18 years and the COVID-19 confirmed through real time-polymerase chain reaction (RT-PCR). The exclusion criteria were pregnant women, hospital stay less than 7 days, deceased patients, transferred to intensive care, patients with insulin therapy at admission, diabetic patient with advanced CKD (chronic kidney disease) patient under chemotherapy. Among the patients hospitalized a number of 90 patients met all the inclusion criteria. 12 patients were lost to follow-up because they did not complete all the required assessments. The evolution of the 78 patients with non-insulin-dependent DM at admission was towards transformation into insulin-dependent DM at 6 months after discharge in 30

cases (38.5%), while the rest of the patients remained on oral antidiabetic drugs (48 patients, 61.5%).

Study tolos

For all participants, there were registered basic demographic data: age, gender, body mass index (BMI), medical history and the type of treatment followed at home for diabetes mellitus and treatment in hospital. All patients received dexamethasone in the first 10 days after admission in the dosage of 16 mg/day. Other data collected included the HbA1c value at 3 and at 6 months after discharge.

For this study, there were collected parameters routinely assessed to detect the possible predictors of diabetic patient evolution in SARS-CoV-2 infection: complete blood count (leucocyte, lymphocyte, neutrophil), FBG (fasting blood glucose), HbA1c (glycated hemoglobin test), CRP (C-reactive protein), AST (aspartate aminotransferase), ALT (alanin aminotransferase), eGFR(estimated glomerular filtration rate), ferritin, procalcitonin, D-dimer, LDH (lactate dehydrogenase), aPTT (activated partial thromboplastin clotting time), natrium, potassium, INR (International Normalized Ratio), fibrinogen. All analyses were performed using standard clinical chemistry techniques in the clinical laboratory of the hospital where the study was performed. The samples were collected in the morning, a jeun, and we extracted data from the first day of admission, during hospitalization (days 3–7), and upon discharge, at 3 months and 6 months after discharge.

Statistical análisis

After checking the distribution by the Kolmogorov-Smirnoff test, the variables were described by mean and standard deviation, respectively median and interquartile range. The comparison of the variables between the two groups were checked out using the Student's test for independent batches, respectively the Mann-Whitney test, depending on the distribution. Categorical variables were analyzed by the chi-square test and described as percentages of the total number of cases. For variables with a statistically significant difference, a logistic regression model with stepwise entry was built to analyze the independence of the risk factors and determine the odds ratio. In order to verify the linear correlation between independent risk factors and glicated hemoglobin at 6 months after discharge, we used the Pearson correlation coefficient, as these are variables with a normal distribution.

RESULTS

We selected a number of 360 patients admitted for SARS-CoV2 infection. A number of 270 patients were excluded due to not meeting the inclusion criteria or had exclusion criteria, or not consent. Among the patients hospitalized a number of 90 patients met all the inclusion criteria. Of these, 12 patients were lost to follow-up because they did not complete all the required assessments. The evolution of the 78 patients with non-insulin-dependent DM at admission was towards transformation into insulin-dependent DM at 6 months after discharge in 30 cases (38.5%), while the rest of the patients remained on oral antidiabetic drugs (48 patients, 61.5%) (Figure 1).

The difference between the two study groups from a demographic and medical history point of view is shown in the following table (Table 1).

Table 1. Demographic and medical history for the two study groups

Parameter	Group IN	Group NIN	p-Value
Gender (M/F)	20/10	28/20	0,6193*
Age (years) – media (SD)	65,07 (8,43)	64,75 (10,56)	0,8900**
Environment of origin (U/R)	18/12	34/14	0,4590*
BMI (kg/m²) – media (SD)	28,93 (3,68)	28,29 (3,33)	0,4295**
PMH, N (%)			
HTN	26 (86,67%)	46 (95,83%)	0,2977*
Heart failure	6 (20%)	18 (37,5%)	0,1685*
AF	6 (20%)	2 (4,17%)	0,0631*
CVA	2 (6,67%)	6 (12,5%)	0,6581*
MI	4 (13,33%)	14 (29,17%)	0,1807*
COPD	8 (26,67%)	8 (16,67%)	0,4387*
Asthma	8 (26,67%)	12 (25%)	0,9184*
Cognitive disorders	2 (6,67%)	6 (12,5%)	0,6581*
Dyslipidemia	22 (73,33%)	32 (66,67%)	0,7125*

Group-IN = insulin-necessity at 6 months after discharge, Group-NIN = non-insulin necessity at 6 months after discharge, M=male, F=female, SD=standard deviation, U=urban, R=rural, BMI = body mass index, PMH=personal medical history, N=number, HTN= hypertension, AF= atrial fibrillation, CVA = cerebrovascular accident, MI = previous myocardial infarction, COPD= chronic obstructive pulmonary disease; *chi square test with Yates' correction, **the Student test for independent groups.

Among all preexistent comorbid conditions only atrial fibrillation was prevalent as having a weak statistically significance (p=0,0631) at patients who required insulin treatment at 6 months after admission but did not reach the threshold of statistical significance between groups. The rest of the criteria were similar for the two groups.

Comparing paraclinical investigations, at the time of admission, the results for the two groups are described in the Table 2.

Table 2. Paraclinical investigations at the time of hospitalization for the two study groups

Parameter – median (IQR)	Group IN	Group NIN	p-Value
FBG (mg/dl)	162 (150-220)	186 (131-204)	0,7267*
HbA1c (%)	7,8 (6,9-8,1)	7,75 (6,65-8,2)	0,9344*
CRP (mg/dl)	69,3 (30-102,1)	67,45 (36,65-118,75)	0,6366*
AST (U/L)	31 (22,3-41)	33,25 (26,15-39,5)	0,5377*
ALT (U/L)	39 (23,5-117,6)	38 (23,6-50,6)	0,2255*
eGFR (ml/min/1,73m²)	98,4 (93,2-100,2)	95,7 (89,75-100,55)	0,4595*
Procalcitonin (ng/ml) <0,5 / 0,5-2 / 2-10 / >10	30/0/0/0	`48/0/0/0	1,0000*
D-dimer (µg/ml)	0,34 (0,26-0,71)	0,38 (0,22-0,54)	0,3880*
Natrium (mmol/L)	133,1 (132,1-134)	133,2 (131,65-135,3)	0,7421*
INR	1 (1,00-1,02)	1 (1,00-1,11)	0,1583*
Lung damage (%)	65 (52-66)	61 (54,5-67)	0,7892*
Leucocytes (10³/µl)	9,40 (1,76)	7,34 (2,49)	0,0002**
Lymphocytes (10³/µl)	0,88 (0,42)	0,99 (0,32)	0,1896**
Neutrophil (%)	76,27 (11,90)	73,52 (12,19)	0,3307**
Ferritin (ng/ml)	1176,27 (635,12)	943,97 (473,04)	0,0688**
Parameter − medie (DS)			
LDH (U/L)	429,40 (158,82)	373,75 (156,22)	0,1299**
Potassium (mmol/L)	3,93 (0,44)	3,79 (0,41)	0,0893**
aPTT (second)	19,14 (1,55)	21,7 (3,47)	0,0003**
Fibrinogen (mg/dL)	575,8 (150,4)	543,6 (160,1)	0,3791**

Group IN=insulin-necessity at 6 months after discharge, NIN=non-insulin necessity at 6 months after discharge, IQR=interquartile range, DS=standard deviation, FBG=fasting blood glucose, HbA1c=glycated hemoglobin test, CRP=C-reactive protein, AST=aspartate aminotransferase, ALT=alanine aminotransferase, eGFR=estimated glomerular filtration rate, LDH=lactate dehydrogenase, aPTT=activated partial thromboplastin clotting time, INR=International Normalized Ratio, *Mann-Whitney test; ** the Student test for independent groups.

A higher leukocyte level and a shorter aPTT, at the time of admission, were associated with a higher probability of introducing insulin in the treatment of DM (Figure 1).

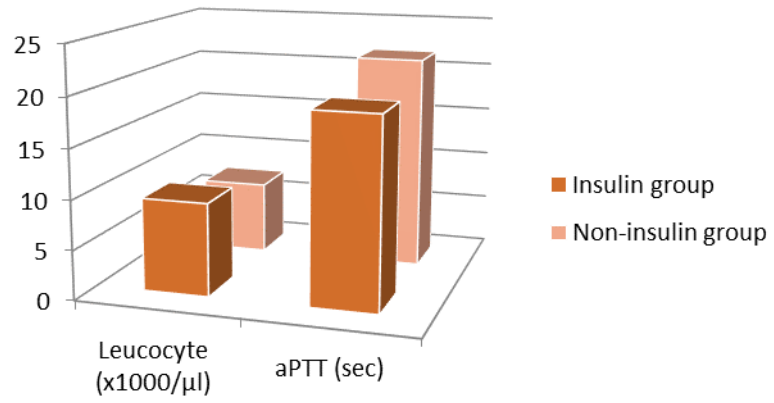

Figure 1. WBC count and aPTT level at the time of admission for the two study groups (IN at 6 months after discharge, NIN at 6 months after discharge, aPTT)

Higher plasma potassium levels and ferritin levels were also observed in these patients, but without reaching statistically significant differences.

The evolution of paraclinical determinations were evaluated as a possible risk factor for the outcomes of diabetes. Results are presented in the following table 3.

Table 3. Evolution of paraclinical investigations during hospitalization for the two study groups

Parameter – media (DS)	Group IN	Group NIN	p-Value
FBG in hospital (mg/dl)	218,2 (56,86)	193,25 (62,71)	0,0807*
Neutrophil at discharge (%)	79,88 (9,97)	70,42 (17,74)	0,0094*
LDH at discharge (U/L)	271,47 (69,89)	277,25 (98,66)	0,7803*
Fibrinogen at discharge (mg/dL) – media (SD)	355 (98,68)	367,1 (150,7)	0,6980*
Lung damage at discharge (%) – media (SD)	31,93 (8,34)	30,04 (6,76)	0,2761*
Parameter– median (IQR)			
HbA1c at discharge (%)	8,3 (8,1-8,8)	8,0 (7,25-8,25)	0,0135**
CRP at discharge (mg/dl)	37,1 (8,5-56,2)	22,72 (4,73-48,95)	0,6963**
AST at discharge (U/L)	29,2 (21-40)	23,6 (18,35-30,65)	0,2854**
ALT at discharge (U/L)	45,6 (26-67,8)	41,75 (34,5-60,3)	0,6963**
Leucocytes at discharge (10^3/µl)	7,6 (6,5-9,6)	8,66 (7,9-9,4)	0,1389**
Lymphocytes at discharge (10^3/µl)	0,92 (0,73-1,2)	1,2 (1,04-1,5)	0,0004**
Ferritin at discharge (ng/ml)	653 (452-1124)	590 (334-718)	0,0844**
Procalcitonin at discharge (ng/ml) <0,5 / 0,5-2 / 2-10 / >10	30/0/0/0	46/0/2/0	0,6918***
D-dimer at discharge (µg/ml)	0,45 (0,19-1,02)	0,32 (0,24-0,48)	0,6961**
Potassium at discharge	4,1 (3,9-4,3)	4,0 (3,9-4,1)	0,0765**
Natrium at discharge (mmol/L)	133,5 (132-135)	134,1 (133-136,5)	0,1387**
aPTT at discharge (seconds)	19,6 (19,1-20,1)	20,15 (19,2-21,15)	0,0458**
INR at discharge	1,1 (1,04-1,10)	1,1 (1,04-1,19)	0,1162**

IN=insulin-necessity at 6 months after discharge, NIN=non-insulin necessity at 6 months after discharge, DS=standard deviation, FBG=fasting blood glucose, HbA1c = glycated hemoglobin test, CRP=C-reactive protein, AST=aspartate aminotransferase, ALT=alanine aminotransferase, eGFR=estimated glomerular filtration rate, LDH=lactate dehydrogenase, aPTT=activated partial thromboplastin clotting time, INR=International Normalized Ratio; *the Student test for independent groups; ** the Mann-Whitney test.

Statistically significant differences were noted in HbA1c, lymphocyte count, neutrophil (in percentage), and aPTT level at discharge. Elevated HbA1c and neutrophils, along with low lymphocyte counts and aPTT were associated with increased risk of negative diabetes outcomes. Also, during hospitalization, differences were observed in blood glucose levels, ferritin level and potassium level at discharge, but these differences did not reach the threshold of statistical significance. Several criteria related to treatment with dexamethasone and length of stay (LOS) were also recorded and these results are exposed in the following table 4. Neither the specific treatment of the COVID-19 infection, nor the LOS influenced the evolution of NIN DM at hospital admission and after discharge. The results of patient reassessment at 3 and 6 months after discharge can be seen in the following table 4.

Table 4. Criteria related to treatment and duration of hospitalization for the two study groups

Parameter	**Group IN**	**Group NIN**	**p-Value**
Medication routes of administration of antiviral medication (oral/parenteral)	10/20	12/36	0.5912*
Dexamethasone dose (mg/zi) – median (IQR)	16 (16-16)	16 (16-16)	0.5343**
LOS – media (DS)	11.53 (1.43)	11.33 (2.25)	0.6656***

IN=insulin-necessity at 6 months after discharge, NIN=non-insulin necessity at 6 months after discharge, IQR=interquartile range, DS=standard deviation, LOS- lenght of stay; *chi square test with Yates' correction; **Mann-Whitney test; ***the Student test for independent groups.

As we can see, HbA1c at 3 and at 6 months after discharge could predict the evolution towards insulin-dependence of DM, with a statistical significance of 0,0669 at 3 months and 0,0061 at 6 months after discharge (table 5). As we can see, evidently the level of HbA1C at 6 months presents important differences being criteria to continue insulin therapy. Estimated glomerular filtration rate eGFR and BMI remain, in principle, unchanged during this follow-up period (Table 5).

Table 5. Patient reassessments at 3 and at 6 months after discharge for the two study groups

Parameter– media (SD)	**Group IN**	**Group NIN**	**p-Value**
HbA1c at 3 months (%)	7,67 (0,73)	7,32 (0,83)	0,0669*
HbA1c at 6 months (%)	7,13 (0,61)	6,70 (0,68)	0,0061*
BMI at 3 months (kg/m²)	28,46 (3,19)	28,29 (3,02)	0,8084*
BMI at 6 months (kg/m²)	28,00 (2,99)	27,87 (2,80)	0,8524*
Parameter– median (IQR)	**Group IN**	**Group NIN**	**p-Value**
eGFR at 3 months (ml/min/1,73m²)	98,6 (96,3-99,3)	97,9 (95,6-98,95)	0,5785**
eGFR at 6 months (ml/min/1,73m²)	98,7 (97,5-99,5)	97,7 (94,9-99,6)	0,4229**

IN=insulin-necessity at 6 months after discharge, NIN=non-insulin necessity at 6 months after discharge, IQR=interquartile range, DS=standard deviation, IQR=interquartile range, HbA1c=glicated hemoglobin test, eGFR=estimated glomerular filtration rate, BMI=body mass index; *the Student test for independent groups; **the Mann-Whitney test.

The logistic regression model built for the conversion of diabetes from NIN to IN for all variables found with statistically significant difference identified only 2 independent risk

factors: white blood cell count (odds ratio = 1.7136, CI 95%: 1.06-2,75) and aPTT level (odds ratio = 0.6484, CI95%: 0.44-0.95) at the time of admission.

The decision to introduce insulin in the treatment of the patient with DM based on the level of HbA1c, we also calculated the Pearson correlation coefficient between the level of HbA1c at 6 months after discharge and the level of leukocytes, respectively aPTT at the time of admission. The results were negative, the correlation between these values not being linear (for leukocytes – r=0.1159, CI 95%: -0.16 – 0.38, p=0.4230 and for aPTT – r=0.0486, CI95 %: -0.23 – 0.32, p=0.7374).

DISCUSSIONS

Management of diabetes in the context of COVID-19 infection is difficult in case of corticotherapy. All patients need to receive insulin therapy with strict monitoring of blood sugar levels during their hospitalizations in order to guarantee a good balance and a good evolution [7,8]. A review by Attri, B., Goyal, A., Gupta, Y. et al [9] provides a practical guidance on the use of the basal-bolus insulin regimen in patients with diabetes mellitus hospitalized with COVID-19. RECOVERY trial provides evidence that treatment with dexamethasone at dose of 6 mg once daily for up to 10 days reduces 28-day mortality in patients with COVID-19 who received respiratory support [10]. In our study we did not found statistically significant differences in case of corticotherapy for our two study groups.

The severity and COVID-19 outcomes are correlated with the extensive infiltration of neutrophils in the lung and neutrophil numbers in the peripheral blood, and the magnitude of neutrophilia is suggestive of the intensity of inflammatory responses [11]. Statistically significant differences were noted in lymphocyte count and neutrophil (in percentage) in our study for leucocyte p=0,0002 (during hospitalization), neutrophile at discharge p=0,0094 and lymphocytes at discharge p=0,0004. Elevated neutrophils, along with low lymphocyte counts were associated with increased risk of negative diabetes outcomes. Significantly higher levels of inflammatory biomarkers indicate that COVID-19 is a potent trigger of inflammatory responses that could be associated with poor clinical outcomes [12]. No differences were observed in case of inflammatory biomarkers (ferritin, CRP, procalcitonin) for our two study groups.

For hospitalized patients' insulin therapy is preferred, in case of moderate and severe COVID-19 disease. Better outcomes have been reported in COVID-19 patients receiving Metformin as therapy for diabetes mellitus [13].

Among the patients who were receiving oxygen, the use of dexamethasone was associated with a lower risk of invasive mechanical ventilation. In both these groups, the use of dexamethasone increased the chance of being discharged from the hospital alive within 28 days.

In our study a higher leukocyte level and a shorter aPTT, at the time of admission, were associated with a higher probability of introducing insulin in the treatment of diabetic patients with COVID-19 infection.

Age remains the strongest risk factor for severe COVID-19 outcomes. In our group media of age was around 65 years, but without reaching statistically significant differences between the two groups. Regarding death reports in the follow-up period, we had 100% survivors on participants in this study.

CONCLUSIONS

At hospitalized diabetic patient with COVID-19 infection under corticotherapy, statistically significant differences were noted in HbA1c, lymphocyte count, neutrophil (in

percentage), and aPTT level at discharge. Elevated HbA1c and neutrophils, along with low lymphocyte counts and aPTT were associated with increased risk of negative diabetes outcomes. As we can see, HbA1c at 3 months after discharge could predict the evolution towards insulin-dependence of DM. In our study patients with NIN DM at admission for Covid-19 infection, need insulin therapy at 6 months in a percentage of 38,6%. For that reason, the periodic diabethological follow- up is necessary for more than 6 months.

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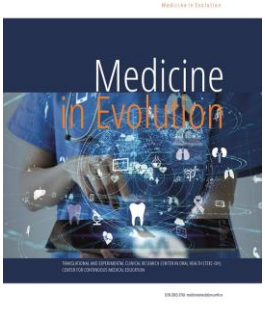
Diagnostic Marker of Interleukin 6 in Acute Pancreatitis



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Abstract

Cytokines exert their action by binding to specific receptors on the cell surface. The experimental model of acute pancreatitis has conclusively shown that TNF-α (tumor necrosis factor), IL-1 (interleukin) and IL-6 are also produced outside the pancreatic parenchyma. This phenomenon occurs one hour after the induction of acute pancreatitis, being accompanied by appreciable histological changes in the pancreas. IL-1 and TNF-α have as primary inducers the production of IL-6 and IL-8 and both occur systematically in acute pancreatitis. IL-6 is the major cytokine mediator of the acute phase response and is produced by monocytes, macrophages and endothelial cells. IL-6 is a measure of systemically activated pro-inflammatory cytokines. The serum level of IL-6 also reflects the severity of acute pancreatitis, its growth precedes that of C-reactive protein by 24-36 hours. IL-8 is the secondary mediator of TNF-α-induced neutrophil activation. It is a chemotactic factor that attracts neutrophils and plays a significant role in the development of MODS (multiple organ dysfunction), especially in acute pulmonary injury, associated with sepsis.

Keywords: Cytokines, pro-inflammatory, neutrophils, primary inducers

INTRODUCTION

Pathophysiological and molecular research has led to the understanding of the primary events that take place in triggering acute pancreatitis, although early diagnosis in pancreatic diseases, in general, continues to be a source of frustration in modern medicine. It presents the news in pathogenesis (co-localization theory, trypsinogen auto-activation theory), location of early events (acinar pancreatic cells being the "key" elements involved: muscarinic receptors, acinar membrane, the role of ionized calcium, the apoptosis) [1-3], extracellular events in the initiation of acute pancreatitis with a central place to enzyme activation and then to the systemic inflammatory response. Aspects related to early microvascular changes, dysfunctions of the ischemia-reperfusion injury and systemic microvascular abnormalities are so important that they justify the therapeutic concept of microcirculation protection [4,5]. The participation of the monocyte/macrophage system, the excessive activation of leukocytes involving the release and activation of lysosomal enzymes and of oxygen free radicals associated with the mechanism of the ischemia-reperfusion injury are defining for the pathogenesis of acute pancreatitis.

There are three factors that are generally involved in pathogenesis: intrapancreatic activation of the digestive enzymes, excessive stimulation of the inflammatory cells and vascular phenomena. Physiologically, zymogen granules are secreted by exocytosis into the excretory duct of the pancreas, and from here into the duodenal lumen where enterokinase converts trypsinogen into trypsin which, in turn, further activates other zymogens [6,7].

According to the co-localization theory, there is a premature fusion between the lysosomes and the zymogen granules, resulting in the phenomenon of crinophagy that triggers the activation of trypsinogen. Excessive trypsin disrupts the protease-antiprotease balance by consumption of specific (PSTI) and nonspecific trypsin inhibitors (α1-antitrypsin and α2-macroglobulin). This activates other zymogens (chymotrypsinogen, proelastase, phospholipase) as well as various protease systems (complement, kinin, coagulation and fibrinolytic factors) triggering a strong inflammatory reaction. The release of different mediators (platelet activating factor - PAF, cytokines, prostaglandins, leukotriene) stimulates the production of acute-phase proteins (endogenous antiproteases, C-reactive protein - CPR) and the activation of granulocytes and macrophages in the pancreas and peripancreatic level [8,9]. Cellular degradation results in the release of proteolytic and lipolytic enzymes (polymorphonuclear elastase-PMN-e), IL-6 generating free oxygen radicals in excess beyond the natural power of neutralization [10]. These cascade activations triggered in the acinar cells, rapidly encompass the entire pancreatic gland as well as the peripancreatic region. Secondary transport in the systemic circulation of many substances produced during the inflammatory reaction will lead to distant complications: cardiac circulatory failure, acute respiratory distress syndrome (ARDS), disseminated intravascular coagulation, acute renal failure, multiple organ dysfunction (MODS). These pathophysiological data enhance our understanding of the interest given in the dosage of biological markers (CPR, interleukins, PMN-e, phospholipase A2). Undoubtedly, the kinetics of the appearance of these markers represents a progress for early diagnosis and severity assessment, prognosis and rapid application of the appropriate therapeutic measures [11,12].

MATERIAL AND METHODS

A prospective study was used in order to achieve the proposed objectives that of determining the importance of the laboratory tests and of defining interleukin-6 as an early predictive marker in acute appendicitis.

In this regard, a group of 90 patients diagnosed with acute pancreatitis was created. All patients were hospitalized during 2021 in the surgical units of the County Emergency Clinical Hospital Oradea.

Determining interleukin- 6

The major actions of interleukin 6 (IL-6) on lymphoid and non-lymphoid cells are modulatory mechanisms of the body's immune and inflammatory responses. Although many of these functions overlap with those of type 1 interleukins (IL-1), such as the synthesis of acute phase reactants and fever, IL-6 also has anti-inflammatory effects. The IL-6-specific receptor (IL-6R) belongs to the (haematopoietic) cytokine receptor superfamily. IL-6R is a membrane protein complex consisting of two structural and functional subunits: a specific 80-kDa IL-6 binding protein (α chain) and a signal transducer, gp130 (b chain, a component for several types of receptors, such as IL-11, IL-27, IL-31). Cytokine IL-6 is secreted as a polypeptide consisting of 184 amino acids, with a molecular weight of about 21 kDa, depending on the degree of glycosylation. Like IL-1, IL-6 is secreted mainly by macrophages, being also synthesized by T and B lymphocytes, fibroblasts and endothelial cells, keratinocytes, synoviocytes, chondrocytes, epithelial cells. Thus, IL-6 is produced in response to bacterial and viral infections, inflammation or trauma, rapidly reaching detectable plasma levels unlike many other cytokines. Cytokine IL-6 is considered the major mediator for the hepatic production of acute-phase reactants: fibrinogen, serum amyloid A, haptoglobin, C-reactive protein, complement. Following exposure to IL-6, the liver decreases the albumin and transferrin synthesis, initiating processes of hepatocyte regeneration instead. Cytokine IL-6 stimulates humoral and cellular immune responses by acting on both B and T lymphocytes. IL-6 plays an important role in the differentiation and growth of the B cells and stimulates their production of immunoglobulins. It also promotes T cell activation, growth and differentiation. It is involved in the pathogenesis of multiple myeloma, being used as prognostic factor of the disease. IL-6 stimulates haematopoiesis (acts synergistically with IL-3), induces the secretion of ACTH and other pituitary hormones (prolactin, growth hormone, luteinising hormone). In addition to its pro-inflammatory effects, IL-6 also mediates several anti-inflammatory effects: while IL-1 and TNF mutually induce their synthesis as well as that of IL-6, IL-6 completes this inflammatory cascade as it inhibits the synthesis of both IL-1 and TNF while stimulating the synthesis of IL-1RA.

Recommendations for the determination of IL-6

Interleukin titres determined in various biological fluids may be used to diagnose immune disorders and to monitor treatments only when correlated with complementary clinical and paraclinical data.

Preparing the patient - fasting (in a fasting state) or postprandial

Collected sample - venous blood

Collecting tube - vacutainer with no anticoagulants, with/without separator gel4.

Collected quantity - minimum 0.5 mL serum

Causes of sample rejection - intensely hemolyzed, jaundiced, lipemic or bacterially contaminated sample; samples that did not arrive frozen at the laboratory

Processing after collection - the serum is separated by centrifugation as soon as possible after complete coagulation and the sample shall be immediately frozen at -20°C; samples collected outside laboratory points shall be transported in the container for frozen samples.

Sample stability – the serum is stable for one month at -20°C; do not defrost/refreeze.

Method - the immunochemical method with chemiluminescence detection (CLIA)

Reference values - <3.8 pg / mL4.

Interpretation of results

Increased levels of the marker are found in: rheumatoid arthritis; multiple myeloma (prognostic factor); autoimmune diseases (lymphomas); sepsis (AIDS); alcoholic liver disease; viral infections; transplant rejection; severe preeclampsia.

RESULTS

Bioclinical examinations were recorded in 90 patients (33.5%), 45 cases from every stage of severity, 30.2% representing mild acute pancreatitis and 37.5% severe acute pancreatitis (Figure 1).

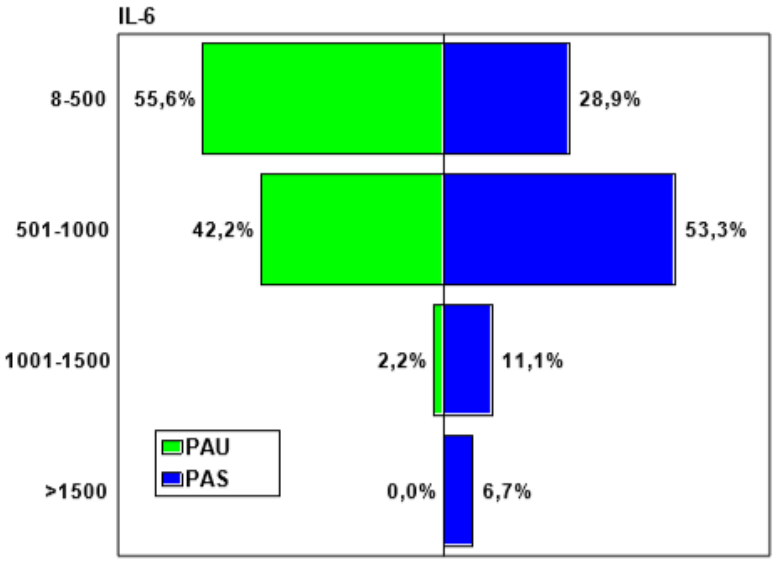

Figure 1. Distribution of cases in terms of severity of acute pancreatitis and IL-6. PUA=Mild acute pancreatitis; PAS=Severe acute pancreatitis

As far as the biological markers are concerned, the progress made in the field of prognostic evolution of acute appendicitis is based on the current knowledge of the pathophysiological events that appear during the evolution of the disease. They represent a priority in the current medical research due to their role in human pathology, in general, and due to the fact that these bioactive compounds may become therapeutic targets. The ideal marker should be an objective indicator and non-observer-dependent, simple, fast and cheap, safe and non-invasive, not influenced by comorbidities, with a high positive predictive value and usable in the first 24-48 hours after the onset of the disease.

There are significant differences between the two forms of acute pancreatitis in terms of IL-6 ($p < 0.001$). Thus, the number of normal values of IL-6 is almost two times higher in patients with mild acute pancreatitis than in patients with severe acute pancreatitis (55.6% versus 28.9%) and the mean value at mild acute pancreatitis is within normal limits (425.0 pg/ml), while in the group with severe acute pancreatitis the value is significantly increased (733.0 pg/ml).

DISCUSSIONS

Interleukin 6 (IL-6) is a pro-inflammatory cytokine synthesized by a wide variety of cells, including the periacinar fibroblasts, under the action of TNFα and IL-1β. It is the major mediator of acute-phase protein synthesis. Serum concentration precedes the growth of CRP by 24-36 hours and evolves in parallel with it [13,14]. The experimental evidence showed that IL-6 overexpression induces severe forms of acute pancreatitis and its counteraction with

monoclonal antibodies has protective effects. In human acute pancreatitis, the increased values were correlated with complicated and lethal forms of the disease. Recently, it has been reported that IL-6 is the best prognostic marker of respiratory failure [15-17]. There is an 18- to 48-hr latency, with maximum values in the first two days of illness, a period in which the discrimination between mild and severe forms of acute pancreatitis is maximum, comparable to that of IL-8. However, increased levels in concentration were observed in burns, trauma and elective abdominal surgery [18-20]. Despite all these shortcomings and contradictions, IL-6 remains one of the most widely used biological markers for the early detection of the severity of acute pancreatitis.

It is assumed that cytokines play an important role in the pathogenesis of acute pancreatitis, but little is actually known. Interleukin-6 (IL-6) exerts a wide spectrum of regulatory activities in immune and inflammatory responses [21-23].

Salvatore Cuzzocrea et al. conducted a study that investigated the role of endogenous IL-6 in the inflammatory response associated with acute pancreatitis. Thus, it has been demonstrated that endogenous IL-6 has an anti-inflammatory role in acute pancreatitis, through the activation and adhesion of neutrophils and the generation of cytokines, as well as reactive oxygen and nitrogen species.

In their study, Ohmoto Kenji and Yamamoto Shinichiro showed significant correlation between serum IL-6 level and the markers for predicting severity in acute pancreatitis, suggesting that IL-6 was a useful indicator of the severity of this disease [25].

CONCLUSIONS

The predominant pathological state of the patients with severe acute pancreatitis may be altered from the systemic inflammatory response syndrome to the compensatory anti-inflammatory response syndrome by successful treatment. There are significant differences between the two forms of acute pancreatitis in terms of IL-6 ($p < 0.001$). The number of normal values of IL-6 is almost two times higher in patients with mild acute pancreatitis than in patients with severe acute pancreatitis (55.6% versus 28.9%) and the mean value at mild acute pancreatitis is within normal limits (425.0 pg/ml), while in the group with severe acute pancreatitis the value is significantly increased (733.0 pg/ml).

Inflammatory markers appear in the serum later than the preceding ones. They offer the advantage of being able to monitor the clinical progression and provide complementary opportunities.

These biochemical parameters show promise and need to be evaluated prospectively in large patient cohorts, including a significant proportion of severe cases.

Apart from their diagnostic role, these new markers can become therapeutic targets, with the possibility of preventing or mitigating the severity of acute pancreatitis (AP).

Future hopes are tied to markers of pancreatic injury and inflammation, especially cytokines, provided that a dosing methodology is developed to make them useful in emergency conditions.

Genetic manipulation holds a new promise in identifying markers of severity in AP.

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Assessment of Oral Hygiene Behavior in Adults

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Abstract

This research aim to identify oral hygiene behavior as well as to observe attitudes towards oral hygiene. The objective of the present study are to reveal the frequency of dental check-ups, to evaluate the level of knowledge about brushing techniques, oral hygiene aids, importance of oral hygiene as well as the importance of regular check-ups, sources of information about oral hygiene made by individuals involved in the oral hygiene process. The study uses cross-sectional quantitative observational research with an online questionnaire on the Google Forms platform as the primary survey. 94 individuals with the age between 18-45-years old completed the questionnaire regarding oral health behavior. From the sample surveyed it appears that 47.9%(n=45) use an electric toothbrush. It was also observed that 69.1% (n=65) of the individuals flossed regularly and 65.2% (n=61) of these had injured the papilla through incorrect use. Another important and much omitted factor is that 90.4% (n=85) of those questioned rinse immediately after brushing, thus toothpastes with fluoride in their composition cancel out their remineralising effect.

Keywords: oral hygiene, attitudes, knowledge, quantitative research

INTRODUCTION

Oral health-related perceptions, attitudes, and behaviour is in relation to oral hygiene conditions in a young population. In order to improve oral hygiene, in preventive dentistry, educational interventions have often assumed that improved knowledge automatically leads to beneficial oral health behavioural actions (1). Maintaining oral health involves adopting specific behaviors like dental check-ups, frequent toothbrushing, healthy diet, and floss use. These behaviors are crucial in preventing dental caries and periodontal disease, as they reduce the prevalence of these diseases and aid in early diagnosis and prevention of oral diseases. Regular dental services are also essential for maintaining a proper oral health (2-4). Social-cognitive factors, such as the beliefs and attitudes of individuals towards health, may have a marked influence on the health actions of individuals and consequently on their health condition (5). Indivduals' behavior is influenced by their own choices, motivations, lifestyle, beliefs, and value system, as well as sociocultural norms and oral health systems (6).

Oral diseases impact individuals' psychological, physical, and social lives. Their perception of oral health is crucial for body image and quality of life (7). Neglecting oral health in healthcare can impact health behaviors and knowledge acquisition, affecting individuals' ability to promote good oral health (8).

There is evidence that supports the fact that proper oral health knowledge leads to better oral care practices and a positive attitude towards oral health habits (9). Understanding individuals' current knowledge about oral health can guide the development and implementation of educational strategies, ensuring that additional knowledge leads to improved oral health (10).

The oral health system in Europe is influenced by various factors, including government involvement in treatment and promotion policies, and investment in oral health professionals for primary prevention (11). This can lead to disparities in the population's oral health status, habits, and knowledge. The Nordic oral health model is characterized by extensive public dental services, free services for children under 18, and substantial investment in preventive services and regular checkups (12). The South European model is predominantly private, with limited government involvement and insurance schemes (11). The Eastern European model is mainly private, focusing on curative treatments and free treatment until age 19 (13). Recent studies suggest that involving dental hygienists in public health could increase public awareness and improve oral health outcomes (14).

The main reason behind this research is the European trend towards preventive dentistry at the expense of curative dentistry. One of the main factors facilitating the development of dental caries is poor oral hygiene, carried out incorrectly, or even the lack of it.

The literature shows that oral self-care practice, individual belief and attitudes are considered to have an important role in oral health care. The relation between psychosocial dimension and oral health behavior has been analyzed by several different studies. Good oral health is an essential component to maintain and improve general health and quality of life. Assessment of self-rated oral health is considered a valid and useful measurement indicator of oral health conditions in epidemiology, which can easily and simply evaluate the individual general oral health status (15).

It will also look at the directions and measures taken with regard to oral hygiene in particular and preventive dentistry in general at EU and national level, as well as measures taken to promote oral health.

Research has shown that adults hardly ever manage to clean more than 30–40% of their gingival margins by means of tooth brushing and interproximal hygiene (16,17). Thus, the question arises of why oral hygiene behavior is so inefficient.

Aim and objectives

The main purpose of this research is to identify oral hygiene behavior as well as to observe attitudes towards oral hygiene.

The main objectives of the present study are to reveal the frequency of dental check-ups, to evaluate the level of knowledge about brushing techniques, oral hygiene aids, importance of oral hygiene as well as the importance of regular check-ups, sources of information about oral hygiene made by individuals involved in the oral hygiene process.

MATERIALS AND METHODS

A retrospective descriptive study was conducted on a sample of 94 individuals from the general population. First-order demographic parameters such as biological factors (age, sex) and social factors (last education, current professional status) were analysed.

This study was based on cross-sectional quantitative observational research using an online questionnaire on the Google Forms platform as primary survey. The advantages of this method of data collection are possibility of using longer questionnaires, low probability of bias, possibility of remote administration, access to a larger sample and rapid data collection. However, this method of data collection also has disadvantages such as poorer data quality and a higher possibility of refusal by participants. However, these disadvantages are not an impediment in choosing this method of data collection and the influence of these disadvantages on the result is very small.

The sampling of individuals included the following steps setting up the sampling frame, choosing the sampling method, determining the sample size, carrying out the sampling activity and collecting the data.

There were 17 single-answer questions in the questionnaire. The first 5 questions of the questionnaire are designed to collect general data about the individuals and the next 12 questions are designed to collect data about the individuals' oral hygiene. The questions were ranked according to certain criteria in order to achieve the objectives of the study, including: biological factors (non-modifiable): age, gender, social factors (modifiable); last education completed, current professional status.

Table 1. Demographic and Dental Hygiene Habits Questionnaire

Questions
1. Your age:
2. Your gender:
3. Last completed studies
4. Your current professional status:
5. How often do you go to the dentist?
6. How often do you brush your teeth?
7. Duration of tooth brushing:
8. Do you use a manual or electric toothbrush?
9. How often do you replace your toothbrush?
10. Do you wash and dry the toothbrush head after each use?
11. Do you keep your toothbrush in its designated boxes?
12. Do you floss?
13. The next question is for people who answered 'yes' to the previous question. Have you ever injured your interdental papilla or gums while flossing?
14. Do you use interdental brushes?

15. Do you use the oral douche?
16. Do you use mouthwash?
17. Do you use mouthwash?

The main tools and adjuvants used in oral hygiene: toothbrush, floss, interdental brushes, mouthwash, mouthwash were also of interest in the questions. Investigating the correctness of the use of oral hygiene instruments: frequency of visits to the dentist, frequency of dental brushing, duration of dental brushing, frequency of toothbrush replacement, procedure of toothbrush care after brushing, how to store the toothbrush, the existence of lesions on the interdental papilla or gingiva after flossing, the time of rinsing the oral cavity after brushing was also investigated.

RESULTS AND DISCUSSIONS

As far as biological factors are concerned, it was found that 66% (n=62) of the participants in the questionnaire belong to the age category 18-25 years, 26.6% (n=25) belong to the age category 26-30 years, 2.1% (n=2) belong to the age category 31-35 years, 3.2% (n=3) belong to the age category 36-45 years, and 2.1% (n=2) of the participants are over 45 years. The gender representation shows that 78.7% of the participants are female and 21.3% are male.

In terms of social factors, we found that 67% (n=63) of the participants have a high school education, 31.9% (n=30) of the participants have a master's or bachelor's degree and only 1.1% (n=1) have a professional degree. 89.4% (n=84) of the participants are students and 10.6% (n=10) are employed.

The demographic characteristics of the sample studied by age group, gender, education, and professional status are highlighted in the following table.

Table 2. Demographic results

		The studied sample	
Demographic characteristics		Număr	Procent (%)
Age	18-25	62	66
	26-30	25	26,6
	31-35	2	2,1
	36-45	3	3,2
	Over 45	2	2,1
Sex	Male	74	78,7
	Female	20	21,3
Last completed studies	High school	63	67
	Vocational school	1	1,1
	Higher education	30	31,9
Current professional status	Student	84	89,4
	In the field of work	10	10,6

To determine the frequency of visits to the dentist, a sample of 94 individuals from the general population was surveyed: "How often do you go to the dentist?". Out of the total 94 participants in the questionnaire: 33% (n=31) go to the dentist once every 6 months, 36.2% (n=34) once a year and 30.9% (n=29) occasionally. The present study revealed that adolescents with poor oral hygiene conditions had less positive perceptions, attitudes, and behaviours towards oral health than those with good oral hygiene conditions.

In order to determine the frequency of tooth brushing among survey participants, they answered the following question: "How often do you brush your teeth?". Out of the total 94 participants of our study, 83% (n=78) perform tooth brushing twice a day, 16% (n=15) perform tooth brushing once a day and only 1.1% (n=1) once every few days.

Also in this questionnaire we aimed to find out whether participants respect the 2 minute time limit for brushing their teeth. According to the values in the figure we observe that out of the total of 94 individuals 5.3% (n=5) perform tooth brushing for less than 1 minute, 19.1% (n=18) perform tooth brushing for 1 minute, 54.3% (n=51) perform tooth brushing for 2 minutes and 21.3% (n=20) perform tooth brushing for more than 2 minutes.

In an attempt to outline the prevalence of manual versus electric toothbrush use in the general population sample we determined that 52.1% (n=49) use a manual toothbrush and 47.9% (n=45) use an electric toothbrush.

In this study we investigated whether the individuals surveyed replace their toothbrush at regular intervals of 2-3 months or at longer intervals. Of the total 94 individuals corresponding to the values in the chart 10.6% (n=10) replace their toothbrush less than every 2 months, 52.1% (n=49) replace their toothbrush every 2-3 months, 19.1% (n=18) replace their toothbrush every 4-5 months, 9.6% (n=9) replace their toothbrush every 5-6 months and 8.5% (n=8) replace their toothbrush only when they notice significant wear on their bristles.

This study determined whether the individuals in the study sample take the necessary measures to combat toothbrush contamination. Study participants were asked whether they wash and dry their toothbrush after each use. Of the total 94 participants, 75.5% (n=71) answered "yes", 13.8% (n=13) answered "no" and 10.6% (n=10) wash and dry their toothbrush after each use only sometimes.

In this study we have detected whether or not individuals avoid keeping toothbrushes in toothbrush boxes. According to the values in the chart 33% (n=31) keep toothbrush in toothbrush boxes and 67% (n=63) answered "no".

With this survey we have tracked whether the individuals in the sample use floss as an adjunct to brushing. According to the values in the chart 69.1% (n=65) floss, 29.8% (n=28) do not floss and only 1.1% (n=1) answered "sometimes".

For this study, individuals who answered yes to the question "Do you floss?" were screened. In this questionnaire we aimed to assess the correct handling of dental floss by detecting the occurrence of lesions in the interdental papilla or gingiva. Out of the total 94 individuals 65.2% (n=43) injure the interdental papilla or gingiva during flossing and only 34.8% (n=23) do not injure it.

In this study, additional means of tooth brushing and their use by the sample individuals were detected. Through this study we determined whether the study sample from the general population uses interdental brushes. According to the values from the total of 94 participants, only 14.9% (n=14) use interdental brushes and 85.1% (n=80) do not use them. The use of mouthwash was of interest in the research. The values obtained indicate that out of the total number of individuals only 21.3% (n=20) use mouthwash and 78.7% (n=74) do not use mouthwash. The study determined whether the individuals use mouthwash. According to the recorded values a majority of 66%(n=62) use mouthwash and only 34% (n=32) do not use mouthwash. In this study we investigated whether fluoride ion remineralisation is compromised because of immediate rinsing of the oral cavity after tooth brushing. According to the variables in the figure we found that a high rate of 90.4% (n=85) rinse the oral cavity immediately after brushing and only a minor rate of 9.6% (n=9) do not.

Using the first figure we determined that of the total sample of high school graduates only 33% (n=21) go to the dentist once every 6 months, 40% (n=25) go once a year to the dentist and 27% (n=17) go occasionally. According to the variables, of the total participants who have a high school education only 33% (n=21) go to the dentist once every 6 months, 30% (n=19) go once a year and 37% (n=23) go occasionally.

Consistent with the variables we noted that the correct duration of tooth brushing of 2 minutes was applied by a higher rate of individuals (61%) in the age category 18-25 years compared to the lower rate of individuals (44%) in the age category 26-30 years.

According to the graph we determined the correlation between the age category and the type of toothbrush used, so as the individuals move to an older age category, they tend to use more and more manual toothbrushes. According to the values in the graph it was noted that the use of the electric toothbrush prevails in the age category 18-25 years.

Consistent with the values in the graph, individuals who have only completed high school change their toothbrushes at short intervals, most of them at intervals of 2-3 months. Individuals who have completed higher education (bachelor's or master's degree) change their toothbrush approximately equally at intervals of 2-3 months and 4-5 months.

We found that individuals in the sample who brush twice a day replace their toothbrush every 2-3 months. In contrast, the largest number of individuals examined who brush once a day change their toothbrush every 4-5 months.

According to the variables in the chart, we determined that both individuals using the manual toothbrush and individuals using the electric toothbrush have a prevalence of tooth brushing duration of 2 minutes.

Consistent with the values in the graph, we found that the highest number of individuals who go to the dentist once every 6 months and once a year replace their toothbrush every 2-3 months. In the graph we found that the highest number of individuals who occasionally go to the dentist replace their toothbrush every 2-3 months and every 4-5 months.

CONCLUSIONS

Out of the total 94 individuals surveyed, only 30.9% (n=29) visit the dentist only occasionally. This in itself is not a fault but may be a factor in oral hygiene education. Regarding the frequency of brushing, out of a total of 94 participants in the questionnaire, only 17% (n=16) brushed less than twice a day, 16%(n=15) brushed only once a day and 1%(n=1) brushed every few days. In terms of duration of brushing 24.4%(n=23) brush for less than 2 minutes, 19.1% (n=18) brush for 1 minute and 5.3% (n=5) brush for less than 1 minute. Out of the total of 94 participants 37.2%(n=35) replace their toothbrush less often than indicated, of these 19.1%(n=18) replace their toothbrush every 4-5 months, 9.6% (n=9) replace their toothbrush every 5-6 months and 8.5% (n=8) replace their toothbrush only when it shows significant wear.

Of the total number of participants, 24.4%(n=23) are guilty of improper toothbrush hygiene, of which 10.6%(n=10) claim to wash and dry their toothbrush after use only sometimes and 13.8% (n=13) do not do so at all. Regarding toothbrush storage, 33% (n=31) of those surveyed store their toothbrush in toothbrush boxes.

Findings on objectives are mostly related to the use of adjuvant oral hygiene methods or the use of more modern means in the hygiene process. From the sample surveyed it appears that 47.9%(n=45) use an electric toothbrush. It was also observed that 69.1% (n=65) of the individuals flossed regularly, 1.1% (n=1) said they flossed sometimes, and 65.2% (n=61) of these had injured the papilla through incorrect use. Other adjuvants used by the individuals surveyed are mouthwash in 66% (n=62), mouthwash in 21.3% (n=20) and interdental brushes in 14.9% (n=14). Another important and much omitted factor is that 90.4% (n=85) of those questioned rinse immediately after brushing, thus toothpastes with fluoride in their composition cancel out their remineralising effect.

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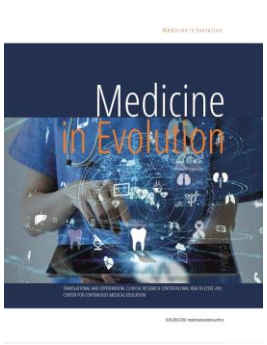
Parotid Gland Lithiasis in Stensen's Duct. Case Report



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Abstract

Salivary disease may result as a side effect from long term medications in chronic patients, dehydration, autoimmune diseases, ductal stenosis, smoking, trauma to salivary glands or due to systemic illness. Patients with sialoliths present a dysfunction related to salivary secretion. Salivary gland stones or calculi are the most common disease of the salivary glands most common in men aged between 30 to 60 years old. More than 85% of salivary sialoliths occur in the submandibular gland, 5–15% occur in the parotid gland and around 2% are in the sublingual and minor salivary glands. The article will present the case of an 84-year-old male patient with a parotid gland sialolithiasis.

Keywords: Parotid gland, lithiasis, sialoliths, parotid calculi

INTRODUCTION

Salivary gland stones or calculi are the most common disease of the salivary glands most common in men aged between 30 to 60 years old. More than 85% of salivary sialoliths occur in the submandibular gland, 5–15% occur in the parotid gland and around 2% are in the sublingual and minor salivary glands [1]. The submandibular salivary gland is more likely to develop lithiasis than the parotid gland because of the sinuos position of Wharton's duct and the more mucus rich saliva [2, 3]. The aetiology of the disease is unknown, but it is considered that it may result as a side effect from long term medications, such as diuretics and anticholinergics, dehydration, ductal stenosis, autoimmune diseases such as lupus and Sjoegren's syndrome, smoking, local trauma to the salivary glands, radiation therapy or kidney failure [4-6]. The incidence of salivary gland calculi is estimated at 1 in every 30000 patients. Men seem to be more affected than women within the ratio 2:1 [7]. The majority of the calculi are less than 1 cm, but bigger or giant sialoliths have been described in reports. The sialoliths have a homogenous predominantly composed of elements comprising hydroxyapatite, carbon, calcium, oxygen, phosphorus and sulfur. According to one of the ethiopathogenetic theories, the formation of the salivary gland calculi results from a deposition of calcium salts around a core made of bacteria, foreign bodies, desquamated epithelial cells with an estimated rate of 1-1. 5 mm per year [8]. Multiple salivary stones in the submandibular duct and the parotid gland have rarely been reported except the patients with severe Sjoegren's syndrome [9]. Sialadenitis, or salivary gland infection may be caused by bacteria, viruses, a salivary stone or other blockage of the salivary gland duct. The inflammation of a salivary gland and the resulting salivary stasis from the blockage may allow the bacteria to ascent into the gland [10]. The calculi are more common in Wharton's duct, so the sialadenitis is more present in submandibular gland in comparison to the parotid gland.

MATERIAL AND METHODS

An 84-year-old male patient came to the department of Oral and Maxillofacial Surgery with complaint of pain, bad breath and swelling that increases before meals. The intra-oral examination showed a stony hard mass, that could be palpated in the region of the left Stensen's duct with the approximate dimensions of 1 cm, with obstruction of the parotid duct (Figure 1). After palpation and massaging the gland, the ejection of saliva was with pus and not free flowing as on the other side. The patient was feeling pain and pressure. The computed tomography (Figure 2) confirmed the presence of a sialolithiasis of the left parotid gland and ipsilateral dilatation of Stensen's duct. The swelling was indurated, tender on palpation, and firm in consistency (Figure 2 c).

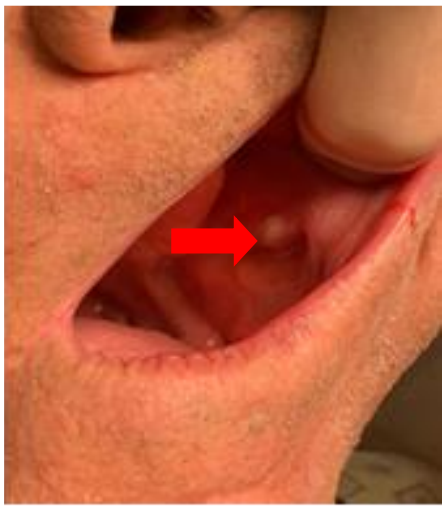

Figure 1. Stone like mass is palpable in the buccal mucosa

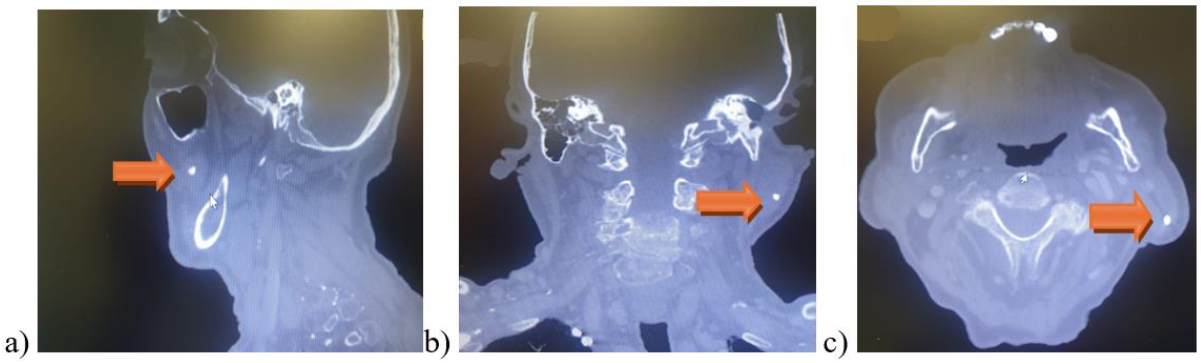

Figure 2. Sagittal, axial, and coronal CT images show a radiopaque sialolith measuring approximately 10 mm x 6 mm

On surgical exploration (Figure 3) under local anesthesia, a stone measuring about 10 mm x 6 mm in length was visible at the orifice as seen in (Figure 4), which was surgically retrieved. A stent was placed in the left Stensen's duct to maintain the patency of the duct and massage of the gland was done to support the flow of the saliva. Wound closure was done with 4–0 synthetic polyester non-absorbable.

Figure 3. Surgical exploration

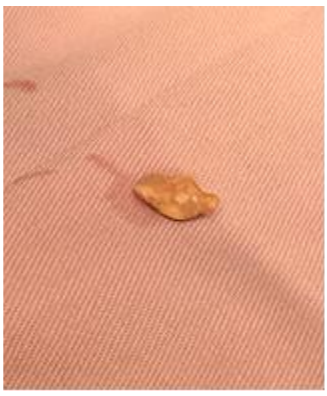

Figure 4. Sialolith

RESULTS

The post operative evolution of the patient was good. The patient was given medication as following: antibiotics, anti-inflammatory, antispastic and analgesic. Good oral hygiene and hydration with plain water was recommended. The patient was discharged after five days and advised to return for follow-up.

DISCUSSIONS

The salivary gland lithiasis is the most frequent cause of salivary gland swelling, the obstruction affects the parotid, the submandibular, and the sublingual glands. It predominantly affects individuals between 30 to 70 years old and is more common in males. The most frequent symptom is sialadenitis, inflammation of the gland, that can be acute or chronic, or even salivary colic associated with meals. In bacterial sialadenitits, there may be a purulent discharge. The initial management is conservative, with various minimally invasive surgical options available for persistent cases. In the case that we reported the calculi could be palpated with digital examination intra-orally; it felt like a hard mass. Less commonly, the sialolithiasis can be seen as granular masses at the entrance of the duct. In order to identify the degree of obstruction, the physician can try to massage the gland. The purpose of this massage is to see the if the saliva is passing through the duct or if it is blocked. Differential diagnosis includes ductal stenosis, Sjoegren's disease, sialosis, bacterial and viral infections, radiotherapy reaction. The diagnosis of sialolithiasis can sometimes be difficult. There are many cases that are asymptomatic and clinical symptoms appear later. An asymmetric swelling is present on the affected salivary gland. It has been reported that approximately 60% of parotid calculi and 30% of submandibular calculi are located distally in the ducts. Sometimes they are large, so the physician can visualise and palpate the stone in the oral cavity. Salivary stones vary in size their shape can be oval or round, their colour can be white or yellow. Sometimes the stones can be palpated along the anatomic course of the affected salivary gland [11-14]. Their size and weight differ. Sialoliths diameter ranges between 2 and 15 mm [14]. It is noted in literature that submandibular calculi are larger than parotid calculi [15]. Their usual weight is between 250 mg and 300mg but there are reported cases with calculi up to 5 g. [16]. We know that sialoliths have many manifestations and they may or may not be radioopaque. There are non-radioopaque sialoliths and their management is difficult radiographically. The computed tomography with axial, sagittal and cranial images is the preferred imaging modality in our department. We consider that CT scan is the most important tool for diagnosis, treatment planning and follow-up in the pathology of the salivary gland.

CONCLUSIONS

The first step in the treatment of the parotid gland lithiasis is conservative. Non-steroidal antiinflamatory and antispasticity drugs, antibiotics, if necessary, hydration, sialogogues (lemon, chewing gum, hard candies), massaging the gland to stimulate saliva secretion and flow, warm heat therapy. The second step in the treatment is removing the stone directly at the duct opening. If it is not possible, sialendoscopy is required. It is a minimally invasive procedure to diagnose and treat salivary gland disorders. Depending on the size of the stone (stone <3 mm) the procedure of choice can be interventional sialendoscopy with endoscopic removal (basket, forceps), when the sialolith is bigger between 3mm-6mm or bigger than 6mm interventional sialendoscopy with laser fragmentation or ESWL extracorporeal shock-wave lithotripsy. If the obstruction is severe then it requires surgical intervention, especially when the obstruction is close to the gland.

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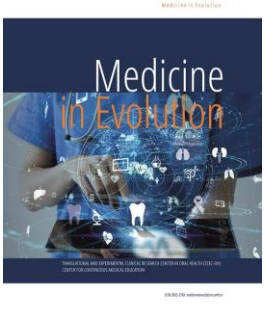
Anxiety Management in Dental Treatments through Virtual Reality



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Abstract

The integration of Virtual Reality (VR) into dentistry represents a significant advancement in patient-centred care, particularly for addressing dental anxiety, a common obstacle to effective treatment. This article examines the effectiveness of VR in reducing anxiety during dental procedures, combining a survey of dental students at the Victor Babeş University of Medicine and Pharmacy Timisoara with an extensive literature review. The survey evaluated students' views on VR's effectiveness against traditional methods and their readiness to use VR in future treatments. Results show a strong belief in VR's potential to outperform traditional anxiety management techniques, with many students willing to adopt it. However, implementing VR in dentistry faces challenges such as technological, financial, and operational issues. This study emphasizes the need for a strategic approach to VR integration, suggesting future research on its long-term effects, cost-benefits, and personalized VR experiences. VR's advancement in dentistry promises improved care and aligns with digital health innovation trends.

Keywords: Virtual Reality (VR); Dental Anxiety Management; Technology Integration in Dentistry; Patient-Centred Care

INTRODUCTION

The intersection of technology and healthcare has opened new avenues for enhancing patient care and management, particularly in dentistry [1,2]. Anxiety and fear associated with dental treatments have been long-standing barriers to effective dental care, contributing to avoidance behaviours and delayed treatment [3,4]. Virtual Reality (VR) emerges as a promising solution to mitigate these challenges by providing immersive experiences that distract and relax patients during dental procedures [5,6]. This article explores the effectiveness of VR in anxiety management in dental treatments, drawing insights from a recent survey conducted among dental students, alongside a review of relevant literature.

The introduction of VR technology in the dental field represents a significant shift towards a more patient-centred care, an approach that prioritizes the patient's comfort and experience during treatment. This innovative approach fundamentally reimagines the patient experience, prioritizing comfort, and engagement during dental treatments. Historically, dental visits have been associated with anxiety and discomfort, often leading to avoidance behaviours that compromise oral health [7–9]. VR technology, with its immersive and interactive capabilities, offers a transformative solution to this longstanding challenge. By simulating serene environments or distracting scenarios, VR has the potential to transport patients away from the clinical setting, thereby reducing their anxiety and perception of pain. This immersive technology not only caters to the psychological needs of patients but also aids dental professionals in performing procedures with greater ease and efficiency. The growing body of research supporting VR's effectiveness in anxiety reduction highlights its potential as a transformative tool in dental practices. Furthermore, the application of VR in dentistry extends beyond mere distraction. It encompasses patient education, where individuals can virtually experience their dental procedures before they happen, thereby demystifying the process and reducing fear of the unknown. This educational aspect supports informed decision-making and enhances patient autonomy, key principles of patient-centred care. By visually and interactively explaining procedures through VR, dentists can build trust and reduce anxiety, fostering a more positive patient-dentist relationship. [10–12]

In other words, the integration of VR into dental treatments aligns with contemporary trends in digital health innovations, where technology is increasingly leveraged to enhance health outcomes and patient experiences. As dental anxiety poses a significant barrier to seeking timely and necessary care, the utilization of VR technology offers a novel pathway to overcoming these challenges. This approach not only has implications for improving patient compliance and satisfaction but also for the overall efficacy of dental treatments. By reducing the stress and anxiety associated with dental visits, VR can play a crucial role in promoting oral health and preventing the exacerbation of dental issues due to neglect or fear of treatment.

The potential benefits of VR in dentistry extend beyond anxiety reduction, suggesting broader applications for patient education and treatment planning. Through virtual reality simulations, patients can gain a better understanding of their dental conditions, the proposed treatments, and the expected outcomes. This immersive form of patient education can demystify dental procedures, reduce fear of the unknown, and empower patients to make informed decisions about their oral health care. Additionally, VR can be utilized for training dental professionals, offering a risk-free environment to practice and refine their skills before performing procedures on actual patients [13,14]. This dual application of VR not only enhances patient care but also elevates the training and expertise of dental professionals, leading to overall improvements in dental health services.

Moreover, the implementation of VR technology in dental practices represents an innovative approach to addressing the psychological components of dental care. Recognizing that a significant portion of dental anxiety stems from negative past experiences or the anticipation of pain, VR offers a distraction technique that can break the cycle of fear and avoidance. This technology provides an alternative to traditional methods of anxiety management, such as sedation, by offering a non-pharmacological and patient-friendly option [15]. As research continues to evolve, the customization of VR experiences to meet individual patient needs and preferences could further enhance its effectiveness, making dental care more accessible and less daunting for those with significant anxiety. This progress in dental technology and patient care methodology signals a promising future for the integration of VR in enhancing the dental experience, ultimately contributing to better oral health outcomes and patient satisfaction.

The potential benefits of VR in dentistry extend beyond anxiety reduction, suggesting broader applications for patient education and treatment planning. Through virtual reality simulations, patients can gain a better understanding of their dental conditions, the proposed treatments, and the expected outcomes. This immersive form of patient education can demystify dental procedures, reduce fear of the unknown, and empower patients to make informed decisions about their oral health care. Additionally, VR can be utilized for training dental professionals, offering a risk-free environment to practice and refine their skills before performing procedures on actual patients. This dual application of VR not only enhances patient care but also elevates the training and expertise of dental professionals, leading to overall improvements in dental health services. [2,6,10].

MATERIAL AND METHODS

The primary data source for this essay is a survey titled "Anxiety Management in Dental Treatments Through Virtual Reality," conducted via Google Forms, with 100 respondents from the Victor Babeş University of Medicine and Pharmacy (UMFT), dental students.

To thoroughly assess the perceptions and attitudes of UMFT dental students towards the use of Virtual Reality (VR) for anxiety management in dental treatments, this comprehensive survey was implemented. The survey methodology was informed by the principles outlined by Fowler Jr. in "Survey Research Methods" [16], emphasizing the importance of clear, unbiased question formulation and the selection of a representative sample. The survey, hosted on Google Forms, comprised a series of structured questions, designed to capture both quantitative, data on levels of agreement or disagreement with VR's potential benefits, and qualitative feedback on personal experiences or observed outcomes when using or considering VR in dental settings.

Respondents were recruited from among dental students fifth year, with varying degrees of exposure to dental practice and VR technology (a subject that was also touched upon in their communication course), ensuring a variety of insights. The survey included demographic questions to contextualize responses, Likert-scale items to quantify perceptions of VR's effectiveness, and open-ended questions for detailed comments on potential applications, concerns, and suggestions for integrating VR into future dental care. This methodological approach aligns with the recommendations of Creswell and Creswell in "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" [17], who advocate for mixed-methods research to enrich data analysis and provide a more comprehensive understanding of the research topic.

RESULTS

This question seeks to gauge medical students' perceptions of the effectiveness of VR in reducing anxiety during dental treatments compared to traditional methods. The 100 respondents provided insightful data on the topic.

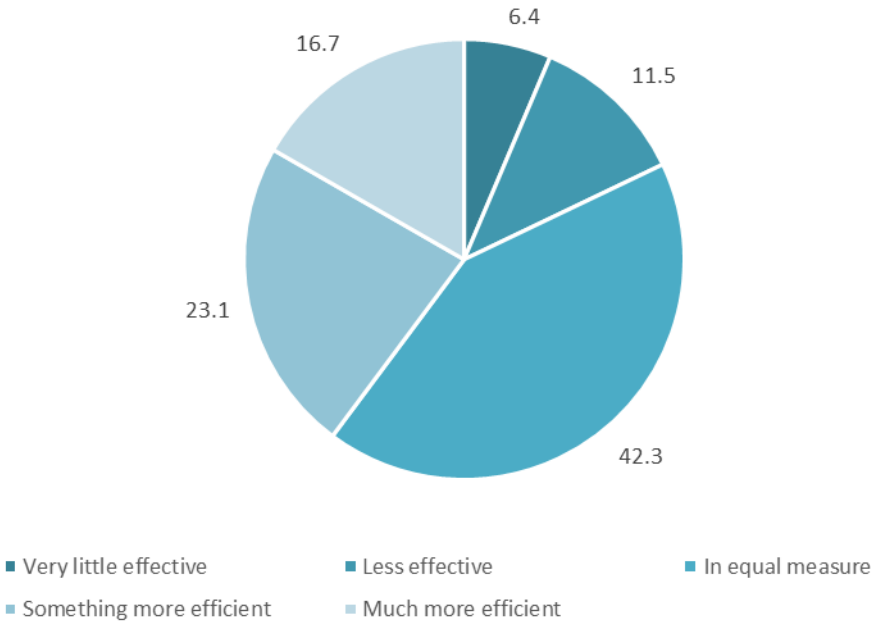

Figure 1. Medical students perception

A minority of the respondents (17.9%) view VR as less effective or very little effective in reducing dental anxiety compared to traditional methods. This scepticism could stem from concerns about VR's ability to provide a genuinely immersive experience that could distract from dental procedures or doubts about its effectiveness for all patient demographics. It may also reflect a preference for more established, familiar methods of anxiety management. The largest segment of respondents (42.3%) believed that VR is equally effective as traditional methods in managing dental anxiety. This significant proportion suggests a recognition of VR's potential as a viable alternative to sedation and counselling, acknowledging its benefits without dismissing the value of established methods. It indicates a balanced view, recognizing that VR can complement existing techniques and serve as part of a broader, multimodal approach to anxiety management in dental settings. What is more, nearly 40% of the respondents perceive VR as more efficient than traditional methods in reducing dental anxiety, with about one-sixth of the sample considering it much more efficient. This optimistic assessment could be attributed to VR's immersive nature, which can effectively distract patients and create a pleasant experience, thus reducing anxiety levels. This group likely sees VR as a modern, innovative approach that can surpass traditional methods in certain aspects, such as by offering customizable experiences tailored to individual patients' preferences and needs without the side effects associated with pharmacological interventions.

Another survey question aim was to assess the willingness of respondents to utilize virtual reality as a method for managing anxiety during their next dental treatment. It was a crucial question in order to understand the patient openness towards adopting new technology in a clinical setting, especially in the context of dental care where anxiety is prevalent.

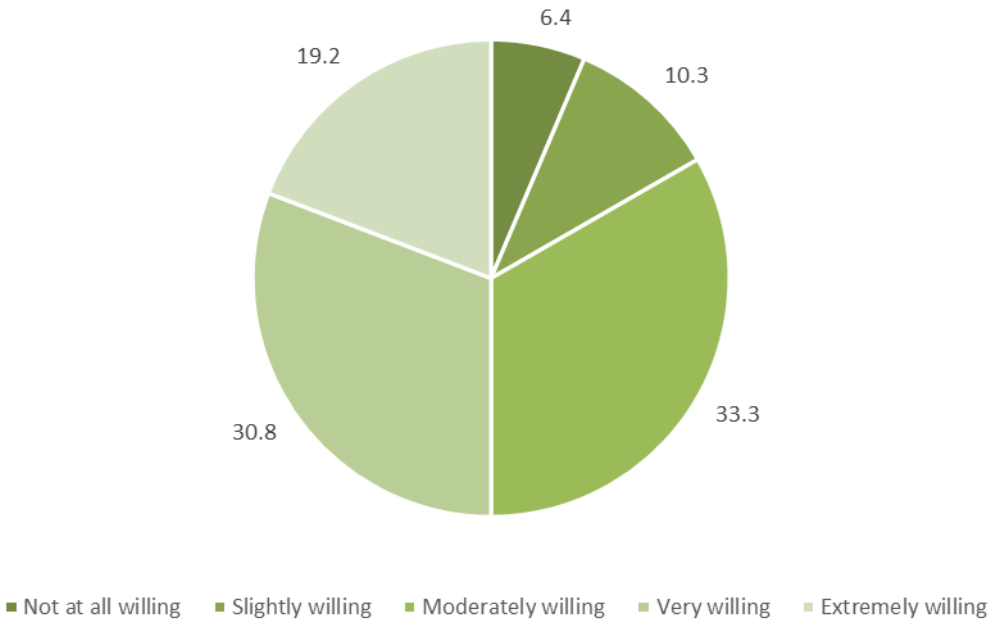

Figure 2. The willingness of respondents to utilize virtual reality as a method for managing anxiety during their next dental treatment

A minority of the respondents (16.7%) expressed reluctance or minimal willingness to use VR for anxiety management during dental treatments. This hesitance could be attributed to various factors such as discomfort with using VR technology, scepticism regarding its effectiveness, or a preference for traditional anxiety management methods. It highlights a segment of the population that may require more information or evidence of VR's benefits to overcome their reservations. A significant portion of respondents (33.3%) indicated a moderate level of willingness to try VR as a method for managing dental anxiety. This suggests an openness to exploring new technologies, albeit with some reservations that could stem from uncertainties about VR's practical application, potential side effects, or its efficacy compared to conventional methods. This group might represent individuals who are open to innovation but seek more assurance or empirical evidence before fully embracing VR in a dental setting. Interestingly, nearly half of the respondents (50%) showed a high level of enthusiasm towards using VR for anxiety management, indicating a strong interest in innovative approaches to enhance their dental experience. They likely perceive VR as a promising tool that can offer a significant improvement in managing dental anxiety, possibly due to positive predispositions towards technology or dissatisfaction with existing anxiety management options. Their readiness to adopt VR suggests a potential market for implementing such technologies in dental practices, highlighting the importance of addressing this demand with effective and accessible VR solutions.

DISCUSSIONS

In conclusion, the survey insights underscore the complexity of introducing VR technology into dental anxiety management. While there is evident enthusiasm and potential for VR to enhance dental care, successful implementation will require a multifaceted approach that considers patient preferences, empirical evidence, and the practicalities of integrating new technologies into existing healthcare frameworks. Future research should continue to explore the long-term effects of VR on dental anxiety, the cost-benefit analysis of VR adoption in dental practices, and strategies for personalizing VR experiences to meet

diverse patient needs. Ultimately, as mentioned before, the integration of VR into dental treatments represents a forward-thinking approach to healthcare that aligns with contemporary trends towards patient-centred care and technological innovation.

CONCLUSIONS

The survey of dental students on the use of VR for anxiety management in dental treatments indicates a strong belief in the potential of this technology to improve patient care. Supported by literature, the findings suggest that VR can significantly reduce dental anxiety, enhancing patient experiences and outcomes. However, successful implementation will require addressing practical challenges and integrating VR within a broader strategy of anxiety management. The practical challenges of implementing VR in dental settings are multifaceted, ranging from technological to financial and operational considerations. For instance, the initial cost of VR equipment and the need for ongoing maintenance and content updates can pose significant barriers to widespread adoption. Additionally, training dental staff to effectively use and troubleshoot VR technology is crucial for ensuring a smooth integration into daily practice. These challenges underscore the importance of a thoughtful and strategic approach to adopting VR, one that includes evaluating the return on investment in terms of improved patient satisfaction and potential increases in patient throughput due to reduced anxiety and more efficient procedures. Moreover, the integration of VR technology into dental practices must be done in a manner that complements existing anxiety management strategies, such as cognitive behavioural therapy and pharmacological interventions. As VR technology continues to evolve, the potential for creating highly immersive and personalized experiences offers exciting possibilities for further reducing dental anxiety and enhancing patient care. Future research in this area will be vital for identifying best practices for VR implementation and for understanding its full impact on the dental industry.

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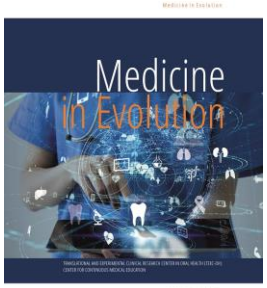
A Case of Odontogenic Keratocyst in the Posterior Ramus and Body of the Mandible



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Abstract

The dental lamina gives rise to the odontogenic keratocyst (OKC), a common odontogenic cyst that affects the maxillofacial region. The OKC is distinct from other jaw cysts and is more likely to return when combined with aggressive clinical behaviour. The recurrence rate in OKC is 25%–30%. In 2005, the World Health Organization (WHO) group categorized odontogenic keratocyst (OKC) as a tumour and proposed the abbreviation KCOT to differentiate the condition from the ortho keratinizing variant. The WHO reclassified KCOT as OKC in 2017 based on data demonstrating non-neoplastic clinical behaviour. The 19-year-old male in this case study has OKC in the ramus and body of his jaw, near the left mandibular molar tooth. This case study aims to demonstrate the need for dentists to do in-depth investigations into each circumstance and offer patients better treatment options with ongoing patient monitoring and follow-up. Enucleation, marsupialization, and other surgical techniques are possible; however, in this case, our objective was to preserve the patient's mandible and facial features.

Keywords: Keratocyst, odontogenic cyst, mandible

INTRODUCTION

The cystic lesions that most frequently affects the maxillofacial region are odontogenic cysts. They are generally divided into two groups: one for development, which includes keratocyst and dentigerous cysts, and the other for inflammation, which includes radicular cysts [1]. The odontogenic keratocyst (OKC) was first described by Philipsen (1956), in 2005, it was designated by the World Health Organization as a keratocystic odontogenic tumor (KCOT). Then reclassified as odontogenic keratocyst (OKC) in 2017 [2]. It is "a benign unicystic or multicystic intraosseous tumor of odontogenic origin, with a unique lining of para keratinized stratified squamous epithelium and propensity for aggressive, infiltrative tendencies" [3]. The percentage of OKC versus other cysts of the jaws as given by different authors: Hjorting-Hansen et al. and Toller 11%; Brannon and Payne 9%; and Pindborg and Hansen 7% [4-9]. The lesions can grow remarkably without appreciably deforming the jaw skeleton because growth occurs mostly in the antero-posterior dimension. The propensity for rapid growth is brought on by increased osteolytic activity of prostaglandin substances in the cell population of the cyst lining, higher activity of the epithelial cells lining the cyst, and higher accumulation of hyperkeratotic scales in the cyst lumen, resulting in a greater hydrostatic pressure difference [10]. The OKC has a unique and prevalent clinical and histologic lesion with aggressive nature. It often develops in the dental lamina, but some speculate that basal cell component may be its likely source [11]. The etiology of KCOT is related to the development of the dental lamina and, in particular, remnants of it after it has served its purpose. These dental lamina-derived epithelial islands are primarily seen in the periodontal ligament and gingiva. It clarifies the clinical entity of OKCs lateral follicular or periodontal appearance [12]. The characteristic features of OKC are the tendency to grow along the cancellous channels with very little cortical expansion. Numerous hypotheses regarding the growth of KCOT have been put forth. These include intraluminal hyperosmolality, active epithelial proliferation, the collagenolytic activity of the cyst wall, and synthesis of interleukin 1 and 6 by keratinocytes which will induce the secretion of keratocyte growth factor from interactive fibroblasts along with tumor necrosis factor leading to increased levels of prostaglandins and expression of the parathyroid related protein [12]. The mandible is involved in 70% or more cases, particularly in the third molar, angle, and ramus regions. Next, the most common site of occurrence is the maxillary third molar, followed by the mandibular premolar.

MATERIAL AND METHODS

A 19-year-old male patient reported to our dental institute with mild pain and swelling in the lower left backregion of the mandible. The patient was sent from a dental private practice after the dentist saw the orthopantomography (Figure 1).

Figure 1. Unilocular radiolucency with scalloped and corticated margins seen in the mandibular posterior left body and ramus extending next to the tooth 38

An unilocular radiolucency can be seen in the mandibular posterior left of the body. Computed tomography was done to examine the extent of the lesion three-dimensionally (Figure 2).

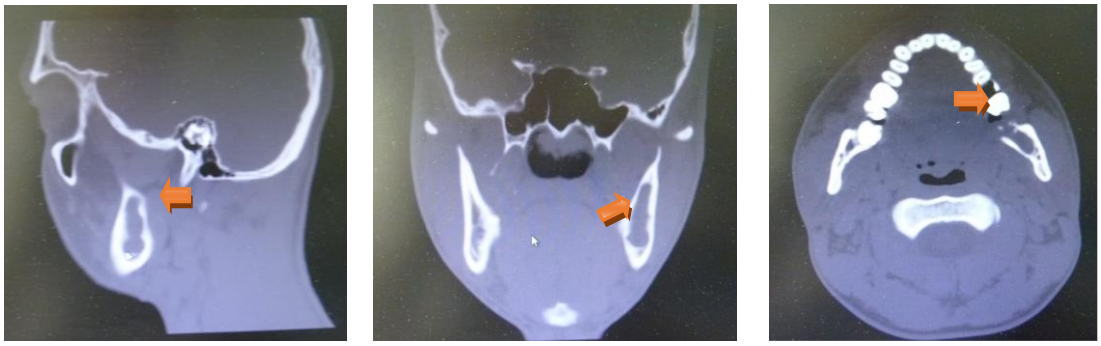

Figure 2. Sagital, coronal and axial images of the CT revealed an unilocular radiolucency

The computed tomography revealed in the left mandibular angle, next to the root of the tooth 38 a well-defined unilocular cystic mass, with axial diameter of approximately 7/11 mm and cranio-caudal diameter of 30 mm, which thins the cortical bone. Antibiotic and anti-inflammatory therapy was started.

After taking the informed consent the patient was scheduled for surgery (Figure 3) In analgesia, local anesthesia was performed, standard triangular flap (Figure 4), cyst enucleation with curettage (Figure 5), histopathological examination, tooth extraction 38 (Figure 6), wound closure.

Figure 3. Prepared sterile surgical instruments

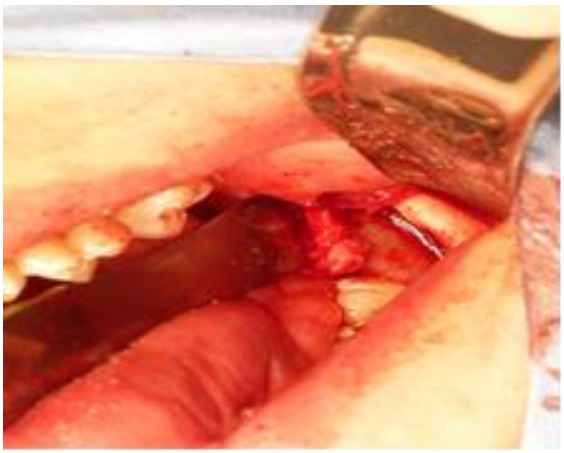

Figure 4. Intraoral view after cyst extirpation

Figure 5. Excisional biopsy of the cyst

Figure 6. Tooth 38 after surgical extraction

The excisional biopsy revealed cell layer thick para keratinized stratified squamous epithelium and necrotic epithelium.

RESULTS

The evolution of the patient was favourable, he respected the indications and the compliance was very good. Preoperative and postoperative antibiotics and anti-inflammatory regimen was followed. The suture was removed after 8 days. The postoperative course was uneventful and the patient is still being followed-up (Figure 7).

Figure 7. Orthopantomography 7 months after surgery

DISCUSSIONS

According to a study conducted by Borgehesi A et al. in 2018, OKC account for around 10% of all odontogenic cysts. The reported age distribution ranges from 8 to 82 years, with a high occurrence in the third decade of life. There is a slight male bias [13]. The same findings were observed in our case. A study by Hasen EH et al. in 1969 highlighted that keratocyst in the jaw appeared to be non-inflammatory. The epithelium is most likely derived from epithelial remnants from the dental lamina, and the researchers concluded that the dental lamina could yield keratinized epithelium [5]. Toller PA et al. in 1972 featured that the

keratinizing epithelium surrounding the odontogenic keratocyst shows cell maturation rather than degeneration and can expand in size primarily through epithelial cell multiplication. The turnover of epithelial cells in odontogenic keratocyst is higher than in other cysts [6]. Yazdani J et al. in 2009 pointed out that OKC is unique among jaw cysts as it frequently recurs and is related to aggressive clinical behavior. OKC has a risk of relapse of 25-30% [1]. Brannon RB and Pinborg JJ suggested in their study that OKC has a peak incidence in the second and third decades of life. The mandible to the maxilla ratio was 2:1, and the ramus and third molar regions of the jaw were the most often used areas. The same was observed in this case; the lesion involved the mandible's body up to the mandible's angle and ramus. The dentigerous cyst was the most common diagnosis for keratocyst. These cysts may be very aggressive clinically. Their radiographic appearance was quite variable, although they resembled ameloblastomas; the same appearance was evident in our case, which caused a dilemma in arriving at a diagnosis. They have a high recurrence rate compared to other types of odontogenic cysts [7,9].

CONCLUSIONS

In this case report, a 19-year-old male patient with a cystic swelling clinically and radiographically mimicking an ameloblastoma in the left side ramus and body of the mandible. The histopathologic report supported the diagnosis of OKC. This OKC was discovered accidentally by a routine investigation at the dentist after a routine orthopantomography. The affected tooth, 38 was extracted, the cyst was enucleated completely and a long-term follow-up was conducted. It showed proper healing (Figure 9), and as of this writing, OKC has not returned. Enucleation, marsupialization, and other surgical techniques are possible; however, we aimed to preserve the patient's mandible and facial features in this case. This case study intends to demonstrate the need for dentists to thoroughly evaluate each scenario and provide better treatment options with long-term patient follow-up.

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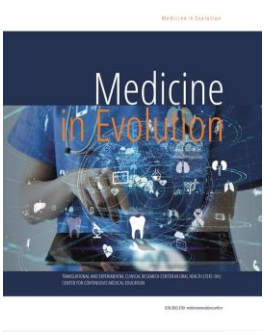
The Prevalence of Dental Erosion in Young Adults – A Quantitative Approach



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Abstract

Nowadays, dental aesthetics is of particular importance. The shape, colour and appearance of teeth are a very important criterion for inclusion in society. From their aesthetic to their masticatory function, teeth are indispensable to us in both natural and artificial form. Tooth wear is a term that refers to the loss of dental hard tissue because of mechanical or chemical processes not involving bacteria. Individual dietary habits may be the most important factor affecting dental structures through the erosive potential of acidic foods. The methodology used a quantitative approach for the study of the conditions that could lead to dental erosion in young adults. The instrument used was a questionnaire distributed online.

Keywords: eating habits, quantitative assessment, dental erosion

INTRODUCTION

Nowadays, dental aesthetics are of particular importance. The shape, colour and appearance of teeth are a very important criterion for inclusion in society. From their aesthetic to their masticatory function, teeth are indispensable to us in both natural and artificial form [1].

Tooth wear is a term that refers to the loss of dental hard tissue because of mechanical or chemical processes not involving bacteria [2]. Wear caused by normal masticatory function is considered a natural phenomenon. It can also be regarded as an adaptive and compensatory mechanism [3]. Our need to feed ourselves as well as the variety of foods available, exerts a load on the dental structure leading to inevitable wear of the teeth. Dental erosion is a type of wear caused by the action of acids not involving bacteria [4].

Globally, it is estimated that the prevalence of dental erosion is present in about 30% of people aged 9 to 19. In Europe, the percentage of young people with dental erosion ranges from 18% to 64%. These values vary widely because there is no standardisation and horizontal and vertical development of research on this issue, different clinical indices are mixed and the teeth examined are not always specified [5].

Individual dietary habits may be the most important factor affecting the erosive potential of acidic foods. Frequent consumption of citrus fruits could significantly increase the risk of dental erosion. Individuals with a high-fruit diet may also have higher frequencies of dental erosion [6].

According to the literature, the states with the highest level of erosion in children are the UK with 59.7%. High percentages are also found in Saudi Arabia with 95% and Sudan with 66.95%. It should be noted that the top countries in terms of percentage of dental erosion are countries with a high standard of living such as the UK or Saudi Arabia [7,8]. At the opposite pole, are countries such as Brazil with 26% and Turkey with 28%. At older ages, 18-34, there is a decrease in dental erosion, but at similar rates [9].

Studies conducted on the military in Saudi Arabia, on populations aged 18-34 years, showed dental erosion in 77% of the cases [10]. Another study, conducted in Switzerland on adults between 26 and 30 years of age, showed the presence of dental erosion in almost the entire population [11].

Aim and objectives

The motivation for conducting this research is due to the increasing prevalence of dental erosion internationally, despite prophylactic measures, an increase that is not yet fully explained. The aim of this study is to investigate the frequency of dental erosion as a function of lifestyle, dietary habits and other related diseases in young adults in Romania.

For this research, three objectives and three hypotheses were set for testing, in support of which the questions included in the questionnaire were established. The first objective concerns the collection of information on dental erosion in adults aged 18-34 years. The second objective aims to identify the conditions experienced by adults between 18 and 34 years old according to their eating habits. The third objective aims to identify dental hygiene habits and employed prophylaxis measures.

Three hypotheses were also generated. The first hypothesis targets young adults who frequently consume fruits and juices, citrus fresh beverages and have a higher degree of dental erosion. The frequency of episodes of nausea and vomiting is directly proportional to dental erosion. The second hypothesis is related to the high frequency of dental erosion in relation to a diet involving frequent consumption of highly-acidic foods. The third hypothesis

is that young adults who visit the dentist twice or more a year for check-ups and prophylaxis have less dental disease and manifestations of erosion.

MATERIAL AND METHODS

The individuals who participated in this research were informed in writing about the conditions of participation in this study. Written consent was obtained from all of them after they were made aware of and understood the conditions and modalities of the study undertaken.

The methodology used a quantitative approach for the study of conditions that could lead to dental erosion in young adults. The instrument used was a questionnaire distributed online via Google Forms.

The sample size was calculated for a 95% probability of guaranteeing results and a maximum allowable error of 5%. A sample size of 348 respondents was required in order to fit this data.

Sampling was non-random on a voluntary basis. This type of sampling was based on the self-selection of units (i.e. respondents decide themselves whether or not to participate in the survey). The statistical analysis software SPSS 25 was used for testing the hypotheses.

The questionnaire was created in Google Forms and distributed online via e-mail and social media platforms (Facebook, Twitter and Instagram). The response collection period was between 30 March 2022 and 18 April 2022.

RESULTS AND DISCUSSIONS

The questionnaire collected responses nationwide. A total of 348 complete responses were achieved during this period. The demographic data collected for the questionnaire were age, gender, residence, education and income.

The age of the respondents was segmented into 5-year categories to facilitate the interpretation of the results, but also to make it easier to observe the behavioural patterns and conditions of the respondents by approximate age. Out of the 348 respondents, 46% were in the 30-34 age category, 24.4% in the 25-29 age category, 20.1% in the 20-24 age category and 9.5% in the 18-19 age category. The residence background data showed a distribution of 64.1% in the urban area and 35.9% in the rural area.

The highest level of education of each respondent was collected and the following distribution emerged: two people had a PhD (0.6%), 12.4% a Master's degree, 31.7% a university degree, 7.5% a post-secondary school degree and 42.5% only a high school degree at the time of the questionnaire.

Monthly income earned by respondents was the last variable collected in the demographic data category: 23.3% had incomes below 1300 lei, 25.9% had incomes between 1300-2000 lei, 22.7% had monthly incomes between 2000-3000 lei, 18.45 had incomes between 3000-5000 lei and 9.8% had monthly incomes above 5000 lei.

The questionnaire started with a general question about the importance each person attached to their dental health. The response options were designed using a scale from 1 to 5, where 1 corresponds to “not at all important” and 5 to “very important”. Out of the 348 valid responses, only one respondent chose a rating of 1, stating that the health of their teeth is not at all important to them. A rating of 2 was chosen by three people, representing 0.9% of the sample, and a rating of 3 was selected by 2% of the sample. Significantly more responses were for a rating of 4 on the scale, with 14.1% of respondents choosing this value. Most responses were for a rating of 5 on the scale, with 82.85% of respondents stating that the health of their teeth is very important.

The second question in the questionnaire concerned the importance given to oral hygiene. A scale from 1 to 5 was used, similar to the first question, where 1 corresponds to a "very low importance" given to oral hygiene and 5 to a "very high importance" given to oral hygiene. For this question, by self-assessment, 0.6% of the respondents chose a rating of 1, 1.1% of them a rating of 2 and 12.4% of the respondents a rating of 3. More answers were for a rating of 4, with 35.9% of the answers and most respondents chose a rating of 5, corresponding to a maximum importance given to oral hygiene.

After these two questions, participants were asked how often they brushed their teeth. One person mentioned that they did not brush and nine others mentioned that they brushed 3-4 times a month, 5.2% said they brushed 3-4 times a week, 42.25% said they brushed once a day, and most responses were for the option of brushing at least twice a day, with 49.7% of responses.

The next question in the survey asked about the frequency of flossing. The majority of respondents, 57.2%, said they did not floss at all, 8.3% said they flossed 3-4 times a month, 5.4% said they flossed approximately 3-4 times a week, 12.6% responded that they flossed once a day and 5.7% said they flossed at least twice a day.

The frequency of using mouthwash for oral hygiene was also investigated through the questionnaire. Thus, out of 348 valid responses, the majority, 39.7%, indicated that they did not use mouthwash, 11.2% said they used it 3-4 times a month, 11.5% said they used it 3-4 times a week, 25.9% of respondents said they used the mouthwash once a day and 11.85%, at least twice a day.

Afterwards, the participants in the online survey were asked how often they went to the dentist for check-ups, hygiene and scaling: 43.1% of respondents said that they only went to the dentist when absolutely necessary, 7.8% said that they went for check-ups once every 2 years, 26.7% said that they went to the dentist once a year, 14.4% went twice a year and 8% went 3-4 times a year for check-ups and hygiene.

The next item on the questionnaire was a series of statements to which respondents were instructed to respond if it matched their situation by choosing between two options – true or false (Table 1).

Table 1. Number of responses to statements

Statements	**True**	**False**
I only use fluoride toothpaste.	64	184
I use oral hygiene products recommended by my dentist.	129	219
I choose oral hygiene products by brand.	179	169
I use oral hygiene products according to the desired results.	289	59
I change my toothbrush every 3 months.	276	72
I use an electric toothbrush.	120	228

The consumption of some foods was investigated with the following questionnaire item. The aim was to find out how often foods were consumed that are known to cause dental erosion and oro-dental diseases. The foods listed were fizzy juices, energy drinks, coffee, wine, fresh fruit juices, sweets, fresh fruits. Response options for frequency were as follows: no consumption, 3-4 times a month, 3-4 times a week, once a day and twice a day.

Fizzy juices were rarely consumed or not at all, with only 22 people saying they consumed them once a day and 26 at least twice a day. Energy drinks were even less consumed by young adults, with no responses for twice a day consumption, and only 3 responses for once a day consumption. Coffee was more commonly consumed, with only 78 respondents saying they did not consume at all, and 44 saying they drank coffee at least twice a day. Wine was not consumed by the majority of respondents, about 60%, and 108 of them

said that they drank it 3-4 times a month. Only 18 said they drank wine 3-4 times a week, and none once or twice a day.

Regarding the oral health-related conditions, 10.9% said they suffered from gastro-oesophageal reflux disease, 12.9% said they suffered from bruxism, 1.1% said they suffered from bulimia and 0.6% said they suffered from anorexia, while 23.3% said they did not suffer from any of these conditions.

Another question was asked in the questionnaire to establish whether there are episodes of nausea and vomiting among young adults and more specifically how often they occur. There were 345 responses to this question, as it was marked as optional for response. Thus, 71.3% of the respondents said that they did not experience episodes of nausea and vomiting at all, 20.6% said that they experienced them rarely, 3.2% said that they experienced them monthly and 4.9% of the respondents said that they experienced them weekly.

Regarding tooth wear, study participants were asked to self-assess and choose the appropriate situation related to worn appearance and reduced tooth surface. When asked this question, the majority of the survey participants (65.8%) indicated that their dentition did not show any worn or reduced tooth surface area. Out of the remaining respondents, 14.5% mentioned that their front teeth were affected, 7.5% mentioned that their posterior teeth were affected and 12.2% mentioned that all of their teeth were affected.

Another issue leading to dental erosion is the consumption of carbonated drinks, but using a straw for these drinks manages to reduce their impact on the teeth. When asked if they used a straw for drinking carbonated drinks, 8.1% said yes, 42.3% said no and 49.6% said they used it occasionally.

Another item in the questionnaire was a multiple-choice question that asked respondents to self-assess whether these situations are applicable to them. Thus, 25.2% said they had transparent tooth edges, 50% said they noticed thinning and yellowing of their teeth, and 51.5% said they had increased tooth sensitivity. 13.6% said they had rough and irregular tooth edges, and 20.9% said they had stains or excavations on the surface of their teeth.

The last question in the questionnaire asked about areas of the teeth that have lost tooth substance and that are more sensitive to hot or cold stimuli. The majority of the respondents, 39.2%, said that they did not experience any sensitivity, 26.6% said that it occurred in a small number of teeth, 14.3% said that they experienced sensitivity in all the teeth and 10.5% said that it occurred only in the incisal edges.

RESEARCH LIMITATIONS

The disadvantage of the questionnaire distributed online was the voluntary participation aspect of the respondents. Most obviously, the gender distribution of respondents became very skewed, which may affect the representativeness of the questionnaire and the response rates to some questions. Out of the total number of respondents, 92% were female.

Respondents' self-assessment is a factor that involves the possibility of misjudging aspects of the actual oral health of the participants. Thus, we acknowledge that some conditions may have been underestimated or unknown to some of the respondents at the time of answering the questionnaire and that clinical examination would have provided much greater accuracy of these conditions.

COMPARISON OF DENTAL EROSION IN ROMANIA WITH OTHER COUNTRIES

From the data collected from the questionnaire it can be seen that the aspect of wear and reduction of the dental surface was mentioned by a total of 34.2% out of the 348 respondents. Considering that we are talking about self-assessment, we incline to believe that the early stages of tooth wear were neglected by the participants in the questionnaire and that

it is possible, that at least a percentage of the respondents were not aware of tooth wear until it reached advanced stages.

On another item in the questionnaire, the responses revealed that a total of 51.5% of people said that they had dental sensitivity, half of them said that they felt a thinning of the teeth, some said that they had teeth with transparent edges and a smaller percentage said that they had rough and irregular tooth edges. Given that this item allowed for multiple responses, we can conclude that at least 51.5% of respondents showed some form of tooth wear. We tend to believe that for many respondents there was no clear causality between tooth sensitivity and loss of dental hard tissue, transparent or irregular incisal edges.

Therefore, we set a minimum percentage of dental erosion based on the answers about dental erosion given to the two questions, i.e. 51.5%, estimated as an average result from the self-assessment of young adults.

In Sweden, in 18- and 19-year-olds, the prevalence of erosive wear of dentin among young people was observed in 22.3% of those clinically evaluated [12]. It should be noted that in this study, the low percentage is due to the investigation of dentin erosion and not enamel. Compared to the results of our study, this percentage may seem lower, but in our case, dental erosion was not categorized in enamel erosion and dentin erosion, because the assessment was performed subjectively through the self-assessment of each participant. In Norway, 38% of the 18-year-olds investigated had dental erosion in 2013 [12].

Finally, we can conclude that economically developed countries show a higher degree of dental erosion, and according to age, erosion is most advanced among children, it decreases in young adults, and probably continues to increase with advancing age [13]. The 51.5% prevalence of dental erosion estimated from the research undertaken for this paper is higher than in some countries and lower than in others. This is due both to the limitations of our own study and to the limitations of studies conducted in other states, where particular research situations (erosion by tooth type, enamel or dentin, etc.) may make the results not directly comparable.

VERIFICATION OF OBJECTIVES

The questions in the questionnaire were used to meet the three objectives and to test the three hypotheses established at the beginning of the research. The three objectives, gathering information on dental wear in adults aged 18-34, observing the conditions experienced by adults aged 18-34 in relation to dietary habits, and observing dental hygiene and prophylaxis habits, were met through the responses gathered from the questionnaire.

After achieving these objectives, data generated by Google Forms in an Excel spreadsheet was used to statistically analyse whether correlations existed, and whether they were statistically significant, between the demographics and the type and degree of dental erosion of the respondents. The Pearson correlation coefficient, denoted by r and p-value was used as a comparative indicator of the 0.05 threshold set for α to verify the probability that in the study population, the correlations found actually exist. The coefficient α=0.05 means that a correlation found with this value will exist in the studied population with 95% probability, or that this correlation did not occur randomly in the study.

For the interpretation of the results, we took as reference a scale with which the strength of the results obtained were correlated. Thus, the values range from 1 to -1, which means that we can have a positive or directly proportional correlation between variables, or a negative or inversely proportional relationship between variables. Regarding the size of the coefficient, depending on its value between -1 and 1, the following powers were considered for the given absolute values: r = 0 – no correlation, r = [0.01, 0.09] – negligible correlation, r = [0.10, 0.29] – low correlation, r = [0.30, 0.49] – moderate correlation, r = [0.50, 0.69] – strong correlation, r = [0.70, 0.99] – very strong correlation and r = 1 – perfect correlation.

In Table 2 it can be seen that there was no correlation between the age of the respondents and the importance attached to the health of their teeth. Similarly, age had no correlation with the frequency of going to the dentist for check-ups and hygiene.

Table 2. Demographic data correlations

		Age	Gender	Environment/ Residence	Importance of dental health	Frequency of dental check-ups
Age	Pearson Correlation	1	-0.011	0.139**	-0.009	-0.037
	Sig. (2-tailed)		0.837	0.009	0.866	0.495
	N		348	348	348	348
Gender	Pearson Correlation		1	-0.111*	0.114*	-0.014
	Sig. (2-tailed)			0.038	0.033	0.798
	N			348	348	348
Environment/Residence	Pearson Correlation			1	0.008	0.020
	Sig. (2-tailed)				0.886	0.706
	N				348	348
Importance of dental health	Pearson Correlation				1	0.161**
	Sig. (2-tailed)					0.003
	N					348
Frequency of dental check-ups	Pearson Correlation					1
	Sig. (2-tailed)					
	N					

* Correlation is significant at the 0.05 level (2-tailed);
** Correlation is significant at the 0.01 level (2-tailed)

The gender of the respondents was correlated to a small extent with the importance given to teeth health with a Pearson coefficient r=0.114 and p=0.033, which showed that this low correlation, was a positive and statistically significant one. From the interpretation of this result, we deduced that female respondents attached slightly more importance to dental health.

Respondents' residential environment did not correlate with the importance they placed on dental health. Similarly, the frequency of visits for check-ups did not correlate with the residence environment. Therefore, from these data, we deduced that in both rural and urban areas, there was a similar frequency of hygiene and scaling for young adults in Romania.

In this section we also wanted to find out whether the education of young people and their income level influenced the importance given to oral hygiene (Table 3).

Table 3. Income and education correlations

		Income	Education	Frequency of dental check-ups	Importance of oral hygiene
Income	Pearson Correlation	1	0.321**	0.095	0.099
	Sig. (2-tailed)		0.000	0.077	0.066
	N		348	348	348
Education	Pearson Correlation		1	0.134*	0.150**
	Sig. (2-tailed)			0.013	0.005
	N			348	348
Frequency of dental check-ups	Pearson Correlation			1	0.246**
	Sig. (2-tailed)				0.000
	N				348
Importance of oral hygiene	Pearson Correlation				1
	Sig. (2-tailed)				
	N				

* Correlation is significant at the 0.05 level (2-tailed);
** Correlation is significant at the 0.01 level (2-tailed)

The income of 18–34-year-olds did not influence the frequency of dental visits or the importance of oral hygiene. In this sense we concluded that regardless of income, young people went to the dentist with the same frequency. In addition, for those of younger ages, with lower incomes, we could consider that their monthly income was still supplemented by their parents' income and that, from this point of view, for some of them, the level of income was irrelevant to the frequency with which they went to the dentist.

The education of the participants in the questionnaire had a small influence on the frequency of dental check-ups. The Pearson coefficient was r=0.134, and the p=0.013, below the 0.05 limit set, so we concluded that this correlation was statistically significant for the population studied. A similar correlation was observed between education completed and the importance given to oral hygiene, with r=0.150 and p=0.005, which validated this low correlation for the population studied.

Note that the frequency of going to the dentist was to a small extent correlated with the importance given to oral hygiene, with r=0.246 and p=0.000, which showed that this low correlation was valid for the whole population of young adults in Romania.

Hypothesis 1 – "Young adults who frequently consume fruits, citrus fruits and fresh citrus juices are more likely to have dental erosion. The frequency of episodes of nausea and vomiting is also directly proportional to dental erosion." For this hypothesis, the frequency of consuming fruits, citrus fruits and fresh citrus juices was correlated with the responses given for worn appearance and/or reduced tooth surface area (Table 4).

Table 4. Correlations for Hypothesis 1

		Do your teeth look worn or have they reduced their surface area?	How often do you eat the following foods? [Citrus fruits and fresh citrus juices]	How often do you eat the following foods? [Fruits]	Do you have episodes of nausea and vomiting?
Do your teeth look worn or have they reduced their surface area?	Pearson Correlation	1	0.224*	0.208	0.311*
	Sig. (2-tailed)		0.043	0.051	0.049
	N		345	345	345
How often do you eat the following foods? [Citrus fruits and fresh citrus juices]	Pearson Correlation		1	0.357*	0.012**
	Sig. (2-tailed)			0.013	0.005
	N			348	348
How often do you eat the following foods? [Fruits]	Pearson Correlation			1	-0.004**
	Sig. (2-tailed)				0.000
	N				345
Do you have episodes of nausea and vomiting?	Pearson Correlation				1
	Sig. (2-tailed)				
	N				

* Correlation is significant at the 0.05 level (2-tailed);
** Correlation is significant at the 0.01 level (2-tailed)

Frequency of consumption of citrus fruits and fresh citrus juices showed a low and positive correlation with the presence of dental erosions (r=0.224 and p=0.043). Frequency of fruit consumption in general showed no statistically significant correlation for the studied population. The frequency with which episodes of nausea and vomiting occur is positive and moderate (r=0.311 and p=0.049). Therefore hypothesis 1 was partially confirmed.

Hypothesis 2 – "Young adults who have a diet involving frequent consumption of high-acid foods have a higher frequency of occurrence of dental erosion." For this hypothesis we selected responses on frequency of consumption of acidic juices, energy drinks, coffee and sweets and associated them with the degree of tooth wear and tooth sensitivity (Table 5).

Thus, from Table 5 it appears that there was a positive and low to moderate correlation between tooth wear and frequency of consumption of fizzy drinks, a negligible correlation between tooth wear and consumption of energy drinks, and a negligible correlation between consumption of coffee and sweets and tooth wear.

Table 5. Correlations for Hypothesis 2

		Worn appearance or reduced tooth surface	Increased sensitivity	Frequency [Fizzy juices]	Frequency [Energy drinks]	Frequency [Coffee]	Frequency [Sweets]
Worn appearance or reduced tooth surface	Pearson Correlation	1	0.244**	0.326*	0.200*	0.173	0.360**
	Sig. (2-tailed)		0.000	0.019	0.044	0.074	0.007
	N		342	345	345	345	345
Increased sensitivity	Pearson Correlation		1	0.186*	0.016	0.183	0.222
	Sig. (2-tailed)			0.011	0.075	0.079	0.091
	N			342	342	342	342
Frequency [Fizzy juices]	Pearson Correlation			1	0.388**	0.103	0.288**
	Sig. (2-tailed)				0.000	0.056	0.000
	N				348	348	348
Frequency [Energy drinks]	Pearson Correlation				1	0.063	0.186**
	Sig. (2-tailed)					0.244	0.000
	N					348	348
Frequency [Coffee]	Pearson Correlation					1	0.050
	Sig. (2-tailed)						0.352
	N						348
Frequency [Sweets]	Pearson Correlation						1
	Sig. (2-tailed)						
	N						

* Correlation is significant at the 0.05 level (2-tailed);
** Correlation is significant at the 0.01 level (2-tailed).

Worn appearance or reduced tooth surface was in a low and positive correlation with increased tooth sensitivity (r=0.244 and p=0.000), in a moderate and positive correlation with consumption of fizzy drinks (r=0.326 and p=0.019), and in a low and positive correlation with the consumption of energy drinks (r=0.200 and p=0.044), while the results were statistically significant for the study population. Dental sensitivity was in a positive and low correlation with consumption of fizzy juices (r=0.186 and p=0.011), and the result was statistically significant. There was a low and positive correlation between the consumption of coffee and dental erosion, with a coefficient r=0.173, but the correlation was not statistically significant (p=0.074). Consumption of fizzy juices showed a positive and moderate correlation with the consumption of energy drinks (r=0.388 and p=0.000). Consumption of sweets showed a positive and moderate correlation with dental erosion (r=0.360 and p=0.007), low correlation with consumption of fizzy juices (r=0.288 and p=0.000) and low correlation with consumption of energy drinks (r=0.186 and p=0.000), the results being statistically significant for the studied population.

Dental erosion was in a positive and low or moderate positive correlation with increased tooth sensitivity, the consumption of carbonated drinks, energy drinks and sweets which shows that hypothesis 2 was also partially confirmed.

Hypothesis 3 – "Young adults who visit the dentist twice or more a year for check-ups and prophylaxis have less dental disease and manifestations of erosion." After the statistical analysis with SPSS (Table 6), it was found that there was a negative but negligible correlation between tooth erosion and the frequency of going to the dentist for check-ups, and between tooth erosion and tooth sensitivity. These correlations were not statistically significant for the study population, therefore hypothesis 3 was refuted.

Table 6. Correlations for Hypothesis 3

		Frequency of dental check-ups.	Have your teeth become worn or reduced in surface area?	You have increased sensitivity and more tooth loss in the area?
Frequency of dental check-ups.	Pearson Correlation	1	-0.092	-0.042
	Sig. (2-tailed)		0.088	0.443
	N		345	342
Have your teeth become worn or reduced in surface area?	Pearson Correlation		1	0.244**
	Sig. (2-tailed)			0.000
	N			342
You have increased sensitivity and more tooth loss in the area?	Pearson Correlation			1
	Sig. (2-tailed)			
	N			

** Correlation is significant at the 0.01 level (2-tailed)

CONCLUSIONS

From the data obtained with the questionnaire, it can be seen that the prevalence of dental erosion in young adults in Romania exceeds 51.5%, which shows that Romania is approaching the European average prevalence of dental erosion.

The first hypothesis investigated, "Young adults who frequently consume fruit and fresh citrus juices show dental erosion more often. The frequency of episodes of nausea and vomiting is also directly proportional to dental erosion", has been partially confirmed. High frequency of consumption of citrus fruits and fresh citrus juices was found to lead to a higher frequency of dental erosion. A positive correlation was also found between frequent episodes of nausea and vomiting (specific to patients with certain conditions such as gastro-oesophageal reflux disease, bulimia) and dental erosion.

The second hypothesis, "Young adults who have a diet that involves frequent consumption of highly-acidic foods have a higher frequency of dental erosion" was also confirmed, with the exception of coffee consumption which showed no statistically significant correlation with dental erosion.

The third hypothesis, "Young adults who visit the dentist twice or more a year for check-ups and prophylaxis have less dental disease and erosion" was refuted. No correlation was found between erosion or tooth sensitivity and frequency of dental visits.

Our study showed that in our country young adults were also affected by dental erosion, but this was not related to demographic characteristics, but to oral hygiene habits and especially to food consumption habits, confirming similar research in the literature.

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Exploring the Pharmacotoxicological Mechanisms of Botulinum Toxin on Healthy and Tumoral Oral Cells

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Abstract

This study investigates the pharmacotoxicological action mechanisms of botulinum toxin (BT) on oral cellular health, comparing its effects on healthy and tumoral cells in the oral cavity. Utilizing primary cultures of oral keratinocytes and fibroblasts, alongside oral squamous cell carcinoma (SCC) lines, the research assesses BT's cytotoxic, antiproliferative, and migration effects under controlled in vitro conditions, complemented by in ovo chorioallantoic membrane (CAM) assays to evaluate vascular irritant potential. Results indicate a clear dose-dependent cytotoxicity of BT across all cell types. Viability and proliferation rates for healthy keratinocytes and fibroblasts slightly decreased to 95% and 96% at low BT concentrations, with more pronounced effects observed in SCC cells (90% viability). At higher concentrations, viability dropped significantly to 70% for SCC cells, highlighting BT's potential for selective tumoral targeting. Cell migration assays revealed significant reductions in motility for all cell types, suggesting implications for wound healing and tumoral invasion. CAM assay outcomes demonstrated BT's minimal irritant effects at low doses, with increasing vascular irritation observed at higher concentrations. Conclusively, this study underscores the importance of concentration in BT's cellular impact, advocating for optimized therapeutic applications in dental medicine that minimize adverse effects while leveraging its antitumoral potential.

Keywords: in-vitro study, dental medicine, stomatology, botox, botulinum toxin

INTRODUCTION

Botulinum toxin (BT), a neurotoxic protein produced by Clostridium botulinum, has found extensive applications beyond its initial medical use for muscle spasms, extending into the fields of dentistry and cosmetic surgery [1]. The toxin's ability to inhibit acetylcholine release at neuromuscular junctions provides a temporary cessation of muscle activity, making it an invaluable tool for treating a variety of orofacial conditions. This includes management of conditions like hyperactive muscle disorders, which contribute to aesthetic and functional dental issues such as gingival smiles and asymmetric smile corrections [2]. Despite its broad utility, the underlying pharmacotoxicological mechanisms of BT on oral health, particularly its effects on healthy versus tumoral oral cells, remain insufficiently explored. This knowledge gap hinders the optimization of BT use in dental practices, where its potential for enhancing patient outcomes is vast.

In recent years, the application of BT in dental medicine has expanded, driven by its minimally invasive nature and reversible outcomes. This expansion includes therapeutic uses that leverage BT's muscle-relaxing properties to address conditions like bruxism, temporomandibular joint disorders, and post-surgical muscle contractions, which can significantly impact patient quality of life [3,4]. However, alongside its therapeutic benefits, there's an emerging need to thoroughly understand BT's safety profile and its long-term effects on oral cellular health. Studies have begun to investigate BT's cytotoxic effects, signaling pathways, and impact on cell proliferation and apoptosis, particularly in the context of oral mucosa and underlying cellular structures [5,6]. Such research is critical for delineating the boundaries of safe BT use and for developing protocols that minimize adverse effects while maximizing therapeutic benefits.

Moreover, the exploration into BT's effects on tumoral cells in the oral cavity presents a promising avenue for adjunctive cancer therapies. Preliminary studies have shown that BT can influence the cell cycle of tumoral cells, potentially offering a novel approach to managing oral cancer growth and proliferation [7,8]. This burgeoning area of research underscores the importance of understanding the dual nature of BT's effects on both healthy and diseased oral tissues. By delineating the mechanisms through which BT interacts with various cell types within the oral environment, researchers can unlock new therapeutic strategies and improve the safety and efficacy of BT applications in dentistry.

This study aims to elucidate the detailed pharmacotoxicological action mechanisms of botulinum toxin on oral cellular health, focusing on its differential effects on healthy and tumoral cells within the oral cavity. The primary objective is to conduct a comprehensive analysis of BT's cytotoxic effects, its influence on cell proliferation, apoptosis, and migration in both healthy oral cells and oral carcinoma cell lines. Through in vitro and in ovo studies, the project seeks to assess BT's safety profile, identify specific markers of cytotoxicity, and evaluate its potential irritant effects on blood vessels. These objectives are designed to provide a foundational understanding of BT's interactions at the cellular level, offering insights into optimizing its therapeutic use in dental medicine while minimizing potential adverse effects. By achieving these objectives, the research aims to contribute significantly to the body of knowledge in dental pharmacology, supporting the development of safer, more effective BT-based treatments for a range of dental conditions.

MATERIAL AND METHODS

The current study was designed as an in-vitro study at the “Victor Babes” University of Medicine and Pharmacy from Timisoara, in accordance with ethical regulations, and

according to the grant number 26679/09.11.2022. In our study, primary cultures of healthy oral keratinocytes and fibroblasts, along with established lines of oral squamous cell carcinoma (SCC), were utilized to assess the cytotoxic and antiproliferative effects of botulinum toxin (BT). These cells were cultured under controlled conditions (37°C, 5% CO_2) and treated with various concentrations of BT type A, reflecting its clinical application spectrum. The selection of BT concentrations and exposure times was informed by initial dose-response curves, aiming to delineate the optimal conditions that mirror the toxin's pharmacotoxicological interactions in an in vitro setting.

The response of these cell cultures to BT treatment was meticulously evaluated through a series of assays. Viability and proliferation were quantified using MTT and luminescence assays, offering a clear picture of BT's cytotoxicity across different cell types. The scratch assay method was employed to examine cell migration, providing insights into BT's influence on wound healing and tumoral cell invasiveness. Additionally, the effects of BT on apoptosis and cell cycle progression were investigated using flow cytometry and specific nuclear staining techniques. This comprehensive assay suite allowed for an in-depth evaluation of BT's cellular impacts, highlighting its potential therapeutic and adverse effects.

The chorioallantoic membrane (CAM) assay was conducted to assess BT's irritant potential on blood vessels within a living system. Fertilized chicken eggs were incubated until the CAM was suitably developed for experimental manipulation. Subsequently, BT was applied topically to the CAM, and the ensuing vascular responses, including hemorrhage, vessel lysis, and coagulation, were meticulously scored. This in ovo assay complemented our in vitro findings by presenting a complex biological context for BT's interaction with vascular structures, enriching our understanding of its pharmacotoxicological profile.

RESULTS

The data presented in Table 1 reveals a clear, dose-dependent cytotoxic effect of botulinum toxin (BT) on both healthy oral keratinocytes, fibroblasts, and oral squamous cell carcinoma (SCC) cells. With the application of BT at low concentration, a moderate reduction in cell viability and proliferation rates was observed across all cell types, indicating BT's cytotoxic potential. For healthy keratinocytes and fibroblasts, viability decreased to 95% and 96%, respectively, with a more pronounced effect seen in oral SCC cells, where viability dropped to 90%. The impact of BT was more substantial at higher concentrations, where viability fell to 85% for keratinocytes, 87% for fibroblasts, and significantly to 70% for SCC cells. Similarly, proliferation rates followed a comparable trend, underscoring the importance of concentration in BT's cytotoxicity and its potential utility in selectively targeting tumoral cells while affecting healthy cells to a lesser extent.

Table 1. Cell Viability and Proliferation after BT Treatment

Cell Type	Treatment	Viability (%)	Proliferation Rate (%)
Healthy Keratinocytes	Control	100	100
Healthy Fibroblasts	Control	100	100
Oral SCC	Control	100	100
Healthy Keratinocytes	BT Low	95	90
Healthy Fibroblasts	BT Low	96	92
Oral SCC	BT Low	90	85
Healthy Keratinocytes	BT High	85	80
Healthy Fibroblasts	BT High	87	83
Oral SCC	BT High	70	65

Table 2 demonstrates the impact of BT on the migration rates of healthy oral keratinocytes, fibroblasts, and oral SCC cells, highlighting its inhibitory effects on cell motility. Control groups showed baseline migration rates of 214 µm/24h, 158 µm/24h, and 256 µm/24h for keratinocytes, fibroblasts, and SCC cells, respectively. Post BT treatment, a significant reduction in migration rates was noted across all cell types, with keratinocytes showing a decrease to 122 µm/24h, fibroblasts to 104 µm/24h, and SCC cells to 81 µm/24h. This reduction in migration rate indicates BT's potential to impair wound healing processes and possibly inhibit tumoral cell invasion and metastasis, suggesting a dual role in therapeutic applications where modulation of cell migration is desired.

Table 2. Cell Migration Rate

Cell Type	Treatment	Migration Rate (µm/24h)
Healthy Keratinocytes	Control	214
Healthy Fibroblasts	Control	158
Oral SCC	Control	256
Healthy Keratinocytes	BT Treated	122
Healthy Fibroblasts	BT Treated	104
Oral SCC	BT Treated	81

The CAM assay results, as detailed in Table 3, provide insight into the irritant potential of BT on vascular structures at varying concentrations. At low BT concentration, there were no observable effects on hemorrhage, vessel lysis, or coagulation, indicating minimal irritant potential. However, with medium concentration, a moderate response was elicited, as evidenced by scores of 1 and 2 in hemorrhage, vessel lysis, and coagulation. The response was further amplified at high concentrations, reaching scores of 2 and 3 across all parameters. These findings suggest that while BT can be relatively safe at low concentrations, its potential to cause vascular irritation increases significantly with concentration. This highlights the importance of careful dose management in clinical applications to minimize adverse effects, especially in treatments involving vascular-rich areas such as the oral cavity.

Table 3. CAM Assay Scores for BT's Irritant Potential

Sample ID	BT Concentration	Hemorrhage Score (0-3)	Vessel Lysis Score (0-3)	Coagulation Score (0-3)
Sample 1	Low	0	0	0
Sample 2	Medium	1	1	1
Sample 3	High	2	2	2
Sample 4	Medium	1	2	2
Sample 5	High	3	3	3

DISCUSSIONS

The findings from this study offer significant insights into the pharmacotoxicological mechanisms of botulinum toxin (BT) on oral cellular health, emphasizing its differential effects on healthy and tumoral cells within the oral cavity. The dose-dependent cytotoxicity of BT underlines the toxin's potential for therapeutic application, particularly in selectively targeting tumoral cells. A noteworthy observation was the pronounced reduction in viability and proliferation rates in oral squamous cell carcinoma cells at higher BT concentrations, suggesting BT's utility in managing oral carcinomas. This specificity could be leveraged to minimize collateral damage to healthy oral cells, a critical consideration in developing safer, more effective BT-based treatments for oral conditions.

The reduction in cell migration rates post-BT treatment highlights another dimension of BT's therapeutic potential. The significant decrease in migration rates across all cell types, especially in oral SCC cells, suggests BT's role in not only impairing wound healing processes but also in potentially inhibiting tumor invasion and metastasis. This dual functionality points towards the necessity of a balanced approach in BT's clinical applications, where its benefits in reducing tumoral cell motility must be weighed against potential delays in normal wound healing.

CAM assay findings introduce critical considerations regarding BT's irritant potential on vascular structures. The escalation in hemorrhage, vessel lysis, and coagulation scores with increasing BT concentrations underscores the importance of careful dose management to mitigate vascular irritation. This aspect is particularly pertinent in dental applications, where the oral cavity's vascular richness demands a nuanced understanding of BT's effects to avoid adverse outcomes. These results advocate for a cautious optimization of BT's concentration in therapeutic interventions, ensuring efficacy while minimizing potential harm to vascular health.

Over the past twenty years, research into the use of Botulinum neurotoxins for cancer treatment, particularly for shrinking tumors and inducing apoptosis in cancer cells, has significantly expanded. Early investigations, such as the one by Huang et al. in 1998 [9], focused on the effects of BoNT/A on insulin secretion by insulin-secreting HIT-T15 cells, a type of endocrine tumor cell. These studies, employing animal models, human subjects, and in vitro applications of BoNTs on various cancer cell lines, including those from neuroblastoma, breast, prostate, colorectal, and pancreatic cancers, have shown promising results for BoNT/A's potential in cancer therapy. Huang et al.'s work notably demonstrated the ability to regulate insulin secretion through transient transfection of BoNT/A, setting a foundational basis for further exploration of BoNT/A in treating endocrine tumors.

Karsenty et al.'s 2009 [10] study further explored BoNT/A's effects, particularly on prostate cancer cell lines PC-3 and LNCaP, noting a significant reduction in LNCaP cell proliferation and an increase in apoptosis in a dose-dependent manner, without affecting PC-3 cells. This difference was attributed to the presence of the SV2 receptor, with LNCaP cells showing a higher expression ratio. The study highlighted ONA's (OnabotulinumtoxinA) potential to slow growth rate and PSA progression, marking a significant step forward in understanding BoNT/A's therapeutic mechanisms in cancer.

Proietti et al. in 2012 [11] expanded this line of inquiry by examining the effects of different doses of IncoA (IncobotulinumtoxinA) on prostate cancer cells, observing a reduction in cell growth for both LNCap and PC-3 lines. Their work underscored the role of the SV2 receptor and introduced the cPLA2-α expression as a potential marker for BoNT/A's effectiveness. In contrast, Bandala et al.'s study in 2015 [12] focused on breast cancer cells, demonstrating BoNT/A's cytotoxic effects on the T47D cell line and its impact on SV2 receptor expression across various breast cancer cell lines. These studies not only contributed to our understanding of BoNT/A's apoptotic mechanisms but also proposed the SV2 receptor as a potential molecular marker for breast cancer, suggesting innovative approaches for BoNT/A utilization in cancer therapy.

This study, while providing valuable insights into the pharmacotoxicological effects of botulinum toxin (BT) on oral health, has limitations inherent to in vitro and in ovo research models. The direct applicability of these findings to clinical scenarios is constrained by the simplified experimental conditions, which may not fully capture the complex interactions within the human oral cavity or the systemic effects of BT. Additionally, the use of established cell lines, while offering controlled conditions for assessing BT's effects, may not accurately reflect the diversity of cellular responses in different individual's oral tissues. The reliance on these models necessitates cautious interpretation of results and underscores the need for

subsequent clinical studies to validate the therapeutic potential and safety profile of BT in dental applications.

CONCLUSIONS

In conclusion, this study contributes valuable data to the body of knowledge in dental pharmacology, delineating BT's effects on oral health at the cellular level. By identifying specific markers of cytotoxicity and evaluating its impact on cell proliferation, apoptosis, migration, and vascular irritation, the research paves the way for optimizing BT's therapeutic use in dentistry. The insights gleaned from this study underscore the potential of BT as a versatile therapeutic agent in oral medicine, capable of addressing a range of dental conditions with appropriate dose management and application strategies. Future research should further explore BT's long-term effects and its integration into comprehensive treatment modalities, ensuring the development of safe and effective BT-based therapies for oral health conditions.

Acknowledgements

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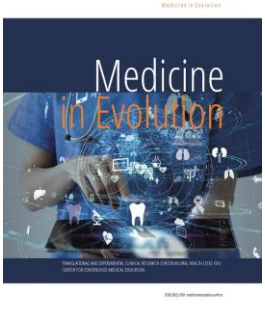
Dental Bleaching Techniques: Hydrogen Peroxide Application vs Laser. Which is More Efficient?



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Abstract

Teeth whitening is a clinical procedure that can be done in many ways usually using gels with carbamide or hydrogen peroxides. The main objective of this study is to compare two methods of teeth whitening: conventional (with 40% hydrogen peroxide gel) and laser method (with 45% hydrogen peroxide gel activated by diode laser). We analysed two groups of 10 patients, one for each method. The results lead to the conclusion that hydrogen peroxide activated by laser seems to be more efficient but it also brings more dental hypersensitivity at the end.

Keywords: Dental bleaching, hydrogen peroxide, laser

INTRODUCTION

Teeth whitening is a complex clinical procedure influenced by many factors such as type of bleaching techniques (trays, tooth paste, laser, Zoom light); teeth size, anatomy and enamel depth; fluctuation and wavelength of irradiation; type, concentration, temperature, pH and type of activation of the bleaching agent [1].

Hydrogen-carbamide peroxide (10%) was used as bleaching agent in custom-made trays since 1960, first under the name of *Gly-Oxide* (Marion Merrell Dow, Kansas City, MO, USA), then as *Proxigel* (1989), which was a mixture between carbamide peroxide, water, glycerine, and Carbopol, and under many trade names until today [2]. In contact with enamel, carbamide peroxide (CP) decomposes itself into hydrogen peroxide (HP) and urea. HP generates a powerful oxidizing action and also leads to formation of other oxidative agents like per hydroxyl anions and hydroxyl radicals [3].

Using laser in addition to any bleaching agent can lead to a higher whitening effect on teeth surfaces. The laser energy break HP into water and free oxygen radicals which can remove the stain molecules [4].

Aim and objectives

The main objective of this study is to compare two method of teeth whitening: conventional method with HP 40% (Opalescence Boost) and Laser White 20 Gel HP 45% activated by Diode Laser (Biolase)

MATERIAL AND METHODS

The clinical study was conducted over a period of 2 years and had two groups of 10 patients each, aged between 18-64 years. The first group was under the conventional teeth whitening method using HP 40% and the second group received HP 45% activated by diode laser (laser method).

The selection and the exclusion criteria for the two groups are in the table no. I:

Table 1. The selection and exclusion criteria for the patients included in this study

Selection Criteria	Exclusion Criteria
– Exogenous discolorations – Age-related discolorations – Patients with unbroken and vital anterior teeth without carious lesions or restorations – Completely erupted teeth	– Patients with periodontal disease – Patients with gingivitis – Gingival recessions – Enamel structural defects – Dental hypersensitivity – Allergy to HP or methacrylate-based resins – Adolescents under 18 years – Pregnant or breastfeeding mothers – Non-cooperative patients

Clinical protocol:

The clinical protocol was conducted by one examiner. The initial teeth colour of every patient was fixed around midday on cloudy days. Photographs were taken using the same camera without a flash and under the light of the dental unit. The groups have been created to be balanced in gender, age, education level, dietary habits, and oral hygiene quality. There were 3 measurements of colour using the Vita Classic colour key: initial, intermediate and after the final application. When colour shade was unclear the Vita 3D-Master colour key was also used.

First, a professional cleaning was performed, including scaling and professional teeth brushing, followed by an antimicrobial treatment with a 2% chlorhexidine solution in cases of minimal signs of gingival inflammation. Scaling was performed using ultrasonic equipment and manual instruments followed by polishing with toothbrushes, rubber cups and professional toothpaste. In cases where scaling was not necessary, preparations consisted in brushing with low-speed brushes and professional fluoridated and abrasive toothpaste (RDA 250). Additionally, patients were advised to brush their teeth at home before the second session. After all these above the first picture was taken.

The first whitening session was 5-7 days after scaling to avoid hypersensitivity and protect the glycoprotein film which cover the enamel.

Method applied to group no. 1 - Conventional Teeth Whitening Technique (CTWT):

A whitening gel based on HP 40% with neutral pH was used. The gel consisted of 2 syringes of HP/Activator x 1.2 mL, one syringe of Opal Dam x 1.2 mL, and 5 micro tips 20 ga/5 micro tips 20 ga FX. After the cheeks and lips were retracted using a retractor and cotton rolls, the resin (Opal-Dam) was applied for gingival protection around the cervical area of the teeth and photopolymerized for 20-30 seconds. Vaseline was also applied for additional protection of the oral mucosa and commissures. After the transparent gel and the activator were mixed, it was applied on teeth surfaces and kept for approximately 20 minutes (figure no. 1). Then, the second picture were taken.

Figure 1. Whitening gel applied on teeth

The procedure continued with the second application. After 20 minutes, the excess of gel was removed with cotton rolls and the patients rinsed their mouth with water. When whitening gel was on teeth aspiration and rubber dam were always used. The final photographs were taken.

Method applied to group no. 2 - Laser Teeth Whitening Technique (LTWT):

First, the lips and cheeks were protected with vaseline and the cotton rolls were used for a better protection and a high comfort of the patient. After the Liquid Dam was put and polymerized the bleaching gel was also mixed and put using a brush applicator. A protective shield was used over the handpiece arch of the diode laser to prevent cross-contamination. The laser handpiece was connected and used on whitening mode, 7W for 30 seconds at 1 mm from the tooth surface with no direct contact with the whitening gel. The gel was left 5 minutes more after the laser then it was removed from the teeth. The first photographs were taken. The Laser White 20 whitening gel was reapplied using the same procedure mentioned above. The final photographs were taken followed by fluoride applications. The examiner and the patients wore glasses for their own protection.

The materials used in this procedure are presented in figure no. 2.

Figure 2. Biolase laser, hand piece and protective eyewear

The home care recommendations after the whitening procedures were: avoid smoking for a while, hot or cold drinks for 2 weeks, and beverage consumption such as tea, red wine, coffee, cola and others; a good oral hygiene and using tooth pastes for hypersensitivity (ex: with strontium chloride).

Clinical data were entered into a computer and processed with trial version 24 of SPSS software (Armonk, NY, USA).

RESULTS

Two representative cases for the two whitening methods used in this study were shown in figures no. 3 and 4.

Figure 3. Conventional Teeth Whitening Technique (CTWT). 3 photos: initial (A), intermediate (B), final (C)

Figure 4. Laser Teeth Whitening Technique (LTWT). 3 photos: initial (A), intermediate (B), final (C)

The initial and final stages of teeth colour are graphical shown in figures no. 5 and 6:

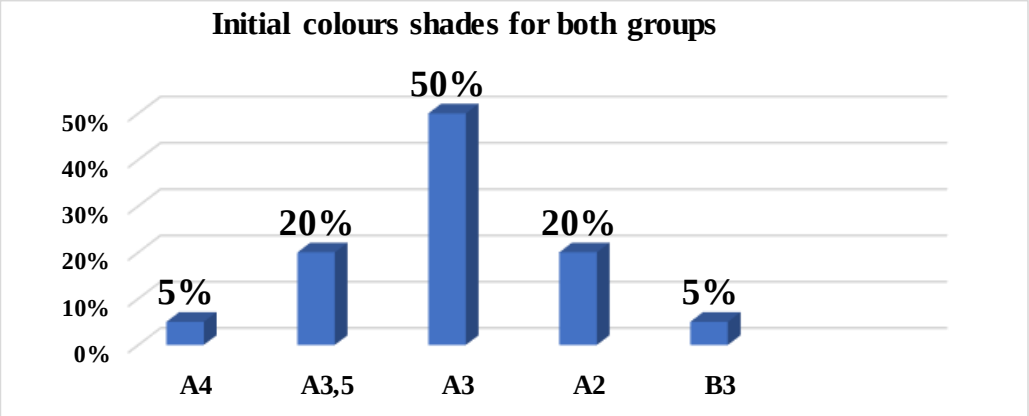

Figure 5. Initial colours shades for both groups of patients

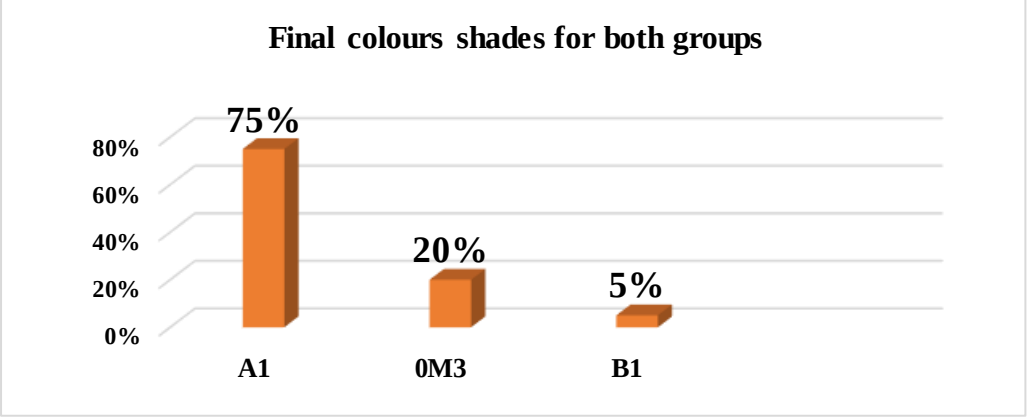

Figure 6. Final colours shades for both groups of patients

The efficiency of the 2 methods used in this study was measured counting the number of shades with which the teeth were whitened (figures 7 and 8)

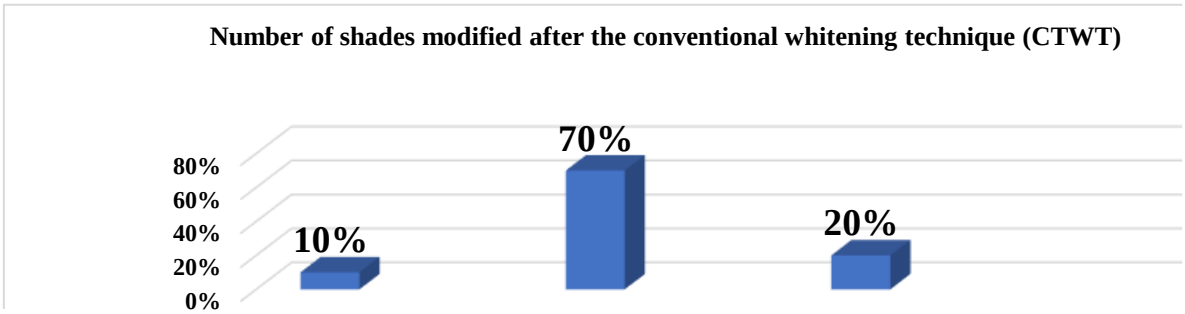

Figure 7. Efficiency of conventional whitening method

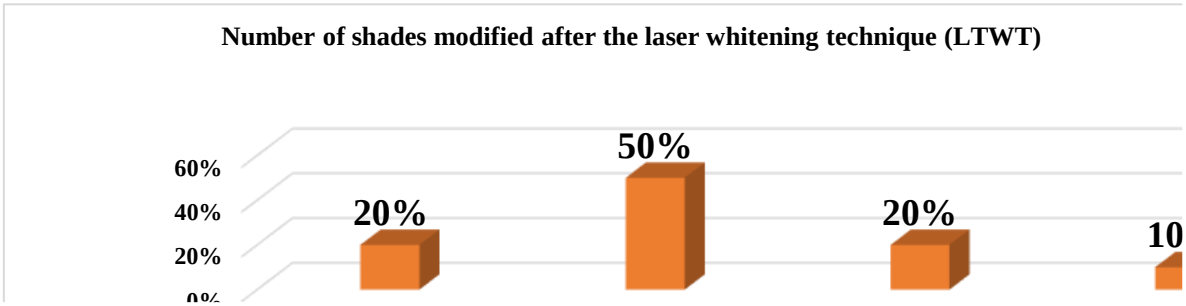

Figure 8. Efficiency of laser whitening method

The difference between initial and final colour shade was calculate for each patient and named *whitening difference* (WD). WD mean value was 1.8 (SE = 0.2) for the CTWT and 2.2 (SE = 0.58) for the LTWT.

50% of patients who whitening their teeth using CTWT had dental hypersensitivity at the end compared to 70% who used laser method.

DISCUSSIONS

Our study showed a small difference between the two methods, LTWT being a little bit more efficient.

Some authors found a bigger differences when they used laser for teeth whitening. For example, Zang et al. found even 8.5 – 11 points difference for WD but they used a more accurate method for measuring the whitening effect and analyse the colour alterations of stained teeth (the International Commission on Illumination – CIELab) [5].

However, it is very difficult to compare those two methods because both of them use active HP (40% and 45%) and the fact that LTWT is more efficient may be because of laser or because of the different of 5% in HP concentration.

Moreover, LTWT methods are different and also it is very hard to compare the method used in this study with the results of other studies. De Moor et al. concluded that for studying efficiency of different LTWT methods we need three laser parameters: light intensity, spectral distribution, and irradiation time [6].

Speaking about side effects, LTWT led to 20% more cases of dental hypersensitivity in our study. However, laser can be also used to treat or prevent hypersensitivity [7]. Another approach will be to use a λ 450 nm blue laser delivered with a flattop beam profile. That seams to lead to a low inflammatory pulp response and to less pain (dental hypersensitivity) after the procedure [8].

CONCLUSIONS

LTWT seems to be more efficient than conventional method but it looks like it has a higher percent of post-application dental hypersensitivity.

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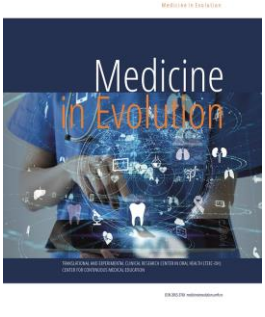
A Deeper Look: Exploring the Relationship between Periodontal Diseases and Cardiovascular Health



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Abstract

Aim and objectives: The research extensively explores the link between cardiovascular and periodontal diseases, focusing on the microbial factor, especially plaque, as the main cause of periodontal disease. Other contributing factors include tartar, occlusal trauma, tooth decay, missing teeth, and specific habits. The study aims to discover and understand the genuine links between these two health conditions.

Material and methods: To carry out this review, we studied the scientific basis of Pub Med as well as Google Schooler and periodontal disease, gingivitis, atherosclerosis and cardiovascular disease, hypertension were used as keywords.

Results: The dental management of patients with cardiovascular diseases is one of the essential points in establishing an appropriate treatment plan.

Conclusions: Detailed medical history, signs, symptoms of cardiovascular disease and thorough medical evaluation are essential for the safe delivery of periodontal dental treatments in patients with cardiovascular disease.

Keywords: Periodontal disease, cardiovascular disease, treatment

INTRODUCTION

Periodontal disease is a condition of microbial cause that affects the supporting tissues of the teeth - gingival tissue, alveolar bone, cementum and periodontal ligaments [1]. An imbalance between the subgingival communities and the host immune response characterizes periodontal disorders, which are dysbiotic conditions in the marginal periodontium [2]. Clinical signs and symptoms of periodontal disease can include pain, masticatory impairment, gingival bleeding, halitosis and tooth mobility [3]. Undiagnosed in time and in the absence of an early treatment, periodontal disease can cause the reduction of the bone structure at the level of the alveolar ridges and the avulsion of the teeth [1].

Over the years, several classification systems have been developed to reflect the variety of forms of gingivitis and periodontitis [4]. The most recent classification of periodontal disease was made in 2017 by the World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions [5]. Gingivitis is an early form of periodontal disease, characterized by gingival inflammation caused by the appearance of bacterial biofilm that accumulates on the teeth and adjacent gums, the condition being reversible, not affecting the bone structures. If left untreated, gingivitis can develop into periodontitis [1,6]. Marginal periodontitis represents an irreversible form of periodontal disease, which generates the loss of the circular gingival tissue of the tooth, the bone support and finally even the loss of the teeth [1].

The term cardiovascular disease (CVD) or heart disease refer to the following four entities that are: coronary artery disease - sometimes referred to as coronary heart disease (CHD) which results from decreased myocardial perfusion that causes angina, myocardial infarction (MI) or heart failure; cerebrovascular disease (CVD) - including stroke and transient ischemic attack; peripheral artery disease - particularly arterial disease involving the limbs that may result in claudication and aortic atherosclerosis - including thoracic and abdominal aneurysms [7]. When we talk about atherosclerotic diseases, we mostly mean peripheral vascular disease, cerebrovascular disease, and coronary heart disease. Chronic inflammatory, infectious, and immunological illnesses such as psoriasis, systemic erythematosus lupus, rheumatoid arthritis and periodontitis are linked to markedly increased chances of severe cardiovascular events [8].

Periodontal disease and cardiovascular disease are covered by Sanz et. al (2020) in the category of non-communicable diseases [9]. Among non-communicable diseases, cardiovascular diseases such as ischemic heart disease, stroke, hypertension, rheumatic heart disease and cardiomyopathy are the most prevalent worldwide, accounting for 45% of total non-communicable disease mortality (NCD) [8,10,11]. At the European level, cardiovascular diseases were found to be responsible for 3.9 million deaths [9]. The World Health Organization estimates that periodontitis affects between 35% and 50% of people worldwide [12], while statistics show that more than 50% of Europeans may have periodontitis in one form or another, and over 10% have the severe form of the condition. The prevalence rises to 70–85% of those in the 60–65 age range [13].

Periodontal disease and cardiovascular diseases are common diseases nowadays, they have in common the aggressive inflammatory response to various stimuli [14]. While periodontal disease is a dysbiotic pathology, in which chronic inflammation is induced and maintained by the multispecies bacterial community accumulated in the subgingival area [6], coronary artery disease is characterized as chronic inflammation that can lead to narrowing and occlusion of blood vessels, causing myocardial infarction (MI) [14].

The etiology of periodontal disease is closely related to the patients' poor hygiene - the determining factor, to which can be added vicious habits that can influence the disease - the

favoring factors. Factors contributing to periodontal disease include smoking, genetic factors (genetic predisposition, genetic disorders), type 2 diabetes mellitus, unhealthy diet rich in refined carbohydrates and processed foods, stress that contributes to a decrease in the immune system, hematological conditions, neoplastic conditions and immunosuppressants, which can induce periodontal manifestations [1]. Associations of periodontal disease with pregnancy, lung disease and cardiovascular disease have been identified, but the causal relationship between these has not been fully established and understood. Therefore, controlling the bacterial biofilm and risk factors can prevent the onset of periodontal disease, slow down the progressive periodontal disease, and through appropriate treatment can attempt to restore lost tooth support [1,15].

However, since atherosclerosis is a common denominator in the pathophysiology of CVD, addressing risk factors related to its development is crucial [7]. Longitudinal investigations conducted recently have established a strong correlation between periodontal tissue and an increased probability of cardiovascular disease. The incidence of CVD in individuals with periodontal disease has not, however, been thoroughly studied [16,17].

Aim and objectives

The current study is to conduct a mini-review on the effects of periodontal disease on patients with cardiovascular diseases or vice versa. The association between periodontal disease and cardiovascular diseases is not fully understood. The objective of this research is to reveal the links between the two conditions and the way of mutual influence.

MATERIAL AND METHOD

In order to carry out this mini-review, we studied the scientific databases PubMed and Google Schoolar, using keywords such as periodontal disease, gingivitis, periodontitis, cardiovascular diseases, hypertension, coronary disease and atherosclerosis. We reviewed the identified articles, removed duplicates, and selected 55 bibliographic references that we considered eligible for the integrated text.

RESULTS AND DISCUSSIONS

Anaerobic organisms responsible for periodontal disease can colonize in deeper areas of the marginal periodontium where they can perform their destructive action if the patient's oral hygiene is inadequate. To date, nearly 800 different species of bacteria have been identified and characterized in human dental plaque. The main bacteria responsible for periodontal disease *are Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Eubacterium timidum, Parvimonas micra, Prevotella intermedia, Campylobacter rectus, Treponema denticola* and *Tannerella forsythia* [1,18,19].

From a mechanical point of view, infections at the gingival level lead to gingival lesions and subsequently to the contamination of the adjacent tissue [20,21]. The patient's medical history, clinical examination of the oral cavity and close examination of periodontal tissues by periodontal chart are the pillars of diagnosis in periodontal disease [22]. The persistent inflammatory state in periodontal disease can lead to aberrant neutrophil activation and a release of pro-inflammatory mediators, leading to tissue damage, bone resorption and disease progression. The release of inflammatory mediators by neutrophils bridges the gap between local and systemic immunity, thus highlighting neutrophils as key factors in linking periodontal inflammation to chronic conditions, including cardiovascular disease [23].

Ulcerated epithelial tissue becomes the portal of entry of periodontal pathogens and their products into the general circulation, into small and large blood vessels [24]. DeStefano

et al. conducted a prospective cohort research in 1993 and discovered, for the first time, that periodontitis is one of the risk factors for coronary heart disease [25]. Routine dental evaluations are invaluable in recognizing early states of periodontal disease and directing early intervention [26].

Over the past two decades, several studies have shown that people with periodontal disease are at higher risk of cardiovascular events, including myocardial infarction, peripheral arterial disease, stroke, and heart failure [27]. Moderately elevated C-reactive protein (CRP) is a predictor of increased risk of cardiovascular disease [28].

Clinical evidence suggests that periodontal disease affects systemic endothelial function and this in turn could have an impact on hypertension [29]. The presence of the bacterial plaque biofilm can influence cytokines, chemokines, T cells and B cells, which cause vascular inflammation, which are closely related to obesity, stress, lifestyle and diet, generating vascular dysfunction, atherosclerosis and hypertension [29].

Experimental animal evidence points to the immune response to a periodontal pathogen common to periodontal disease and cardiovascular disease: *Porphyromonas gingivalis. Porphyromonas gingivalis* induces increased blood pressure, vascular inflammation and endothelial dysfunction [29]. In vitro studies have shown that *Porphyromonas gingivalis* can penetrate the oral mucosa. Currently, it is unknown how precisely *Porphyromonas gingivalis* actively penetrates tissue barriers. It has been observed that gingipains are essential for the breakdown of tissue barriers when *Porphyromonas gingivalis* is actively invading the host tissue [30].

This periodontopathogen is considered the key etiological agent involved in the occurrence of chronic periodontitis [30]. Jong et al. al (2023) is of the opinion that the oral pathogen *Porphyromonas gingivalis* is not only associated with the appearance of chronic periodontitis, but also with the appearance of systemic diseases at the level of the body [31].

The potential mechanisms of action of *Porphyromonas gingivalis* are:

I. the first mechanism - degradation of adhesion molecules between tissue cells and the extracellular matrix produced by enzymes secreted by *Porphyromonas gingivalis;*
II. the second mechanism - transcytosis: bacteria actively enter tissue cells;
III. the third mechanism - professional phagocytes pick up *Porphyromonas gingivalis* and travel in the bloodstream;
IV. the last mechanism - possibly *Porphyromonas gingivalis* can adhere to hyphae (structured filamentous cells of higher fungi) forming Candida albicans, these hyphae can penetrate the mucosal tissue, which can allow *Porphyromonas gingivalis* to reach deeper structures [31].

Adherence of *Porphyromonas gingivalis* to host cells is multimodal and involves the interaction of bacterial cell surface adhesion with receptors expressed on epithelial cell surfaces [30]. The ability to multiply and activate endothelial cells may be one of the pathogenic mechanisms exerted by *Porphyromonas gingivalis* that may explain the association between it and cardiovascular diseases [32].

Based on the identified scientific results, we consider it necessary to evaluate the interdependence relationship between periodontal disease, cardiovascular diseases and *Porphyromonas gingivalis*.

Porphyromonas gingivalis is an anaerobic, gram-negative bacterium that inhabits the oral cavity. It can become highly damaging and multiply to many cells in periodontal lesions under specific conditions because to virulence factors. Many virulence and pathogenicity factors, including fimbriae, hemolysin, hemagglutinin, capsules, outer membrane vesicles (OMS), lipopolysaccharides, and gingipains, support in *Porphyromonas gingivalis* action [33].

Gram-negative bacteria create outer membrane vesicles (OMVs) at various stages of growth in various environments, such as infected tissues [34]. Gram-negative bacteria develop and continuously release outer membrane vesicles (OMVs), which are double-layer spherical membrane-like structures with a diameter of between 50 and 250 nanometers. These structures preserve the integrity of the membrane during the entire process [35].

The tiny, adherent outer membrane vesicles (OMVs) of *Porphyromonas gingivalis* are more persistent due to their resistance to host-derived proteases [36,37]. Outer membrane vesicles (OMVs) have a greater ability to enter deep tissues and trigger an inflammatory host response as compared to their parent *Porphyromonas gingivalis* [37]. In the form of outer membrane vesicles (OMVs), *Porphyromonas gingivalis* can selectively concentrate significant virulence components and release them into the environment [38]. A proteomics investigation of *Porphyromonas gingivalis* outer membrane vesicles (OMVs) was conducted by Veith et al. (2014), yielding a total of 151 proteins [39,40]. The results reported by Guo et al. (2024) showed that *Porphyromonas gingivalis* outer membrane vesicles (OMVs) promoted pericardial enlargement in zebrafish larvae, raised neutrophil numbers, caused vascular injury, and triggered inflammatory pathways. The immune response and the extracellular matrix-receptor interaction signaling pathway were further identified in this process by transcriptomic analysis [41].

Porphyromonas gingivalis outer membrane vesicles (OMVs) include the majority of the identified adhesins, including FimA and Mfa1. In turn, *Porphyromonas gingivalis* is able to interact with other oral bacteria through outer membrane vesicles (OMVs) [42]. The outer membrane vesicles (OMVs) of *Porphyromonas gingivalis* have the ability to travel to the bloodstream and impact distant organs and tissues [43]. Therefore, systemic illnesses linked to an infection caused by *Porphyromonas gingivalis* may also be impacted by outer membrane vesicles (OMVs) [38].

Jia et al. al (2015) closely studied the bidirectional relationship between outer membrane vesicles (OMVs) of *Porphyromonas gingivalis* and cardiovascular diseases and concluded that these nanosized particles can promote epithelial dysfunction [44], while Yang et. al (2016) believe that outer membrane vesicles (OMVs) of *Porphyromonas gingivalis* promote the calcification of vascular smooth muscle cells, a hallmark of atherosclerosis [45]. In vitro and in vivo research demonstrates the significant increase in vascular permeability and vascular edema by cleavage of endothelial cell connexins due to the presence of outer membrane vesicles (OMVs) of Porphyromonas gingivalis and proteolytic damage in blood vessels, where the parent bacteria cannot gain access [46]. These investigations highlight that outer membrane vesicles (OMVs) are as important as the parent periodontopathogenic bacteria [38,46].

While findings reported by Zaremba et al. (2007) support the idea that periodontitis-related bacteria may also infiltrate coronary vessels, Geerts et al. (2002) proposed that oral pathogens and their pathogenic factors may enter the bloodstream through tooth brushing, chewing, debridement, or scaling [47,48].

One of the most prevalent forms of cardiovascular disease, atherosclerosis, was first thought to be caused by the buildup of lipids and fibrous debris. But these days, an increasing number of scientists consider it to be a chronic inflammatory illness. Atherogenic disease risk is associated with infectious diseases like periodontitis. One of the most prevalent bacteria in stomatology, *Porphyromonas gingivalis*, is typically found in patients' atherosclerotic plaque. Moreover, *Porphyromonas gingivalis* has been shown to accelerate the development of atherosclerosis [49]. Data from experiments and epidemiology point to *Porphyromonas gingivalis* infection as worsening the development of atherosclerosis. Rodrigues et al. (2012) demonstrated that the virulence mechanisms of different strains of *Porphyromonas gingivalis* are diverse, and the pathogenic mechanisms identified for one strain are not necessarily

applicable to other strains [50]. Periodontal bacteria present in the bloodstream or in situ in vascular lesions are associated by Salhi et. al (2019) with the development of aneurysmal disease [51]. Recently, several researchers identified *Porphyromonas gingivalis* in atheroma plaques and pointed out the significance of *Porphyromonas gingivalis* type II FimA [52–54].

Numerous investigations have revealed a strong correlation between vascular endothelial homeostasis and periodontal infections, particularly *Porphyromonas gingivalis*. However, the underlying processes and function of *Porphyromonas gingivalis* remain unclear. According to studies conducted by Xie et al. (2020), *Porphyromonas gingivalis* can damage endothelial integrity by preventing cell division, causing endothelial mesenchymal transition, and causing endothelial cells to undergo apoptosis. These processes lower cell counts and weaken the endothelium's capacity for self-healing. Based to a mechanistic analysis, *Porphyromonas gingivalis* can severely degrade endothelium integrity. However, TLR-NF-κB signaling can significantly restore this integrity, indicating that TLR-NF-κB signalling is essential for maintaining vascular endothelial homeostasis. These findings point to a possible course of action for treating and preventing cardiovascular disease [55].

CONCLUSIONS

Periodontal disease could be associated with an increased risk of cardiovascular disease, and its management could influence the treatment of cardiovascular disease. Through this article I have tried to highlight a potential for improvement of cardiovascular diseases through a strict approach to oral hygiene. Periodic professional hygiene reduces the microbial load, including gram-negative flora well represented by *Porphyromonas gingivalis*.

Investigating the correlation between these pathologies is complex, requires a longer period of time and in-depth studies to determine if periodontal treatment can lead to a decrease in morbidity and mortality from cardiovascular diseases induced by *Porphyromonas gingivalis.*

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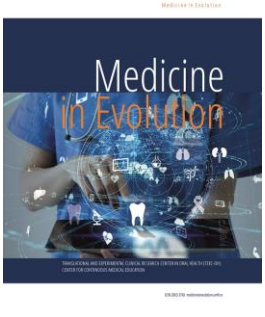
Probiotic Therapy and the Oral Microbiome



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Abstract

The aim of this randomized controlled trial is to obtain an enhancement of general oral health by supplementing the daily oral hygiene with a three-month oral probiotic therapy. For this randomized clinical trial, patients for the study group were selected meeting defined inclusion and exclusion criteria and Gingival Probing Deapth (GDP), Bleeding on Probing (BOP) and pH was measured before and after using probiotic therapy. For statistical analisys, the data was transferred from the periodontal chart into an Excel sheet. The results were presented by means of descriptive analysis, followed by the statistical analysis with the Fisher's exact test, testing whether the null-hypothesis is rejected. In the study group, nine out of ten patients showed an improvement after the treatment phase, and one patient did not present an improvement. In the control group seven out of ten patients showed an improvement, and three patients did not. The test resulted in $p = 0.291$, thus $p > 0,05$, which means, that there was no statistical significance in improvement in the two groups for GPD. Only those participants were included in the database, which demonstrated BOP > 0 during the first measurement. In the study group eight patients were included in the study, of which all presented an improvement in BOP after the oral probiotic therapy. In the control group four patients were included in the study, of which no patient presented an improvement. The test resulted in $p = 0.002$, thus $p < 0.05$. The improvement in the two groups for BOP was considered statistically very significant. In conclusion, improvements have been obtained by a decrease in BOP. Although the intake of oral probiotics on GPD and salivary pH did not show statistical significance, positive changes have also been noted. Further studies are needed to prove the beneficial effects of oral probiotics on oral health.

Keywords: probiotic therapy, oral health, oral pH, BOP

INTRODUCTION

Probiotics are described as living, nonpathogenic bacteria that, when administered in the proper dosage, may have a favorable effect on the host organism (1). A rising interest regarding oral and systemic health is noted since dental health is a crucial factor in life quality. Thus, preventive treatment is considered as essential in oral health. The increasing demand for the prevention of oral diseases and the promotion of oral health, rather than just treating dental problems, causes the patients to be more inclined to obtain a higher standard of oral health promotion service. In the last couple of years, the introduction of probiotics in the field of dentistry has drawn attention and has shown promising affects in terms of oral health.

Probiotics are already widely utilized for general health, especially in gastroenterology. They aid in inhibiting pathogenic colonization and the spread of disease and furthermore stimulate flora that incites health. They reinforce the immune system to fight against allergies, stress, toxicants, and other diseases (2). They develop their health-promoting properties on the one hand through direct local inhibition of competing microorganisms and on the other hand through contact with cells of the mucosal immune system, which are found in all mucosal membranes.

Complex immunological regulatory mechanisms are initiated, that can influence the strength of inflammatory reactions, at the site of direct contact, and also systemically in other regions of the body. In addition, probiotics can stimulate mucosal cells to produce more antibacterial mucus and improve the tightness of the epithelial barrier against penetration of harmful substances and germs (3). Especially in the arising era of antibiotic resistance, the use of oral probiotics seems to facilitate new possibilities in the treatment and the prevention of diseases. The oral cavity is a microbiological medium that requires homeostasis.

The oral microbiome is made up of more than 700 different species (4). Apparently only 54% of them are yet identified with title and culture, 14% are cultured but not titled and the residual 32% are untitled. The oral cavity is characterized by a great diversity of microorganisms like bacteria, viruses, fungi, archaea and protozoa. The dominating microorganisms are bacteria.

Several niches in the oral cavity present different features like the soft tissue lining of the oral mucosa and tongue, the hard tissue lining of the teeth, and the saliva. Every niche has a distinct ecosystem, which provides an ideal environment and nourishment for the inhabiting microorganisms.

The balance between the host and the microbial species that coexist in it is crucial for oral health at all stages of life. However, it is quite difficult to maintain this equilibrium, and many factors might disturb it like general dietary behavior, sugar intake, cigarette smoking, dental hygiene, and utilization of antibiotics and other antimicrobials (5).

Factors like poor oral hygiene, nutrition, and immunosuppression can disturb the equilibrium, leading to oral infections. These might need extensive therapy due to their polymicrobial nature (1).

Currently, a variety of microorganisms are applied as probiotics. The most commonly used bacteria belong to the species Lactobacillus, which is the largest group of bacteria to be considered as probiotics, and the Bifidobacterium and Streptococcus (6,7). These bacteria are naturally inhabiting the system and do not present any adverse effects (7).

The Food and Drug Administration in the United States has declared the following probiotics to be generally considered safe: *Lactobacillus reuteri; Lactobacillus acidophilus*, *Lactobacillus lactis, Pediococcus acidilactici*; *Lactobacillus casei subsp. Rhamnosus*; *Bifidobacterium*

longum; *Bifidobacterium lactis* and *Streptococcus thermophilus*; *Carnobacterium maltaromaticum*; *S. cerevisae* and *Saccharomyces cerevisae* (8).

Their exact mechanism of action in the oral cavity is still unknown, but they are capable to disturb the imbalance existing in biofilm-associated infections.

In terms of oral hazards, probiotic bacteria may minimize the prevalence of infections linked to dental caries (mutans streptococci) (6). Systemic antimicrobial medications may be necessary for the treatment of these diseases, which can lead to gastrointestinal side effects because of broad spectrum antibiotics, bacterial resistance, and allergic reactions. This is why several authors have suggested alternate treatments that can provide significant benefits without doing harm to the patient.

Oral probiotics have displayed successful results in caries prophylaxis, reduction of oral candida counts, periodontal disease management, and in the treatment of halitosis. Lately, probiotic therapies have been established, that target the disruption of cariogenic bacteria. Studies have shown that probiotics are able to temporary decrease the amount of streptococci in saliva and plaque (6).

The presence of pathogenic bacteria and the absence of favourable bacteria can contribute to the onset of periodontal disease. Conventional therapy methods aim the reduction of pathogenic bacteria and include mechanical subgingival debridement, sometimes in combination with antibiotics, and oral hygiene enhancement. Currently, the application of probiotics to re-establish the right number of favourable bacteria in the oral cavity has attracted more attention.

Significant diversity in patient population and investigated variables make it difficult to analyze the existing data. For instance, different degrees of periodontal disease (gingivitis, chronic periodontitis and aggressive periodontitis) and several examined parameters, like measuring pocket depths, bleeding on probing, microbiologic factors in saliva and plaque, and various markers for gingivitis and plaque interfere with the analisys.

Aim and objectives

In this study, the focus was set on the effect of the oral probiotic on Gingival Probing Depth (GPD), Bleeding On Probing (BOP), and on the salivary pH. The aim of this randomized controlled trial is to obtain an enhancement of general oral health by supplementing the daily oral hygiene with a three-month oral probiotic therapy. The applied oral probiotic is a pharmaceutical product, acquirable without prescription, and easy to include in the daily routine.

MATERIAL AND METHODS

For this randomized clinical trial, patients for the study group were selected meeting defined inclusion and exclusion criteria. Compatible patients were found for the control group to achieve comparability between the two groups. Each group compromised 10 patients. The patients were requested to maintain their habitual oral health care during the 3 months trial-period. Inclusion and exclusion criteria were defined to achieve a uniform and appropiate study population

During the first appointment, the pH value of the saliva was measured with the indicator paper "Uralyt-U". The patient was requested to not eat, drink, smoke or brush the teeth at least one hour before the measurement to not affect the results. The patient was instructed to collect saliva in a sterile tube and the indicator paper was immersed in the tube for two seconds. After 5 seconds, the color of the indicator paper was compared to the colour scale to determine the pH-value (9). The normal range of salivary pH ranges from 6.2-7.6 with

6.7 being the average value. Values above 7.6 indicate an alkaline environment and values below 6.2, an acid environment (10).

The measurement of gingival probing depth and bleeding on probing (BOP) was performed with a Williams periodontal probe, which is blunt-tipped and marked with a millimeter-scale. The gingival depth measurement is carried out by inserting the probe into the space between tooth and gingiva parallel to the root surface. Minimal pressure (0.25N) is applied until further insertion is inhibited by resistance as the probe tip reaches the bottom of the pocket. Probing depth assesses the width between the probe tip and the gingival margin.

Probing depth can vary depending on the site of the tooth, local anatomy, probing force, and angulation-, thickness-, and type the probe. Probing depth reproducibility and intra-clinician discrepancies were observed.

Subjects of the study group were instructed to take in the probiotics (,,OraLactin'', ,,BioLactis'', Cumdente, Germany) once daily after a meal for 3 months. It is a natural dental care cosmetic to support the oral immunity, to prevent caries and gingival diseases, and acts against halitosis. The oral probiotic contains gram positive bacterial strains, like lactobacilli and bifidobacteria, which can inhibit the growth of pathogenic bacteria or selectively kill them. Furthermore, probiotic bacteria produce oxygen derivates, which helps to reduce the pathogenic anaerobe bacteria. The powder gets a viscous consistency through the saliva and is rinsed in the oral cavity for 60 seconds.

After 3 months of probiotic therapy of the study group and no therapy of the control group, GPD, BOP and salivary pH were tested again and the results were transferred into a periodontal chart for the reevaluation.

For statistical analisys, the data was transferred from the periodontal chart into an Excel sheet. Per participant there were 146 data points collected for each of the two measurements: 144 gingival probing depths (if 32 teeth present, four probing values each; if missing tooth, respectively no probing value measured), one pH and one bleeding value. These data points were treated as dependent data points as they are the result of the binary independent variable that is if a treatment was undertaken.

The GPD variable in ratio scaled as the metric (measured in mm) has a true zero and equal intervals between neighboring points. For the purpose of the analysis, the mean GPD across all 144 (or less, if not all 32 teeth present) measurements was taken as the underlying question looked at an overall improvement of the oral health and not that of specific teeth.

PH is an interval scaled variable on a linear scale but not relative to a true zero (similar to temperature). In absence of a true zero, relative comparisons can be made but ratios and proportions are not meaningful. BOP is an absolute scaled variable as it counts the number of bleeding points when performing periodontal probing. Thus, its natural origin is zero with clear ordering.

For the purpose of this work, changes were templated into binary values, where a binary value of zero depicts no improvement, whereas a binary value of one depicts an improvement. An improvement has a different interpretation for GPD and BOP than for salivary pH. An improvement was defined as a decrease in value of GPD, and a decrease in the BOP is reflecting less bleeding.

The results were presented by means of descriptive analysis, followed by the statistical analysis with the Fisher's exact test, testing whether the null-hypothesis is rejected or not.

RESULTS

Nine patients of the study group showed an improvement in GPD, denoted by the binary value "1". Only one patient did not showing an improvement, denoted by "0".

The mean decrease in gingival probing depth of the study group counted -5%.

In the control group, seven patients showed an improvement in GPD, and three patients did not present an improvement. The mean decrease in gingival probing depth of the control group counted -1%.

In the study group, eight patients showed a decrease in the number of BOP, which displays an improvement. In the control group none of the participants showed an improvement in BOP after the treatment.

Regarding pH values, one patient in the study group demonstrated an improvement in the salivary pH, denoted by the binary value 1. The salivary pH in the first measurement was 5.9, and at the second measurement 6.7. All other patients of the study group did not present an improvement in the salivary pH, denoted by the binary value "0". They presented a pH-value inside the normal range of salivary pH at the first measurement, and also displayed a pH-value inside the normal range at the second measurement. In the control group, no patient showed an improvement of the salivary pH. All patients of the control group presented a pH-value in the normal range at the first measurement, and at the second measurement as well. The study group had a mean pH of 6.58 at the initial measurement and 6.81 at the second measurement. The control group presented a mean pH of 6.63 at the initial measurement and 6.61 at the second measurement.

The counts of "improvements" and "no improvements" of GPD were transferred into the 2x2 contingency table (Fig. 1). In the study group, nine out of ten patients showed an improvement after the treatment phase, and one patient did not present an improvement. In the control group seven out of ten patients showed an improvement, and three patients did not. The test resulted in p = 0,2910, thus p > 0,05, which means, that there was no statistical significance in improvement in the two groups for GPD.

	Improvement	No improvement	Total
Study	9	1	10
Control	7	3	10
Total	16	4	20

Fisher's exact test

The one-tailed P value equals 0.2910

The association between rows (groups) and columns (outcomes) is considered to be not statistically significant.

Figure 1. Probing depth alterations between study group and control group

Only those participants were included in the database, which demonstrated BOP > 0 during the first measurement. In the study group eight patients were included in the study, of which all presented an improvement in BOP after the oral probiotic therapy. In the control group four patients were included in the study, of which no patient presented an improvement. The test resulted in p = 0.0020, thus p < 0.05. The improvement in the two groups for BOP was considered statistically very significant.

	Improvement	No improvement	Total
Study	8	0	8
Control	0	4	4
Total	8	4	12

Fisher's exact test
The one-tailed P value equals 0.0020
The association between rows (groups) and columns (outcomes) is considered to be very statistically significant.

Figure 2. Bleeding on probing – changes in the control and study group

In the study group, one out of ten patients presented an improvement in salivary pH after the oral probiotic treatment, and nine patient presented no improvement. In the control group zero out of ten patients presented an improvement in salivary pH, and ten patients demonstrated no improvement.

	Improvement	No Improvement	Total
Study	1	9	10
Control	0	10	10
Total	1	19	20

Fisher's exact test
The two-tailed P value equals 1.0000
The association between rows (groups) and columns (outcomes) is considered to be not statistically significant.

Figure 3. pH measurements within the control and study group

The test resulted in $p = 1.0000$, thus $p > 0.05$. The improvement of salivary pH in the two groups was considered not to be statistically significant.

DISCUSSIONS

The experimental study was aimed to estimate the effect of the oral probiotic "OraLactin" ("BioLactis") on the oral health, tested on three parameters, GPD, BOP, and salivary pH. The results were obtained by two different approaches. As first instance, the data of the study group and control group was compared by descriptive analysis, which should give a more detailed overview about the obtained results of the two groups. Next, statistical analysis was performed with the Fisher's test to establish, whether the null hypothesis is rejected or not. The comparison of the results of the two groups concerning GPD showed that there was a greater improvement in the study group than in the control group. In the study group nine out of ten patients presented an improvement, and in the control group seven out of ten people improved their GPD.

The mean decrease of GPD in percentage enables a more precise evaluation. The study group presented a mean decrease of -5%, whereas the control group demonstrated a mean decrease of only -1%. Although in the control group a considerable number of participants

presented an improvement in GPD at the second measurement, the extent of improvement was by far not as great as the improvement in the study group.

The fact, that also in the control group an improvement in GPD was identified, even no oral probiotic was taken in might be explained by the Hawthorne effect. This effect supposes that patients may have carried out a more thorough and a more regular dental hygiene at home, due to their awareness of being monitored in the clinical study, even though they were asked to maintain their ordinary dental hygiene (11). In the study conducted by Krasse *et al*. one of two *L. reuteri* formulas was administered to participants with moderate to severe gingivitis, and it was stated that they had less plaque and gingivitis levels than the placebo group (12). Therefore, reason for the decrease in GPD could be the reduction of enlarged gingiva in areas of gingivitis.

A systematic review and meta-analysis of clinical trials about the supplementary use of probiotics to periodontal treatment, researched by Louis Hardan *et al*., demonstrated the gain of clinical attachment in periodontitis patients after SRP in conjunction with probiotics (13).

No evidence was found for clinical attachment gain only after oral probiotic therapy without SRP. In the clinical practice guideline conducted by Mariano Sanz *et al.* the use of probiotics as supplementation to subgingival instrumentation in periodontitis patients is discouraged. No statistical significance could be obtained in the mean difference in probing pocket depth between probiotics and placebo. Solely the probiotic formulation containing *L. reuteri* demonstrated improved probing depth reductions (14).

Opposing the results of BOP of both groups, eight patients of the study group presented an improvement, whereas in the control group no patient showed an improvement.

It is to mention, that for two patients of the study group, and for six patients of the control group no improvement was possible to achieve, because their initial BOP value was 0.

This significantly decreases the sample size, because only those patients with a BOP > 0 were included in the study, which considerably affects the meaningfulness of the study.

For future studies, it is be recommended to include only those patients in the study group and in the control group, which present a BOP > 0 at the first measurement.

Nevertheless, referring only to those patients included in the study with a BOP > 0 at the first measurement, all patients of the study group demonstrated an improvement in BOP, in contrast to the control group, where no patient presented an improvement. In the double-blind, placebo-controlled randomized controlled trial conducted by Mi-Sun Kang *et al.* an improvement in the bleeding index was recognized in the study group taking in oral probiotic tablets for 8 weeks after SRP (15). Bleeding on probing is a key indicator used to determine gingivitis. The insertion of a periodontal probe causes bleeding, if the gingiva is inflamed and the pocket epithelium is atrophic or ulcerated, which is thought to be mediated by subgingival pathogenic bacteria (13).

For the Fisher's exact test as well, only those patients with a BOP > 0 at the first measurement were included. The test resulted in $p = 0.0020$, thus $p < 0.05$. The improvement in the two groups for BOP was considered statistically very significant.

Disregarding the small sample size, the oral probiotic therapy seems to have a positive impact on gingival bleeding on probing. The systematic review and meta-analysis by Zohre Gheisary *et al*., published in 2022, advocates the outcome of the study. Included in the studies were patients with or without periodontal disease, but most of them focused on patients with periodontal disease. In the study groups, different forms of probiotics were taken in for a deviating treatment duration from one day to four months, and the sample sizes variegated from 10 to 120 patients. The control groups did not receive any probiotic treatment. The effect of probiotics on BOP in patients with periodontal disease showed a statistically significant decrease in the study groups, in comparison to the control groups (16).

In this study, only those patients were considered to have obtained an improvement, who presented a salivary pH outside the normal range at the initial measurement, and inside the normal range at the second measurement. One patient of the study group presented an improvement, by an increase of salivary pH from 5.9 to 6.7. According to research, the determining factor for the onset and advancement of caries is pH rather than sugar. Low salivary pH encourages the growth of acidic bacteria, allowing these to multiply and thereby causing an unfavourable environment for the defending oral bacteria. This enables a change in the environment that favours cariogenic bacteria and further lowers the pH of the saliva. By regulating pH, it is possible to modify plaque biofilms, remineralize lesions, and possibly even prohibit the disease (17). The other nine patients demonstrated a pH value inside the normal range at the initial measurement and at the second measurement as well. In the control group no patient displayed an initial pH-value outside the normal range.

To mention also those changes, which have taken place inside the interval of the normal salivary pH, the mean pH-values at the first and second measurements were compared between the study and control groups. The study group showed an increase of the salivary pH of 0.23 after the oral probiotic treatment (6.58 - 6.81). In the control group the pH changed with 0.02 (6.63 - 6.61).

A study conducted by Shashibhushan Kukkalli Kamalaksharappa *et al.* evaluated the efficacy of probiotic and green tea mouthrinse on salivary pH in children and the comparison of pre- and post-mean pH of the probiotic group showed an increase of pH from 6.45 - 6.65 towards the mean salivary pH value. Anyhow the results did no show statistical significance (17). The improvement of the salivary pH in the two groups was considered not to be statistically significant ($p > 0.05$).

In the present study no standardization of the oral hygiene status of the participants was performed by oral prophylaxis prior to the trial. This might have led to potential distortions of the study outcomes and it is advisable to do in order to create as similar preconditions as possible.

Another limitation is referring to GPD. The statistical test did not show any significance in improvement in the two groups for GPD. The data included in the Fisher's exact test might not be compelling enough, because any decrease in GPD was considered to be an improvement no matter the size (< 0). A delimitation of the size of the decrease of GPD considered an improvement would be useful by taking into account only more significant decreases in probing depth, for example < -5 %. This would exclude a significant number of participants, which were now in this study considered to present an improvement in GPD.

A further limitation pertaining to GPD is the inclusion of the general population in the study, without distinguishing between health, gingivitis and periodontitis. In fact, testing the effect of the oral probiotic on the general population was the intention of the study, but it makes the interpretation of the results fairly difficult. Furthermore, the small sample size states a drawback. This refers especially to the evaluation of the bleeding index, where not all participants were suitable for the trial, because of their initial bleeding index of zero. No further improvement could be obtained so the concerned participants were excluded from the study sample. Thus, especially those results should be interpreted with caution.

In this study, mainly clinical parameters have been tested. To obtain further explanations for the effect of oral probiotics on the measured variables, the inclusion of microbiological or immunological parameters could be additionally implemented in the investigation. (12)

CONCLUSIONS

In conclusion, improvements have been obtained by a decrease in BOP. The decrease in BOP indicates a reduction of pathogenic bacteria inducing inflammation of the gingiva. The link between BOP and microbiological parameters could be additionally investigated in future research. Although the intake of oral probiotics on GPD and salivary pH did not show statistical significance, positive changes have also been noted. Further studies are needed to prove the beneficial effects of oral probiotics on oral health.

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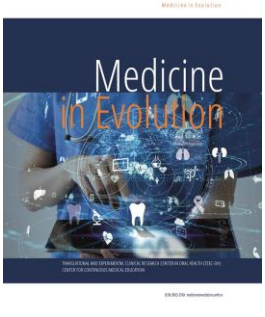
Screening Periodontitis Associated with Diabetes by Using Oxidative Stress Biomarkers in Blood and Gingival Tissue



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Abstract

Introduction: Periodontitis and diabetes have a two-way relationship but the mechanisms implicated in their association are still unclear. Aim and scope: We aimed to evaluate local and circulatory oxidative stress in an experimentally induced periodontitis associated with diabetes on Wistar rats. Materials and methods: Forty Wistar rats were divided in: control group (C) and periodontitis (P), diabetes (D) and periodontitis associated with diabetes (DP) group. Blood and gingival malondialdehyde (MDA) and blood glutathione (GSH), oxidized glutathione (GSSG), GSH/GSSG ratio, and catalase (CAT), and gingival CAT were determined. Results: blood and gingival MDA increased significantly in P and DP and blood GSH, GSSG, GSH/GSSG, CAT and gingival CAT decreased significantly. Circulatory MDA, GSH, GSSG and GSH/GSSG were significantly modified in DP compared to P. Conclusion: oxidative stress is implicated in periodontitis and periodontitis associated with diabetes and circulatory MDA, GSH, GSSG and GSH/GSSG could indicate a risk of their association.

Keywords: Periodontitis, diabetes, oxidative stress, screening

INTRODUCTION

Although oxygen is one of the most important constituent of the aerobic life, under specific conditions it generates reactive oxygen species (ROS) which are capable of producing necrosis and cellular death. Organisms counteract the accumulation of ROS by augmenting the antioxidant activity. When an imbalance between the prooxidant and antioxidant status occurs, oxidative stress is installed and results into alterations and eventually disease [1,2].

Periodontitis has a multifactorial etiopathogenesis implicating infectious agents, factors depending on the host, different diet habits, genetic factors, the state of the general health as well as the quality of the immune-inflammatory response [3]. The most important etiological factor, the bacterial pathogens in the dental plaque, generate a prolonged inflammatory reaction and systemic conditions that lead to oxidative stress [4-6].

On the other hand, the overproduction of ROS can be strictly associated with hyperglycemia, involving mechanisms like glucose autoxidation, polyol pathway, prostanoids synthesis and protein glycation. Moreover, the exposure of the endothelial cells to increased levels of glucose can cause hyperproduction of ROS [7]. This could explain the periodontal tissues alterations in patients with diabetes in the absence of the dental plaque, and sustain the theory of the interrelation diabetes and periodontitis [8,9].

Even though there is an interrelation between diabetes and periodontitis that goes both directions [9] with diabetes being recognized as a risk factor for periodontitis and periodontitis a risk factor for glycemic decompensation and diabetes [10,11], in present, the mechanisms implicated in the association of periodontitis with diabetes are incompletely elucidated [12].

Aim and objectives

In our research we aimed to evaluated the oxidative stress implication in the periodontitis associated with diabetes pathogenesis, by evaluating the circulatory and local levels of some oxidative stress biomarkers: blood malondialdehyde (MDA), glutathione (GSH), oxidized glutathione (GSSG), GSH/GSSG ratio, and catalase (CAT) and gingival MDA and CAT in an in vivo model of induced periodontitis in diabetic Wistar rats.

MATERIAL AND METHODS

Experimental protocol

The study was performed at BIOCOM Research Centre of the Department of Physiology, Cluj Napoca, Romania. 40 Wistar albino rats (males, 8 weeks old, having a mean ± SD 220 ± 20 g each) were distributed 5 per cage, at a temperature of 21 ± 2 °C, 70% ± 4% humidity and 12-h dark/12-h light cycle, fed standard pellet laboratory diet and water ad libitum. One week of acclimatization preceded the experiment.

The rats were randomly divided in four groups: Group DIABETES (D) – rats with induced diabetes; Group DIABETES-PERIODONTITIS (DP) - rats with induced diabetes and periodontitis; Group PERIODONTITIS (P) - rats with induced periodontitis; Group CONTROL (C) – control group.

Reagents

We used streptozotocin (STZ), glucose, 2-thiobarbituric acid, o-phthalaldehyde, hydrogen peroxide and kalium phosphate buffer (Sigma Aldrich Chemicals GmbH (Munich, Germany)). The vehicle for streptozotocin and glucose dissolution was distilled water.

Diabetes induction

Under an anesthesia with a cocktail of ketamine (100 mg/kg body weight (bw)) and xylazine (10-mg/kg-1 bw) administered i.m. (intramuscular), diabetes was induced in groups D and DP by a i.v. (intravenous) injection in the caudal vein containing STZ 30 mgkg-1 bw, followed by glucose 30%, 2 mL/animal, at an interval of 6 h [13]. STZ has been found to selectively alter pancreatic β cells by an oxidative stress mechanism, reduce the insulin level and enhance the glucose level in the circulation, leading to diabetes installation [14]. The animals in group P and CONTROL group were given distilled water alone. The rats were tested for diabetes after 72 h, by measuring their glycemia with a glucometer in the blood collected from the caudal vein. A glycemia <300 mg/dL needed the re-administration of STZ and glucose.

Periodontitis induction

For the induction of periodontitis an orthodontic ligature was placed interproximal, in the gingival sulcus around the second molars [13]. The ligature method is the most common method of periodontitis experimental induction [15] as it facilitates biofilm adhesion, plaque formation and bone resorption [16,17]. The depth of the pockets was measured with a dental probe in 6 sites — mesial, central and distal, both on the buccal and the oral side of the tooth. After 15 days, when the deepest pocket reached an average depth of 3.1 mm, periodontitis was declared induced. The ligatures were then removed with the plaque or calculus maintained in place [13].

Blood and Tissue Sample Collection

After 10 weeks, under anesthesia (100 mg/kg bw ketamine and 10 mg/kg bw xylazine administered intraperitoneal in a cocktail), 5 mL of blood was collected from the retro-orbital venous sinus of all rats and biochemical assays were performed. Gingival mucosa of the ligated teeth and control teeth were harvested, homogenized with a polytron homogenizer (Brinkman Kinematica, Lucerne, Switzerland) for 3 min on ice, in phosphate-buffered saline (PBS) (pH 7.4) and added at a ratio of 1:4 (w/v). The suspension was centrifuged at 3000×g and 4 °C for 5 min and from the resulted cytosolic fraction from which the protein content was assessed [18].

Oxidative Stress Biochemical assays

The levels of oxidative stress and antioxidant capacity in blood were measured fluorometrically using 2-thiobarbituric acid in the case of MDA [19] and o-phthalaldehyde in the case of GSH and GSSG [20,21]. The results were expressed in nmoles/mL.

The protein content in the gingival tissue samples was determined with bovine serum albumin as the standard. After the homogenates were heated in a boiling water bath for 1 h in 75-mM K2HPO4, at a pH of 3 and containing 10-mM 2-thiobarbituric acid, they were cooled and the solution was extracted using 3 mL of n-butanol in 0.6 mL of 2-thiobarbituric acid. MDA levels were estimated spectrofluorometrically in the organic phase using a synchronous technique with 534 nm of excitation and 548 nm of emission. MDA was expressed as nmol/mg protein.

For CAT evaluation, the homogenates and cell lysates were put into reaction with 10-mM hydrogen peroxide in 50-mM kalium phosphate buffer, pH 7.4. CAT was quantified in units/mg protein, where one unit was defined as the quantity of enzyme that generated an absorbance reduction of 0.43 at 25 °C per minute at 240 nm [22].

Statistical Analysis

ANOVA with the Scheffe's tests were applied to compare the levels of significance between groups. SPSS 24 software, Armonk, NY, USA was used for all statistical analyses. The values of $p \leq 0.05$ were considered significant.

RESULTS

Blood MDA, GSH, GSSG, GSH/GSSG and CAT in diabetes (D), periodontitis (P) and diabetes associated with periodontitis (DP) were significantly modified when compared with the control group. MDA, the marker of the oxidative stress was enhanced in the induced pathologies and GSH, GSSG, GSH/GSSG and CAT, indicators of the antioxidative activity were reduced (Figure 1).

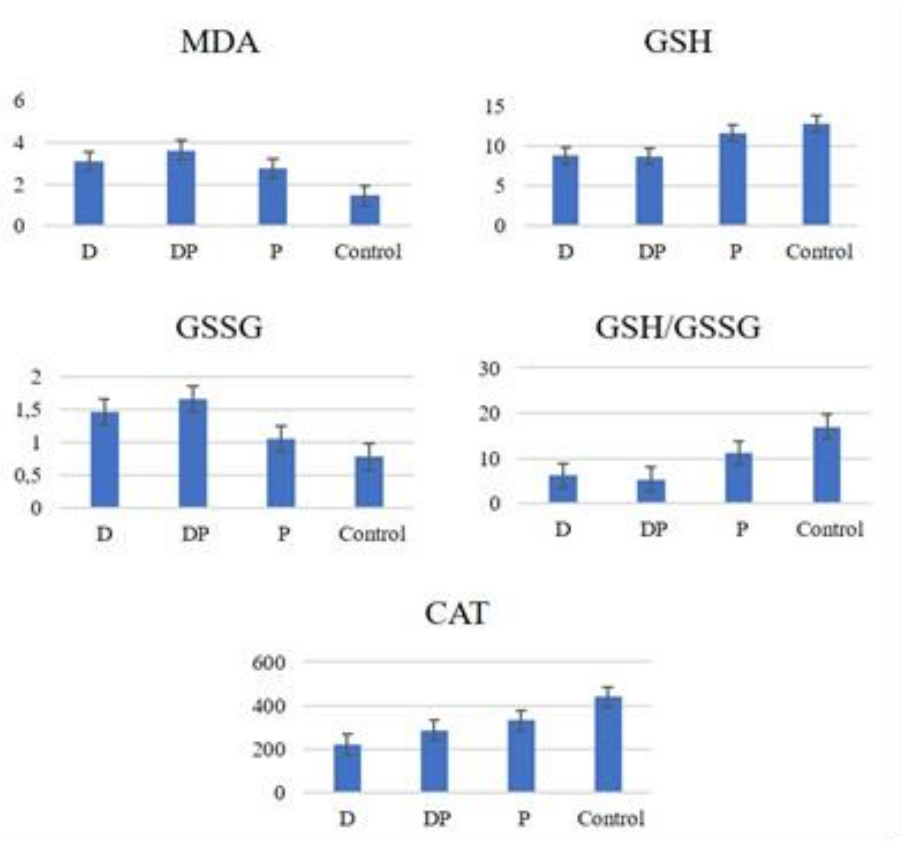

Figure 1. Mean variable evolution of oxidative stress (MDA) and antioxidant capacity biomarkers (GSH, GSSG, GSH/GSSG and CAT) in blood

At the ANOVA test, significant differences of MDA, GSH, GSSG, GSH/GSSG and CAT blood values were depicted between all three groups compared to the control group (Table 1).

Table 1. Variance analysis of the blood variables for groups D, P, DP and Control

	SS	F	p-value
MDA	30.08	33.47	0
GSH	162.464	21.76	0
GSSG	5.36	35.26	0
GSH/GSSG	941.08	52.25	0
CAT	345559	24.63	0

SS – Total Sum of Squares, MDA – malondialdehyde, GSH – glutathione, GSSG – oxidized glutathione and CAT – catalase

The Scheffe test resulted in significant differences between the control group and all other groups, except for the blood GSH levels in DP group.

There were no significant differences in none of the markers when groups D and DP were compared.

Blood MDA was comparable in D and P groups, but the antioxidant capacity biomarkers were significantly different. GSH, GSH/GSSG and CAT were more reduced in diabetes than periodontitis, while GSSG was lower in periodontitis. In the case of diabetes associated with periodontitis (DP), MDA had higher levels than in periodontitis (P) and the antioxidant activity was lowered (GSH, GSH/GSSG and CAT) although, regarding CAT, the differences were not statistically significant. GSSG was more expressed in DP than in P (p<0,005) (Table 2).

Table 2. Scheffe's test results for multiple comparisons of the blood biomarkers

Group		MDA		GSH		GSSG		GSH/GSSG		CAT	
		Mean Diff	p-value	Mean Diff	p-value	Mean Diff	p-value	Mean Diff	p-value	Mean Diff	p-value
D	DP	-0.53	0.19	0.17	0.99	-0.18	0.32	0.91	0.88	-64.73	0.19
	P	0.31	0.55	-2.76*	0	0.41*	0	-4.99*	0	-110.54*	0
	C	-1.63*	0	-3.88*	0	0.69*	0	-10.78*	0	-219.14*	0
DP	D	0.53	0.19	-0.17	0.99	0.18	0.32	-0.91*	0.88	64.73	0.19
	P	0.85*	0.01	-2.93*	0.0	0.60*	0	-5.91*	0	-45.81	0.46
	C	2.17	0	-4.05*	0	0.88*	0	-11.69*	0	-154.41*	0
P	D	-0.31	0.55	2.76*	0	-0.41*	0	4.99*	0	110.54*	0
	DP	-0.85*	0.01	2.93*	0	-0.60*	0	5.91*	0	45.81	0.46
	C	1.31*	0	-1.11	0.3	0.27*	0.03	-5.78*	0	-108.6*	0
C	D	-1.63*	0	3.88*	0	-0.69*	0	10.78*	0	219.14*	0
	DP	-2.17*	0	4.05*	0	-0.88*	0	11.69*	0	154.41*	0
	P	-1.31*	0	1.11	0.3	-0.27*	0.03	5.78*	0	108.6*	0

*Significant mean diff values at the significance level <0.05. Mean Diff – mean difference between the groups.

Analyzing the mean gingival MDA and CAT values in ligatured teeth and control teeth, both biomarkers were modified in gingiva of all groups compared to the gingiva in the controls (p<0,005) (Table 3).

Table 3. Variance analysis of the gingival variables for groups D, P, DP and Control

	SS	F	p-value
MDA	3.09	10.06	0
CAT	14194.28	20.25	0

There was a correlation between MDA and CAT biomarkers in gingival tissue and blood (Figure 2).

Scheffe test revealed that gingival MDA was augmented and gingival CAT was lowered in all groups compared to Control group (p<0.005). The differences were statistically significant (Table 4). Between the pathological groups the only significant result was depicted between MDA in D and P group, where the gingival oxidative stress was more intensive in periodontitis than in diabetes. Blood and gingival CAT was more expressed in the Control group followed by P, DP and D in blood, and by D, DP and P in gingiva.

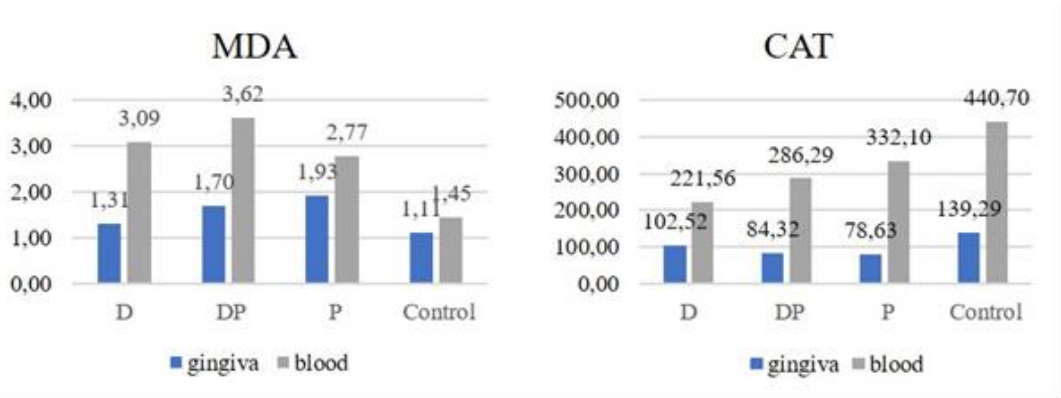

Figure 2. Mean variable evolution of oxidative stress (MDA) and antioxidant capacity biomarker (CAT) in gingiva and blood

Table 4. Scheffe's test results for multiple comparisons of the gingival biomarkers

Group		MDA		CAT	
		Mean Diff	p-value	Mean Diff	p-value
D	DP	-0.38	0.18	18.2	0.25
	P	0.61*	0.01	23.88	0.09
	C	0.19	0.68	-36.77*	0
DP	D	0.38	0.16	18.2	0.25
	P	-0.23	0.58	5.68	0.93
	C	0.58*	0.02	-54.97*	0
P	D	0.61*	0.01	-23.88	0.09
	DP	0.23	0.58	-5.68	0.93
	C	0.81*	0	-60.66*	0
C	D	-0.19	0.68	36.77*	0
	DP	-0.58*	0.02	54.97*	0
	P	-0.81*	0.02	60.66*	0
* significant mean diff values at the significance level <0.05. Mean Diff – mean difference between the groups.					

DISCUSSIONS

In our study the markers of oxidative stress and antioxidant capacity, both in blood and gingival tissue harvested from the studied animals, were significantly modified in diabetes, periodontitis and diabetes associated with periodontitis compared to controls.

For the induction of diabetes, we used STZ, an alchilant agent of DNA [23,24] that produces a rapid depletion of beta cells followed by a reduction in the secretion of insulin, hyperglycemia, a marked proinflammatory state, ROS production, oxidative stress and apoptosis [25,26].

Periodontitis was induced by placing around the molars, in the gingival sulcus, stainless-steel ligatures. The accumulation of dental plaque generates local inflammation, release of proinflammatory cytokines, polymorphonuclear cell infiltration and oxidative reactions leading to production of ROS in order to eliminate the bacteria and prevent the destruction of the periodontal tissue and bone resorption [27,28]. When the antioxidant system is overwhelmed periodontitis is installed [29,30].

The first targets of ROS are the poly-unsaturated fatty acids in the cellular membrane. Their peroxidation leads to MDA synthesis, making MDA an important indicator of the intensity of the oxidative stress [31]. In our study, blood MDA increased significantly in D, DP and P groups compared to the control group attesting the installation of the oxidative stress [32-36].

When groups D, DP and P were compared, rats with diabetes, with or without periodontitis, experienced higher circulatory MDA levels, than the periodontitis rats. The significant differences between DP and P groups could be explain as a summation of local oxidative stress implicated in the etiopathogenesis of periodontitis that is eventually manifesting at a circulatory level [27, 28] and a general oxidative stress present in the context of diabetes [7]. Our results support the theory according to which diabetes when associated with an increased lipid peroxidation could aggravate an inflammatory microbian process such as periodontitis [33]. Circulatory MDA, therefore could be considered an indicator of the association of periodontitis and diabetes.

Lowered levels of the antioxidant indicators GSH, GSSG, GSH/GSSG and CAT were corelated with the MDA levels in the tested groups compared to controls. In the rats with diabetes, DP and D groups, the antioxidant depletion was significantly lowered than in P group as the systemic oxidative stress is corelated with a depletion in the organisms antioxidative pool in the attempt of establishing the oxidants-antioxidants homeostatic equilibrium [4,37-39].

At a local, gingival level, MDA and CAT were significantly different in P and DP groups compared with the control animals indicating an augmentation of oxidative stress and a depletion of the antioxidant capacity in periodontitis and periodontitis associated with diabetes [8,40].

At the D, DP and P comparison, in periodontitis groups, MDA was found more expressed. Significant differences were depicted between D and P groups where local MDA was higher in periodontitis ($p<0,005$) [41].

Blood and gingival CAT values were significantly decreased in the tested groups compared to the control group ($p<0,05$) as a result of the organisms attempt to counteract the oxidative stress [8,40].

Between the tested groups we obtained lower values of CAT in D, DP followed by P when assayed from blood and P, DP and D when assayed from gingival tissue [41]. More significant differences could result after a longer period of time of periodontitis and diabetes evolution leading to a higher accumulation of local ROS and increased local oxidative stress.

CONCLUSIONS

Oxidative stress is implicated in the pathogenesis of periodontitis and periodontitis associated with diabetes, attested by increased circulatory and local MDA levels and reduced circulatory levels of GSH, GSSG, GSH/GSSG and CAT, and locally lowered CAT levels.

Significantly increased blood MDA and decreased blood GSH, GSSG and GSH/GSSG in periodontitis with diabetes when compared to periodontitis, indicate these oxidative stress biomarkers as potential screening tools in estimating the risk of the periodontitis and diabetes association.

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Institutional Review Board Statement: The study was approved by the Ethical Committee on Animal Welfare of "Iuliu Haţieganu" University of Medicine and Pharmacy nr. 172/13 June 2019, in accordance with the Guidelines on the Care and Use of Animals for Scientific Purposes, National Advisory Committee for Laboratory Animal Research, 2004.

Conflicts of Interest: The authors declare no conflict of interest.

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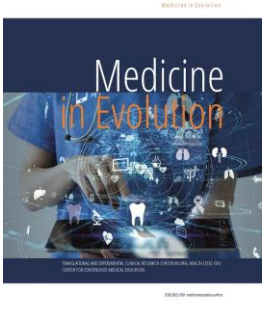
Legal Considerations Regarding the Importance of Complying with the Obligation in Providing Medical Care



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Abstract

The knowledge and compliance of dentist's professional obligations related to the relationship with patients is a theoretical and a practical current topic.

Knowing the consequences that may arise from a legal perspective and the violation of the legislation, determines of a preventive attitude of the dentists. Regarding the dentist's knowledge and information related to their profession, the number of malpractice allegations can considerably decrease. To carry out this study, a questionnaire consisting of 10 closed choice or selection questions had the aim to highlight the degree of dentist's awareness regarding the importance of respecting their professional obligations in the relationship with patients. After completing the questionnaires, the results assess through statistical analysis.

The main conclusion resulting from this study demonstrate that compliance with professional obligations in medical practice in the relationship with patient's needs, first of all, detailed knowledge of the legislation, which requires continuous documentation and participation in professional training courses and conferences dedicated to legislation in the medical domain.

Keywords: obligation, provide medical care, preserve professional confidence, dentist, patient, personal data

INTRODUCTION

Medical care is provide in the public or private health care system and the relationship between the patient and the dentist is based on the dentist's compliance with numerous professional obligations, including the obligation to provide medical care and to keep professional secrecy [1]. The importance of respecting these two professional obligations is evident the provisions of Law no. 95/2006 regarding health reform [2], of Law no. 46/2003 regarding patient rights [3], but also of the Code of Ethics [4]. The dentist has the obligation to provide medical assistance to a person only if the doctor has previously accepted that person as a patient and the medical assistance to be must be part of the specialty or competence of the medical framework for which the doctors has the official recognition [5].

The obligation to provide medical care is an obligation in a strictly professional content, and in this sense, professional competence is one of the main factors in assessing the proper execution or non-execution of this obligation [6].

The dentist who causes harm to the patient as result of insufficient medical knowledge will be legally responsible. Insufficient medical knowledge can be the expression of the dentist's lack of competence in the field [7]. As for exceeding the limits of professional competence, this is justified only in emergency cases where medical professionals with the needed competence are not available. Such a situation exempts from civil liability the medical personnel who acted beyond their professional competence in an emergency medical situation and who, only in this way, caused damage to the patients.

The obligation to provide medical care involves two limits, one related to the personal level of dentist's competency and knowledge and is represented by the scientific and medical clinical situation. The result of the medical act cannot be guaranteed to the patient [8].

The second obligation imposed by the legislation is the one related to the preservation of professional secrecy. Confidentiality constitutes one of the most important values of the medical act and is the basis of the relationship between doctor and patient. The obligation of confidentiality is a professional obligation for all professional healthcare [9]. This obligation is actually the patient's right to the security of personal life, physical, mental and moral integrity, and guaranteeing discretion during the provision of medical care, also ensuring the confidentiality of medical secret information [10].

According to art. 21, Law no. 46/2003, all information regarding the patient's condition, investigation results, diagnosis, prognosis, treatment, personal data are confidential even after his death. In the same sense, and art. 17 of the Dentist's Code of Ethics, according to which the preservation of professional secrecy is mandatory for the dentist, under the conditions established by law.

Aim and objectives

The aim and objectives of this study is to analyse the level of dentist's awareness from Timiș County regarding the importance of respecting professional obligations in the relationship with patients, in order to prevent the engagement of their legal liability as result of causing various damages to those who request assistance medical.

MATERIAL AND METHODS

For this study, were designed 10 closed selection questions focused on analysing the opinion of dentists regarding the importance of respecting the obligation to provide medical care and the maintaining of professional secrecy in the relationship with patients. Each of the

10 questions contained three answer options. The questionnaire was addressed to a group of 50 dentists.

Before answering the questions, dentists signed the consent in order to participate in the conducted study. The aim of this study was explained to the dentists and before completing the questionnaire, the dentists were invited to ask any question they considered necessary regarding this study. The questionnaires were distributed to different dental practices rural and urban cities from Timiş County. The questionnaire also included general information regarding the group of dentists: dentists' gender (M/F), age, and the environment origin (Urban/Rural).

The first question analysed the dentist's knowledge regarding those situations in which the legislation allows them to exceed their professional competence when, at the time of the request for medical assistance by the patient, it is not available any competent medical personnel for that specific medical case. This exceptional situation supports the interests of the patients, and dentists must know from a legal perspective the possibilities and limits in which they can practice and provide medical assistance, without endangering the lives of patients.

The second question aimed to analyse the degree of knowledge regarding those situations in medical practice in which the legislation allows them to provide medical assistance without the patient's consent. We also considered the identification of those sources of information for dentists regarding the regulated legislation for expressing informed consent by patients.

The third question analysed one of the most important rights that not only dentists have to respect, but the entire medical staff, the right to decide for themselves about performing or refusing the medical act, the right to enjoy the professional independence. All medical personnel recognize this professional independence, and through this question, it was aimed to analyse to what extent dentists know in detail the normative acts that protect this right during the exercise of the profession.

Fourth question aimed to analyse to what extent dentists currently feel protected by the legislation in their professional relationship with patients. The aim was to analyse whether the dentist's interests are protected by the legislation or whether there are certain gaps and deficiencies noticed by them that make their medical practice difficult in their relationship with patients.

The fifth question is related to one of the most important obligations namely the obligation of professional secrecy and non-disclosure. Given that there is currently extensive national and international legislation that regulates the obligation of all medical staff to protect professional secrecy, it was aimed to analyse to what extent dentists are familiar with this normative and applies them in their profession. This question is related to the many complaints from patients that have existed over time, generally in medical practice, regarding the violation by medical personnel of the obligation of professional secrecy. It is necessary for dentists to know and apply the legislation that requires them to respect the professional secrecy, precisely so that they do not have to answer legally.

The sixth question is assessing if dentist are familiar with the regulated legislation that dentists cannot transmit information related to the health status of patients to their relatives or friends, without the prior consent expressed. The purpose of this question is to evaluate the degree of awareness of dentists regarding the importance of protecting the information by not disclosing it to third parties. Considering that all the information regarding the health status of patients is part of personal data, the dentist has no right to communicate even to relatives or friends aspects related to the patient's private life. Consequently, it was analyse to what extent dentists know the legal provisions regarding this subject.

The seventh question aimed to analyse to what extent dentists had to call on legal specialists to represent their interests and protect them in court against accusations brought by patients because of infringement of the obligation to preserve professional secrecy. This question aimed a statistical evaluation of the cases in Timiş County in which dentists were accused of violating professional secrecy and need to be defended by a lawyer in a trial.

Question number eight is related to the legal consequences to which dentists may be exposed when violating the obligation of professional secrecy. A series of measures can be taken against the medical staff along with the violation of the obligation to professional secrecy disciplinary sanctions, payment of damages to patients or even criminal sanctions. It is consider appropriate to analyse to what extent the dentists know the legal consequences according to Romanian legislation about not being exposed to the accusations that could be brought against them. It was also aimed which is the information source regarding this topic.

Question number nine, analysed the extent to which dentists know the applicable Romanian legislation in the medical field. It aimed to analyse the interest of dentists in deepening the legislation in Romania regarding their main obligations in the relationship with patients. We set out to analyse the interest of dentists in knowing and understanding the legislation in the field, in order to be correctly inform and to be able to perform the medical act safely, both for them and for the patients. The last question aims to assess the importance of knowing the legislation in the medical field already during the faculty, by studying it within a legal discipline. It is important to assess to what extent dentists find this aspect an opportunity, considering that once they start practicing they encounter a series of situations that require them to know the legislation in the field and its application.

RESULTS

The collected data were analyzed according to the background of the dentists.

Question 1: Are you aware that in the case of a medical emergency, is possible to exceed the limits of professional competence when competent medical personnel for treating a patient with a specific medical condition is not available? Four from the rural area and thirteen from the urban area do not know that in the case of emergency medical is possible to exceed the limits of professional competence when there is no available medical staff. Seven dentists from the rural and twentythree from the urban area have information on this subject after participating in scientific events organized on this topic. Only three dentists working in the urban are have documented themselves on this subject through family members, who work in the legal field (Figure 1a).

Question 2: Related to the obligation to provide medical care, are you aware of the fact that in the case of emergency dental interventions, the informed consent of the patient is not necessary, as the doctor can perform the intervention in his absence? One doctor who practices in rural areas knows the possibility established by law that in the case of urgent dental medical interventions the patient's consent is not mandatory. Nine dentists from the rural and twenty three from the urban area documented themselves regarding the existing normative acts in the matter that regulate this exceptional situation. One dentist from the rural and sixteen from the urban area do not have any information on this subject (Figure 1b).

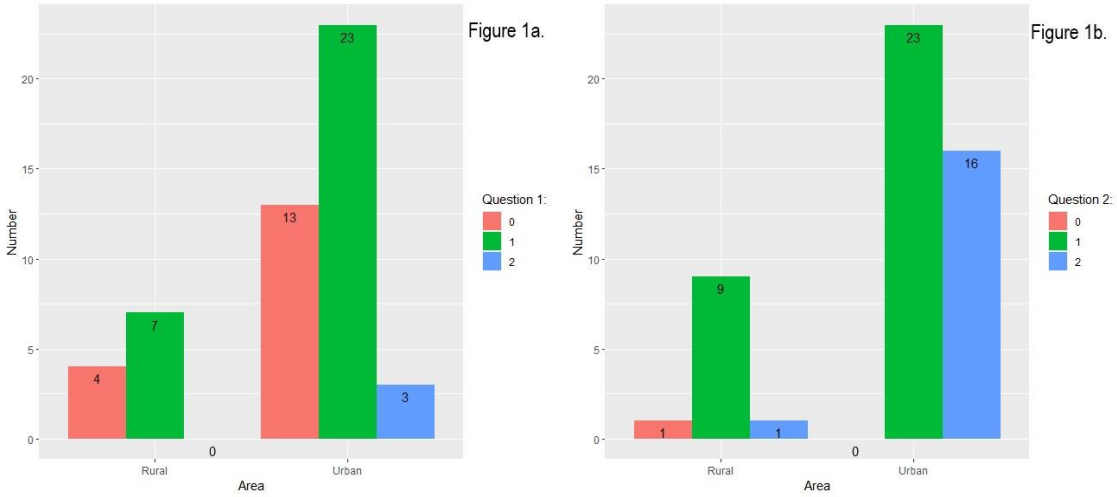

Figure 1. Statistical results for question 1-Figure 1a and for question 1-Figure 1b

Question 3: Regarding the obligation to provide medical care, are you aware that according to Law no. 95/2006 do the dentist and the entire medical staff enjoy professional independence and the right to decide on the medical act? Three from the rural area and fourteen from the urban area know that the professional independence of the medical staff is recognised according to the legal provisions. Six dentists from the rural and nineteen from the urban area know that the professional independence of the medical staff is recognised regarding the provision of the medical act, but they do not have information about the concrete legislation. Two dentists from the rural environment and six from the urban environment did not know that the medical staff enjoys professional independence and the right to decide on the medical act (Figure 2a)

Question 4: Do you currently feel protected by the legislation in the relationship with patients? Six from the rural and fourteen from the urban area believe that the legislation in Romania currently does not offer real protection for the medical staff in the relationship with the patients, being laconic and ambiguous in various aspects. Three dentists from the rural and fifteen from urban area do not know the Romanian legislation in the medical field well enough, to be able to issue a relevant opinion in this regard. Two dentists from the rural and ten from the urban area currently feels protected by the legislation in the field regarding professional relations with patients (Figure 2b).

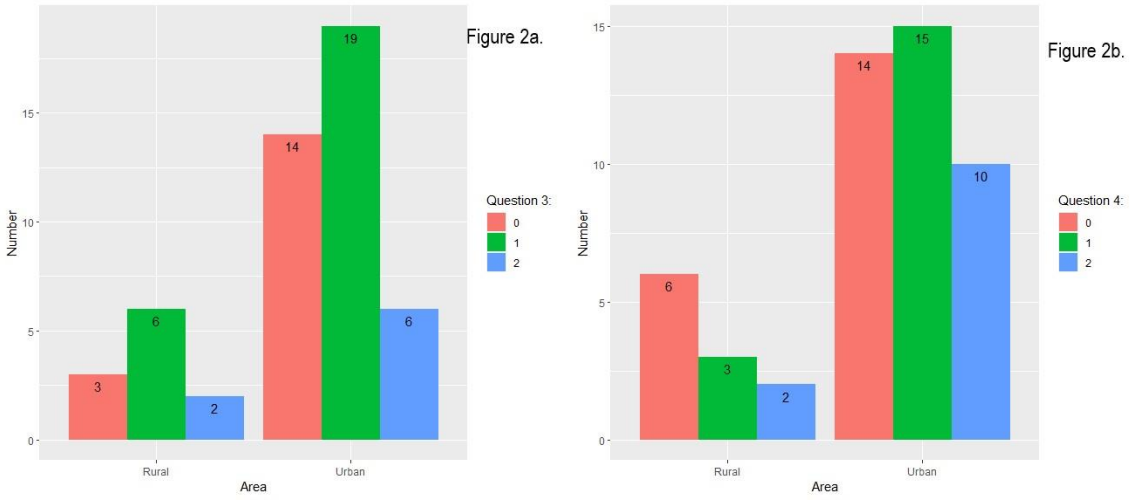

Figure 2. Statistical results for question 3-Figure 2a and for question 4-Figure 2b

Question 5: Do you know what are the main applicable laws in the medical field that regulate the dentist's obligation of professional secrecy in relation to patients. One dentist from the rural and three from the urban area have knowledge of the main applicable laws in the medical field that regulate the dentist's obligation of professional secrecy in the relationship with patients. Eight dentists from the rural and twenty-eight in urban areas are aware that they have the obligation to maintain professional secrecy regarding the data provided by patients when providing the medical certificate, but they do not know precisely which the laws that regulates this at national level. Two dentists from the rural area and eight from the urban area do not have any information regarding the obligation to maintain professional secrecy in the relationship with patients (Figure 3a).

Question 6: Are you aware that, according to the current legislation, you do not have the right to transmit to patient's relatives or friend's information about their state of health, diagnosis, treatment or the results of investigations without their prior consent? Six from rural and thirty from urban areas know that they do not have the right to transmit information about health status, diagnosis, and treatment or investigation results to patient's relatives or friends without their consent expressed by them beforehand. Two dentists from the rural area and two from the urban area found out about the existence of this ban following a lawsuit filed against another dentist. Three dentists from the rural and seven from the urban area did not know that, according to the current legislation, they do not have the right to transmit information about their health status, diagnosis, treatment or the results of investigations to the patients' relatives or friends without their consent expressed by them beforehand (Figure 3b).

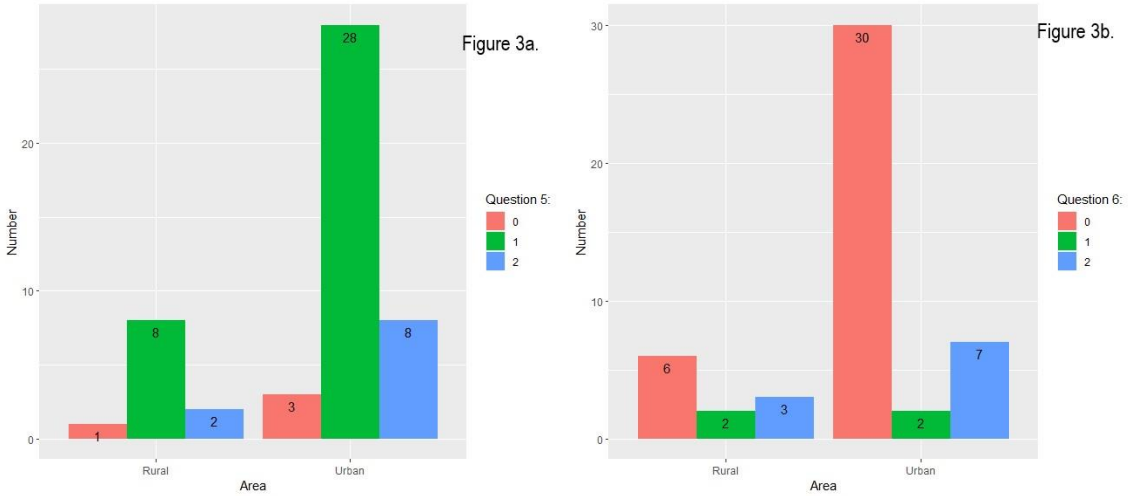

Figure 3. Statistical results for question 5-Figure 3a and for question 6-Figure 3b

Question 7: Have you used medical law attorneys to defend yourself against allegations made by patients regarding your breach of professional confidentiality? The statistics show that out of fifty dentists, only one dentist from urban area has once called medical law lawyers to defend against patient allegations of breach of confidentiality professional. Eleven doctors from the rural area and thirty from the urban area never called on lawyers to defend themselves against the accusations from the patients regarding the violation of professional secrecy, not being accused in this sense (Figure 4a).

Question 8: Do you know what are the forms of legal liability that can be imposed on dentists following the finding of a violation of the obligation of professional secrecy in the relationship with patients? Five dentists from the rural and four from the urban area have detailed information about the legal provisions that regulate the legal liability that can be

imposed on them following the finding of the violation of the obligation of professional secrecy in the relationship with patients. They have repeatedly participated in a series of scientific events on this topic. Two dentists from the rural and twenty-four in the urban area do not know the forms of legal liability that can be imposed on them as result of the violation of the obligation of professional secrecy in the relationship with the patients. They all intend to document themselves as they have observed that have been a number of cases in which various dentists have been found guilty. Only four dentists from rural and eleven from urban areas do not have any information on this subject (Figure 4b).

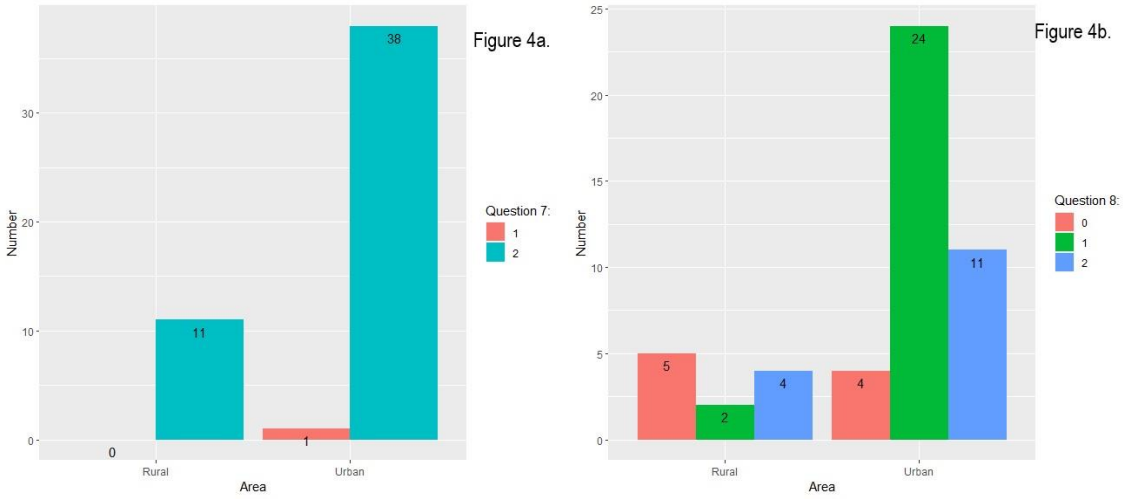

Figure 4. Statistical results for question 7-Figure 4a and for question 8-Figure 4b

Question 9: Are you aware that the legislation in the medical field regulates a series of cases in which the dentist and entire medical staff is exempt from the obligation to maintain professional secrecy in the relationship with patients? Four dentists from the rural and six from the urban area have information regarding the fact that the legislation in the medical field regulates a series of hypotheses in which the dentist and medical staff are exempt from the obligation to maintain professional secrecy in the relationship with patients. They studied a series of legal disciplines applicable in the medical field during the faculty. Five dentists from rural and nine from urban areas documented themselves when they started to practice, and two dentists from rural and twenty-four from urban areas are not aware of the existence of these situations that the law in the medical field regulates (Figure 5a).

Question 10: Do you think that studying a legal discipline applicable to the medical field during the bachelor studies would have contributed to a better knowledge of the legislation and to a greater protection in the relationship with patients? Six dentists practicing in the rural and thirty from the urban believe that studying a legal discipline applicable to the medical field during the faculty contributes to a better knowledge of the legislation and to greater protection in the relationship with patients. Five dentists from the rural and eight from the urban area consider that not in all situations studying during the faculty a discipline about applicable legislation contributes to a better knowledge of the legislation and to a greater protection of dentists in their professional relation with their patients. Only one dentist practicing in an urban area did not answer this question affirmatively (Figure 5b).

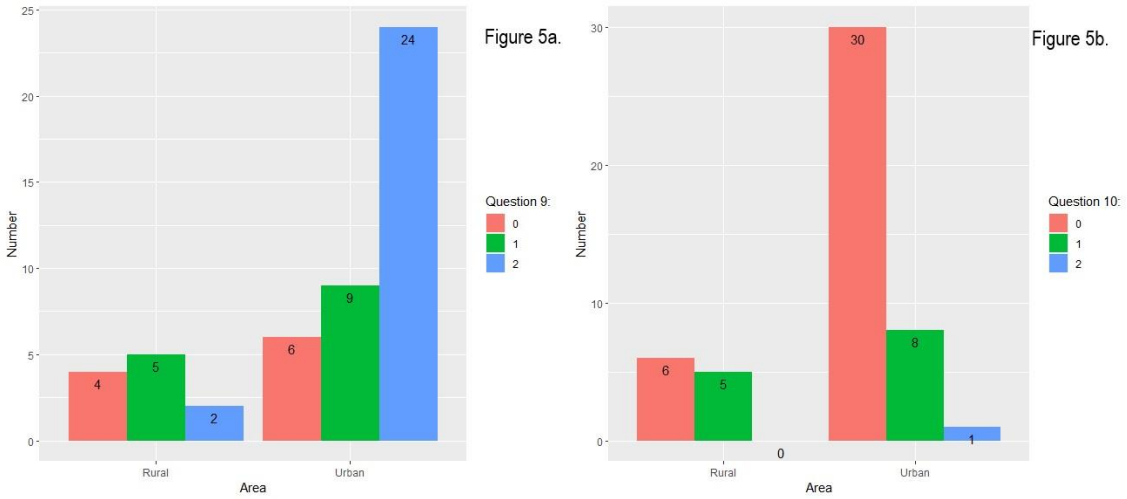

Figure 5. Statistical results for question 9-Figure 5a and for question 10-Figure 5b

DISCUSSIONS

In the context of our society and legislation of human rights, the issue of fulfilling professional obligations in the relationship with patients is more current than ever considering the fact that medical profession is dedicated to the human being. The medical treatment carried out directly on the patient's body, which requires a greater attention of the dentist in providing the medical act. The medical care of the patient has to be done with maximum diligence and caution, so that the risks of medical accidents are minimized, even completely avoided.

The dentist's medical care involve the protection of the patient's life while respecting his rights. The main objective of the relationship between the dentist and the patient is to provide medical care, perform the intervention or treatment corresponding to the established diagnosis, a high level of professional and scientific training, trust, patience, discretion, but also the observance of professional obligations, among which also includes the obligation to provide medical care and to maintain professional secrecy.

Considering all these aspects, dentists must be aware of the importance of complying with the legislation in the field that regulates their professional obligations in medical practice, so that can be guarantee the patients' right to health protection. Awareness of the risks to which they expose themselves, but also the risks to which they expose the patients, together with the non-respect of their professional obligations, determines the increase of doctor's responsibility regarding the medical care, thus avoiding the occurrence of various damages on the health status of the patients.

CONCLUSIONS

Following the statistical analysis, a small number of dentists from rural areas have knowledge of the existing legislation in force in the medical field regarding the observance of professional obligations in the relationship with patients. In this context, we believe that a series of campaigns must be carried out to familiarize dentists working in rural areas with the content of medical legislation.

Another aspect that came across with the assessment of the questionnaires addressed to dentists had is their awareness of the importance of studying and knowing the applicable legislation in the medical field before they end their studies. The majority of dentists who were included in the study were of the opinion that they feel much more protected in their relationship with patients when they have knowledge of the applicable legal provisions in the

field regarding both the way of practicing the profession and the obligations they return to medical practice.

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Importance of Communication for the Dental Treatment of ASD Patients

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Abstract

To ensure the most pleasant and efficient experience for patients diagnosed with autism spectrum disorder in the dental office, collaboration and attention for their needs are essential. Adapting communication strategies to the individual needs of autistic patients can make a significant difference in creating a comfortable environment and build a relationship of trust between them and the medical staff.

In order to carry out this study, a questionnaire was drawn up consisting of ten closed choice or selection questions, which had the role to identify the opinion of dentists regarding the most beneficial methods and means of communication with patients diagnosed with autism.

After completing, the questionnaires, the results were centralized and statistically interpreted. The main conclusion of this study is focusing on the idea of a closer collaboration between dentists and relatives of patients with autistic syndrome is mandatory in identifying their specific needs from the beginning, so that communication is adapted to their condition.

Keywords: autism spectrum disorder, anxiety, dentist, patient, ASD

INTRODUCTION

Autism is a lifelong condition. This disability is a neurological disorder that is diagnosed in the first three years of life and is manifested by limited communication and difficulties in adapting to a social life. The treatment's result and integration of these persons in a normal and social life is influence by the severity of the syndrome, early diagnostic and treatment [1].

In medical practice, patients diagnosed with autism spectrum disorder (ASD) have difficulties in understanding verbal and non-verbal communication [2]. The patients suffering from ASD have the inability to manifest expressive communication and find very difficult to initiate it [3].

It is important for dentists to evaluate the language comprehension of minor patients diagnosed with ASD in order to adapt communication to their level of understanding [4]. The use of language beyond the understanding of ASD patients can be confusing and frustrating, sometimes leading to aggression on their part.

Moreover, in order to communicate in two-way, the dentist has to guide himself in learning strategies for initiating, resuming and sustaining the conversation with these patients, as well as showing respect for the people in the around [5].

The light and noises produced in dental offices by the devices can exceed the tolerance of a patient diagnosed with ASD, increase their state of anxiety and trigger their control and behaviour [6].

Therefore, dentists who provide special assistance to ASD children and ASD adults will have to provide oral health care based on a prior consultation with their relatives and find the specific ways of interacting [7].

The well-being at the end of a consultation and dental treatment depends by a professional dental treatment and the trust the doctor gains and the professional relation with the ASD patient.

Aim and objectives

The aim and objectives of this study are focusing on identifying the most effective methods and means by which communication between the dentist and ASD patients can be improve through a better knowledge, awareness and understanding of their specific condition.

MATERIAL AND METHODS

The material and method of this study consisted in a questionnaire. Fifty-five dentists answered to ten closed questions focused on analysing their opinion regarding the ways that could facilitate the communication ASD patients.

Before receiving the questionnaire, the dentists included in this study signed the informed consent and the aim of this study was explained to them. Dentists were invited to ask any question they considered necessary regarding this study. The questionnaires were distributed into different dental practices in Timiş County and the dentists had one week to complete them. The questionnaire also included question related to information regarding demographic data, sex (M/F), age and the environment origin (Urban/Rural). Each of the ten questions contained three answer options. The first question addressed to dentists had the aim to analyse to what extent they encountered difficulties in communicating with patients diagnosed with ASD, so that, the most optimal means to use in this way could be identified and reduce the possible barriers in communication.

The second question aimed to observe the behaviour displayed by ASD patients during the visit in the dental office. Unfortunately, these patients suffer from bipolar disorder, characterized by episodes of extreme and severe mood swings. Aggressive behaviour can be triggered by various factors such as noise, light, physical discomfort or pain caused by dental treatments. Aggression of this patients is not excluded and can be triggered by anxiety and unfamiliar environment. If it is identified the cause of the aggressive behaviour, the interaction with these patients can be improved and controlled.

The third question assessed if rewarding ASD patients at the end of each consultation or treatment can positively influence their cooperation with the dentist. This method increase patients' confidence and treatment compliance, especially when the patients are children. Positive feedback can strengthen patients' trust in the medical team and contribute to a positive reaction in the dental office. Such rewards can create a positive association with the dental office visit and motivate patients for subsequent visits.

The fourth question is analysing to what extent dentists chose to present the dental instruments and equipment from their office before starting the treatment. In this way the doctor is trying to familiarize them with the environment and reduce the patient's anxiety.

The fifth question aims to evaluate the interdisciplinary collaboration between dentists and psychologists in providing medical services to patients diagnosed with ASD. It was evaluated the opinion of dentists regarding the benefits of this collaboration, if they use the services of a psychologist when providing medical services to patients special needs. In the case of ASD patients, it is necessary for dentists to consult the opinion of a psychologist to understand patient's ways of interaction and communication and to be able to identify those means through which communication can be successful.

Question sixth is dedicated to an extremely current topic in medical practice, namely the evaluation of the effectiveness, organization's performances and the training programs regarding the specific approach to ASD patients. We wanted to analyse to what extent dentists are willing to participate in these training programs organised by specialists in the field. The dental treatments and generally medical treatments for ASD patients require specialized knowledge regarding the most effective ways for collaboration, communication and interaction. ASD patients have a series of particular behavioural characteristics that dentists must be aware about before treating them.

The seventh question analysed if there is a causal link between the timing of scheduling patients with autism at the dental office and the efficiency of their communication with the entire medical team. Question number sever was focused on the importance of the appointment's time for the medical team. Patience is one of the most important characteristics that dentists must demonstrate when interacting with ASD patients. For this important reason, is necessary that ASD patient's appointment need be made in the early part of the day, when the degree of concentration is high. If the dentists are scheduling ASD patients in the second part of the day, there would be a risk that the interaction between them would suffer, due to the fact that medical team is already stressed, tired and under physical tension after a working day. Question seven aimed to evaluate the opinion of doctors regarding the usefulness and benefits of scheduling patients at the office in the first part of the day.

The eighth question analyse to what extent dentists choose to collaborate with the relatives of ASD patients for informing themselves about their specific needs before starting the medical care. It is important for the medical team to adapt their communication and interaction to the particularities or behavioural characteristics of each individual, especially to ASD children.

For the ninth question, it was set out to analyse to what extent dentists show empathy towards ASD patients during their visit to the dental office. The success of the dental procedure does not depend exclusively on the professional training of the medical service

providers, is influenced into a great extent to how involved and how much empathy the medical team can show to ASD patients.

The tenth question aimed to spot the dentist's opinion and experience regarding the usefulness of communicating information to ASD patients using visual communication. This include images, cartoons, drawing because it is an easier way to capture their attention, easier for them to receive the message than exclusively verbal communication.

RESULTS

The collected data were analysed according to the background of the dentists. The results showed for question one that out of fifty-five subjects, three from the rural and nineteen from the urban area believe that the patient diagnosed with ASD most often initiates communication with the medical staff with difficulty during the specialized care. Seven dentists from the rural and nineteen from the urban area have the opinion that patients diagnosed with ASD initiate communication with difficulty only in those situations in which the medical staff manifests a behaviour that causes anxiety, inspiring fear to them during the interaction. Only one dentist from the rural and six doctors from the urban area believe that autistic patients do not have difficulties in initiating communication in the relationship with the medical staff when showing them an open attitude in interaction during the visit to the dental office (Figure 1).

Question 2: During the consultation, does the autistic patient show aggressive behaviour in communication with the medical team? Two dentists from the rural area and one from the urban area had the opinion that patients suffering from ASD show aggressive behaviour in communicating with the medical staff during the consultation. Four dentists from the rural area and thirty-one from the urban area had the opinion that only in certain particular situations they have encountered an aggressive behaviour in the communication with the medical team, five dentists from the rural area and twelve from the urban area encountered cases in which autistic patients had a violent behaviour (Figure 1).

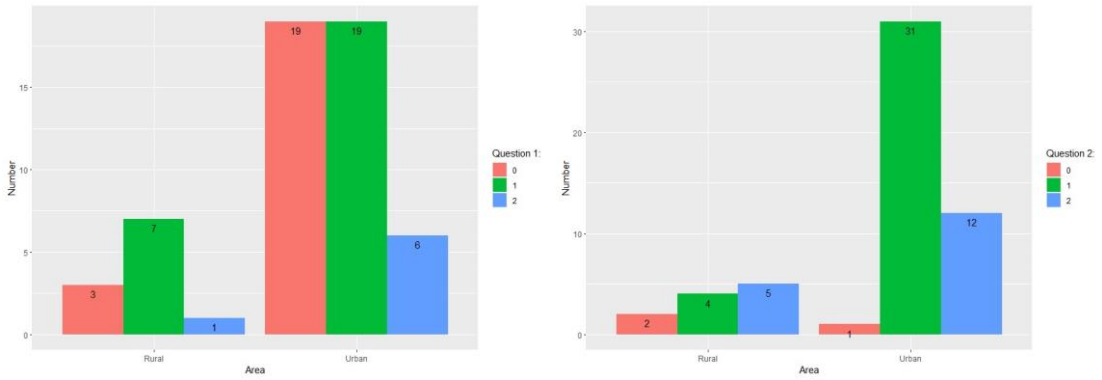

Figure 1. Statistical analysis for question one and two

Question 3: Do you think that rewarding the autistic patient at the end of each consultation in which he was cooperative with the dentist is an effective way to increase his confidence in the medical act? The statistical analysis showed that four from the rural area and twenty-five from the urban area believe that rewarding the ASD patient at the end of each consultation is an effective way to increase their confidence. Seven dentists from the rural and seventeen from the urban area had the opinion that not all ASD rewarded patients, increase their trust in the medical treatment and medical team. Only two dentists working in the urban area did not answer affirmatively to this question in the questionnaire (Figure 2).

For question 4, if dentists consider that the presentation and description of the medical equipment before each treatment contributes to the familiarization of the ASD patients with the medical procedures, thus reducing their state of anxiety. The results showed that two dentists practicing in the rural are and thirteen in the urban area believe that the presentation and description of the medical equipment reduce anxiety for ASD patients. Nine dentists from rural areas and thirty-one from urban areas claimed that this method does not contribute to a better communication and have no positive effect over their state of anxiety of ASD patients (Figure 2).

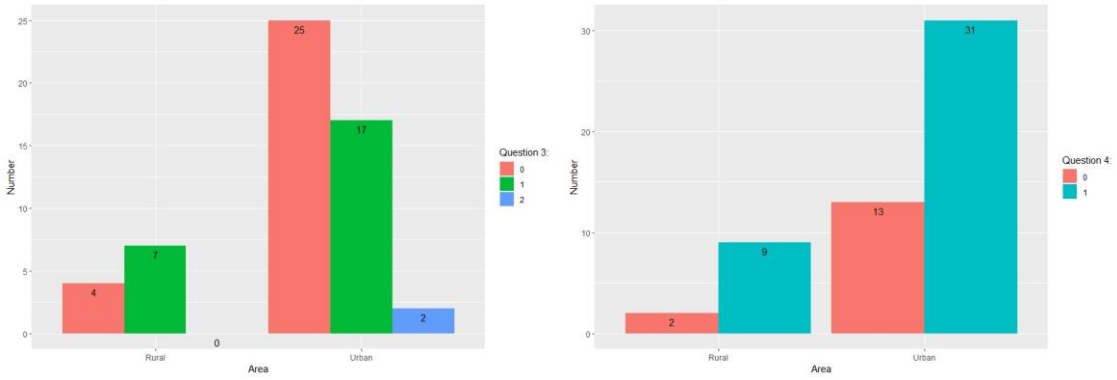

Figure 2. Statistical analysis for questions three and four

Question 5: Do you consider that interdisciplinary collaboration between the dentist and a psychologist is appropriate in the case of patients diagnosed with autism spectrum disorder? The results for question five show that three dentists working in the rural area and twenty-one in the urban area believe that it is beneficial, when dealing with ASD patients, to collaborate with a psychologist. Dentists need help to understand and correctly interpret the behaviour of these patients. Eight dentists from the rural area and twenty-one from the urban area had the opinion that an interdisciplinary collaboration is not always needed, only in those situations in which they encounter severe difficulties in interaction with ASD patients. Only two urban dentists do not consider this collaboration appropriate (Figure 3).

Question 6 assesses if dentist's attendance in training programs improve their approach to ASD patients. Seven dentist from rural areas and thirty-one in urban areas believe that it is extremely beneficial to participate in the training program because of the particularities regarding the way they communicate and behave. Four dentists from the rural area and twelve from the urban area have the opinion that in all situations the efficiency of communication cannot be improved and only one doctor from the urban area consider that participation in this kind of training programs ineffective (Figure 3).

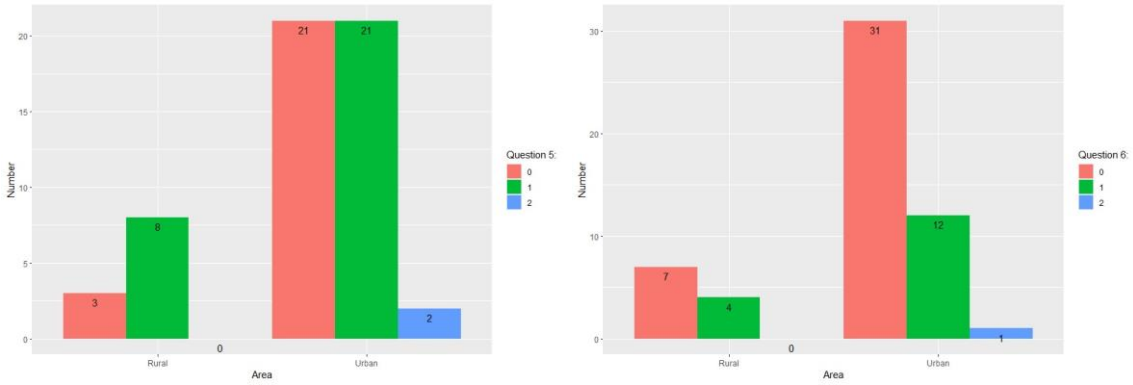

Figure 3. Statistical analysis for questions five and six

Question 7 evaluates the importance of the appointment's time. Four dentists from rural areas and twenty-two from urban areas believe that ASD patients should be scheduled in the first part of the day. They are aware that in the second part of the day their concentration and patience decreases and the risk of non-cooperation is higher. Five dentists from the rural and eighteen from the urban area stated that not in all situations the adoption of this measure will ensure the success of the treatment, and two doctors practicing in the rural and four in the urban are did not answer this question affirmatively.

Question 8 assess if it is important for the doctor to communicate with the family of the ASD patient and to identify their special needs. The results showed that eight dentists from the rural and thirty-seven from the urban area consider that is important to communicate with the family in order to identify their specific needs and to prepare the patient regarding the dental office experience. There was also a limited number of dentists, three from rural areas and seven from urban areas, who did not answer this question affirmatively.

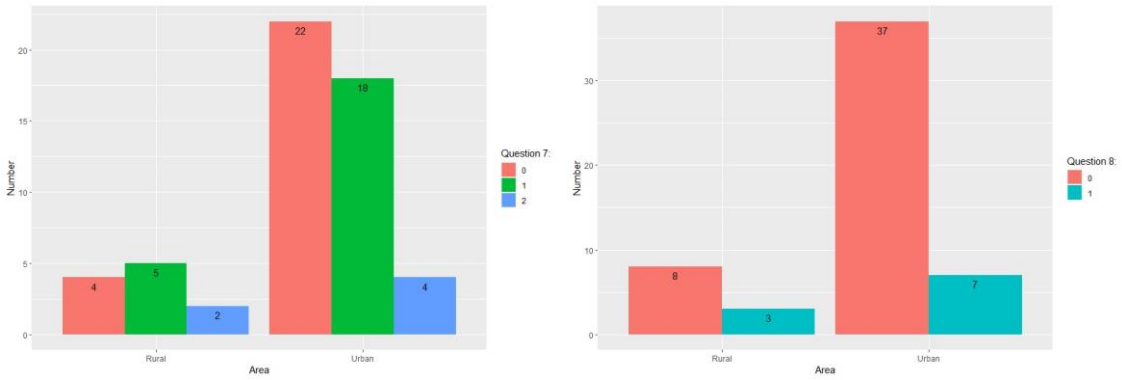

Figure 4. Statistical analysis for questions seven and eight

Question 9 assesses if empathy could be one of the main requirements in communication with ASD patients? Six from the rural and thirty-one from the urban area consider extremely important to show empathy in the communication with ASD patients, considering that their anxiety can be reduced with this attitude during the specialized care. Five dentists from rural areas and thirteen from urban areas do not believe that empathy contributes to facilitating interaction with this category of patients (Figure 5). Question 10 asses if visual communication makes ASD patients more cooperating and four dentists practicing in rural areas and twenty-two in urban areas believe that this method is more useful and with better results. Seven dentists from the rural and twenty-one from the urban area claimed that this method of communication is not effective in all situations, and only one doctor from the urban area denied the usefulness of this method of interaction with patients diagnosed with a spectrum disorder autistic (Figure 5).

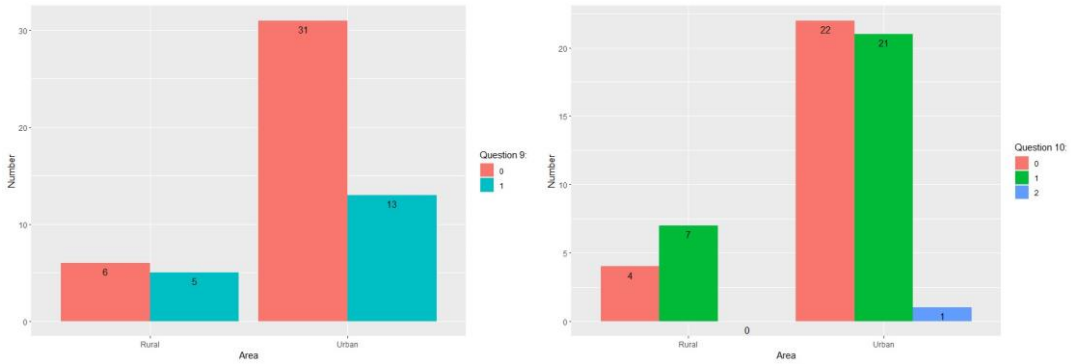

Figure 5. Statistical analysis for questions nine and ten

DISCUSSIONS

The development of an adequate communication between the dentist and the patient diagnosed with ASD is closely related to the behaviour and respect that the dentist show to these patients.

Adequate communication and prior preparation of the ASD patient for the visit to the dental office can help him adapt to an unfamiliar environment into which he enters.

Communication with autistic patients can be difficult, but if it is adapted to their needs, it can contribute to creating a pleasant environment in the dental office both for them and for the entire medical staff.

CONCLUSIONS

Following the statistical analysis, it was found that most dentists are open to adapting their communication to the specific needs of patients diagnosed with ASD.

It was found that a large part of the dentists responded affirmatively to the need for their training by the specialists in the field regarding the approach of ASD patients from the perspective of the most effective communication, which shows their involvement in creating an environment in the dental office when they are requested to provide specialized care to this category of patients.

The severity of the ASD condition can influence and even limit or make e the dental treatment impossible in normal conditions. If it is not possible to communicate and perform a professional dental treatment, the only option for treating these patients is sedation.

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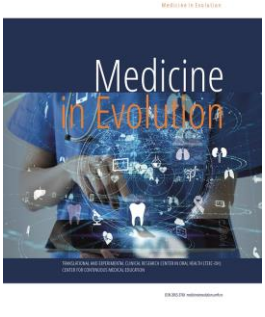
Augmentation of the Mandibular Alveolar Ridge Using Khoury Technique – Case Presentation



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Abstract

Implant-prosthetic rehabilitation of edentulous patients with various forms of bone atrophy represents a challenge in oral implantology. The long-term success and stability of dental implants is directly dependent on the quality and quantity of the supporting bone and surrounding soft tissue. When bone volume is inadequate for implant placement, a variety of bone augmentation techniques and materials can be used. Autogenous bone augmentation, autograft, is considered the gold standard in bone grafting, due to its biocompatible, osteoconductive, osteoinductive and osteogenic properties. The technique of obtaining autografts from the mandibular retromolar area is also called the Khoury technique or the split bone block technique.

Keywords: Bone atrophy, implant, autograft, Khoury technique

INTRODUCTION

The use of dental implants has increased in restorative dentistry due to high success and survival rates. They replace missing teeth or provide retention and support for dentures. In recent years, 3D-guided and computer-assisted implant surgery has become increasingly used, with the placement of osseointegrated dental implants becoming a frequent clinical intervention in dental practice [1-4].

Due to atrophies or bone defects in the jaw and mandible, it is often difficult to place the implant. In these clinical situations, bone grafts and substitute materials play a vital role in restoring the bone. These are biomaterials used to replace bone defects and to recover atrophied bone regions [5].

Classification of bone grafts and bone substitute materials used in dentistry is based on tissue source or material group (Figure 1) [6-8].

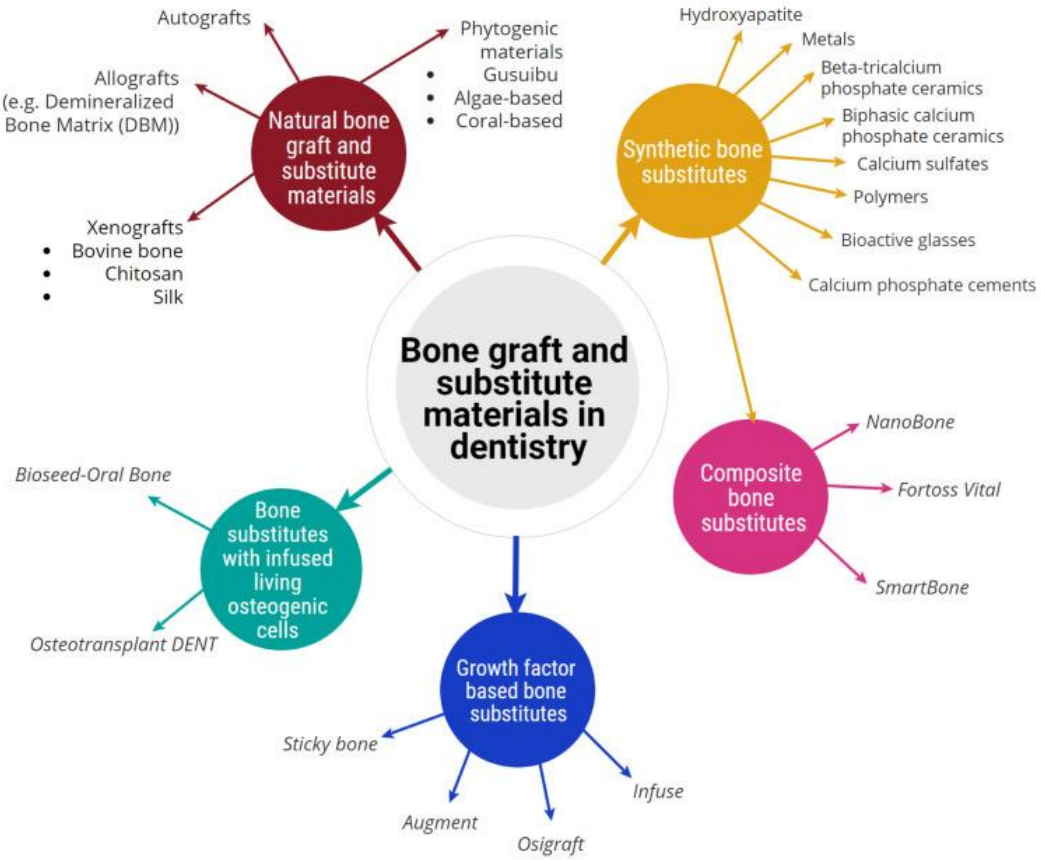


Figure 1. Classification of bone grafts and substitute materials used in dentistry [6]

Autograft, autogenous bone graft from the same individual, is considered the gold standard for bone grafting due to its biocompatible, osteoconductive, osteoinductive and osteogenic properties [9]. Autogenous grafting uses a combination of cancellous and cortical bone to increase bone remodeling performance and healing potential [10]. Cancellous bone has osteoinductive and osteogenic properties, allowing early revascularization and functional remodeling with low complication rates. The bone cortex ensures structural-mechanical integrity and bone healing through osteoconduction [6].

The disadvantages of autografts are: the need for a second surgery, morbidity at the donor site (bleeding, infection, inflammation, pain and the potential for scarring), higher therapeutic costs [7,8].

For complex augmentation procedures, such as posterior mandibular edentulous ridge reconstruction, autografts are the materials of choice because they can predictably increase the quality and quantity of bone, allowing the placement of implants with maximum diameters, thereby facilitating the distribution of forces, for long-term survival [11,12].

Autografts are commonly obtained from intraoral or extraoral areas such as mandibular symphysis, mandibular ramus, external oblique ridge, iliac crest, proximal ulna, or distal radius, which are good sources of cortical and cancellous bone [13]. Autograft harvested from the mandibular ramus is associated with fewer complications, with the risk of inferior alveolar nerve damage [14].

Bone augmentation using the Khoury technique involves the harvesting of a bone block from the mandibular retromolar area, the external oblique line, and the creation of cortical bone plates, with a thickness of 1 mm. With the help of these bone plates, the bone defect is reconstructed in 3D [15]. Thin cortical lamellae, as a rigid wall, are fixed with screws at a distance from the bone crest, and the space created is filled with bone sawdust and/or bone substitutes. The thin bone block prevents the transmission of movements caused by the mucosa to the graft, allows faster postoperative tissue adhesion (due to the autogenous nature of the graft) and inflammatory complications, as well as leads to obtaining a bone bed of higher quality than allogeneic or xenogeneic grafts. Another advantage of the Khoury technique is the fact that the donor area regenerates completely in case of reimplantation of half of the bone block in the original position [16].

MATERIAL AND METHODS

Patient R.D. aged 66, female, presented herself in the dental office for a specialist consultation. Anamnesis and exo- and endooral clinical examination were performed. The reason for the patient's presentation was the discomfort caused by halitosis and dental mobility at the level of teeth 3.5 and 3.8, abutment teeth of a metal fixed partial prosthesis. These teeth suffered from root caries, periodontal pockets and grade III tooth mobility. The first stage of the treatment proposed and accepted by the patient was the ablation of the prosthetic work with the extraction in the same session of the pillar teeth (3.5 and 3.8) after the prior hygiene of the oral cavity with descaling.

After 10 days the patient performed a CBCT investigation (Figure 2) at the level of the left mandibular hemiarch. On section 12 (Figure 2) at the level of the post-extraction alveolus of 3.5 the ridge has an adequate width. Posteriorly, the edentulous ridge begins to narrow drastically, on section 19 a width in the upper part of only 2 mm can be observed (which is insufficient to satisfy the principle that the implant body must be bounded vestibulo-oral by at least 1-1 .5 mm of bone). The height of the ridge is sufficient, around 10 mm while maintaining a distance of 1-2 mm from the mandibular canal and the lower alveolar vasculo-nervous bundle.

As a treatment option, after the patient's consent, bone augmentation using the Khoury technique was chosen, this being a more suitable treatment option for the clinical situation. One hour before the start of the surgical treatment, the patient was administered 2000mg of Augmentin.

A PRF membrane was prepared, obtained from the patient's blood (Figure 3). Venous blood was collected in test tubes (a membrane will result from each test tube) and placed in the centrifuge in symmetrical pairs to swing the centrifuge. Centrifuge for 12 minutes at 1400 revolutions per minute. Due to the contact of the blood with the wall of the test tube, the

coagulation cascade is activated and at the end of the program we will have a coagulum in each test tube. The lower part, consisting of red cells, is removed and the upper part is pressed with a special tool so that the acellular plasma is removed from the clot (consisting of 95% platelets) and a thin, biological membrane is formed.

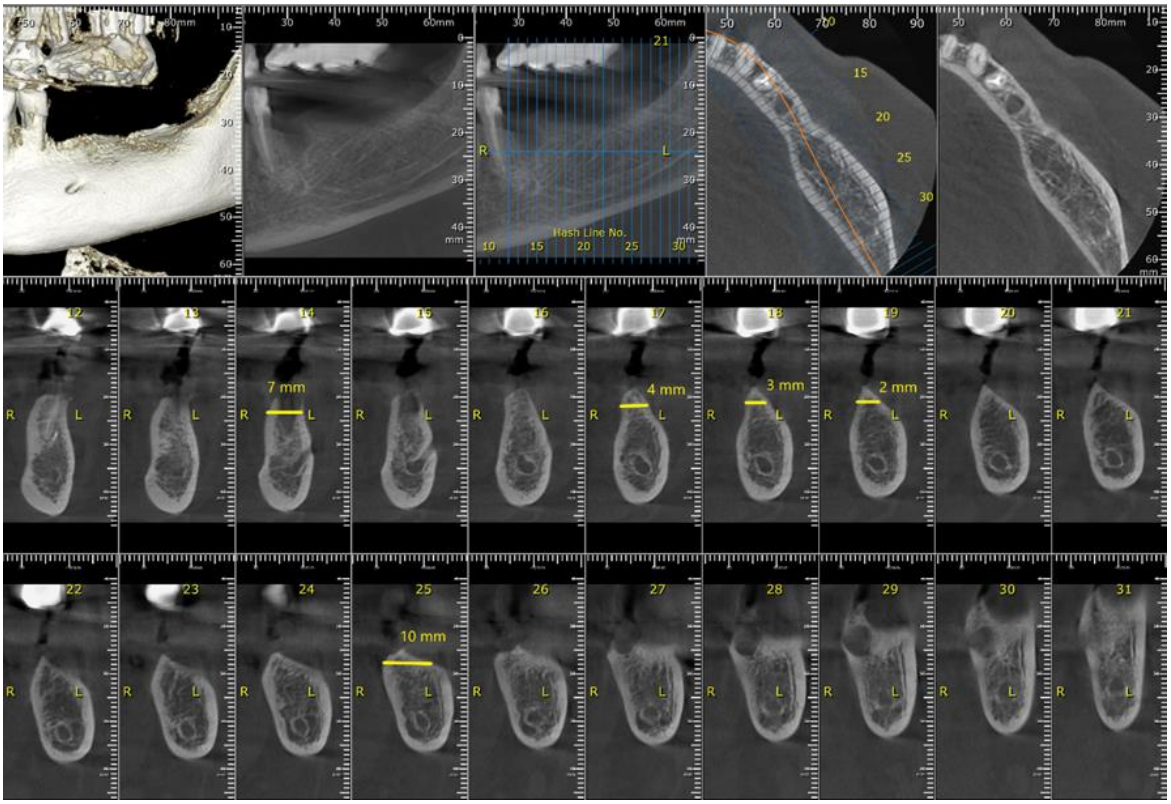


Figure 2. CBCT at the level of the left hemimandible

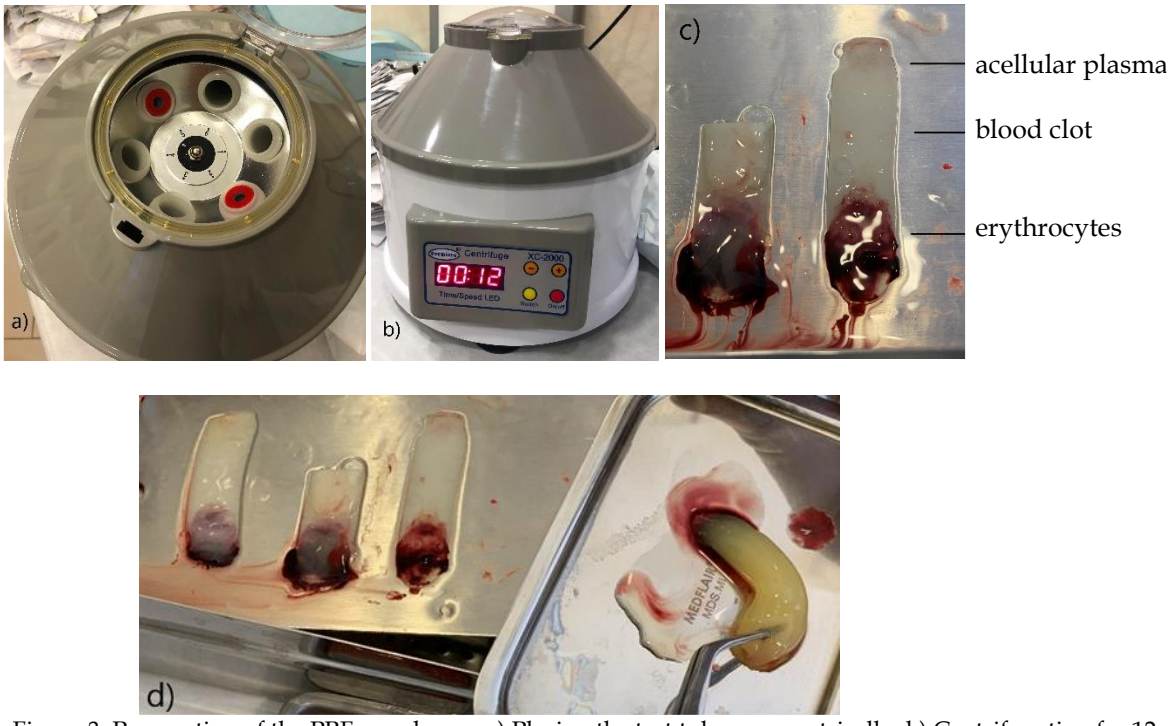


Figure 3. Preparation of the PRF membrane; a) Placing the test tubes symmetrically; b) Centrifugation for 12 minutes at 1400 RPM; c) Blood clots; d) Pressed PRF membrane

To anesthetize the surgical territory, 2 carpules of Ubistesin Forte (4% articaine with adrenaline 1/100,000) were administered through the Spix spinal anesthesia technique, supplemented with buccal nerve anesthesia.

A mucoperiosteal incision and detachment was made distal to the most posterior tooth and continued through the retromolar trigone to mid-height of the ascending ramus. It was completed posteriorly with an oblique unloading incision up to the buccinator muscle, and anteriorly with an incision in the vestibular sulcus at the level of the first premolar.

With a surgical piezotome, three osteotomies were made: two horizontal (superior and inferior) each with a length of approximately 8 mm and one lateral and vertical, approximately 20 mm, each osteotomy penetrating the cortex (Figure 4a). A fourth osteotomy line, medial and vertical, was highlighted with a bone bur penetrating approximately 2 mm, thus remaining in the cortex and creating a fracture line that facilitates graft removal.

The graft was removed with a surgical hammer and chisel (Figure 4b), acting along the fracture line. The thickness of the monobloc graft was approximately 1.5 mm.

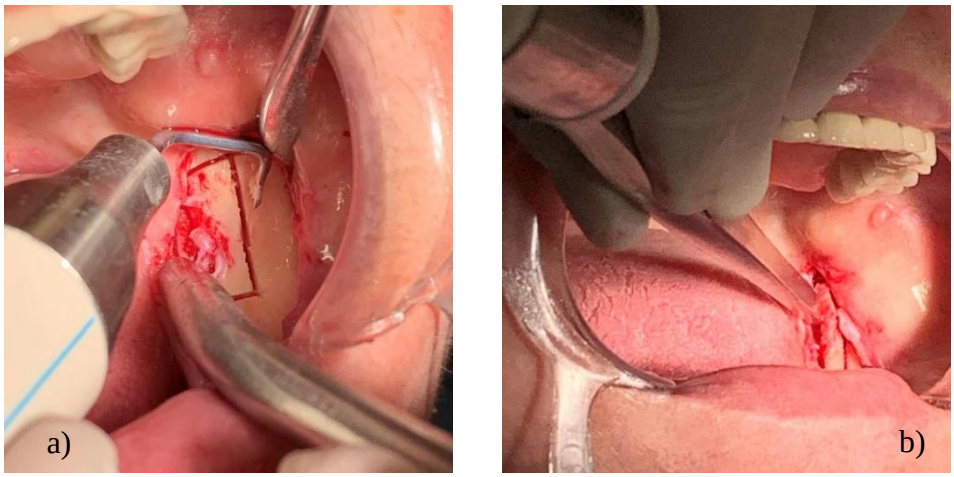


Figure 4. Harvesting the bone block; a) The three osteotomies performed with a piezotome; b) Removal of the block with a surgical hammer

A sufficient amount of bone particles (cortical bone and a small amount of trabeculated bone) was collected with a bone harvester/"safescraper" by scraping (Figure 5a).

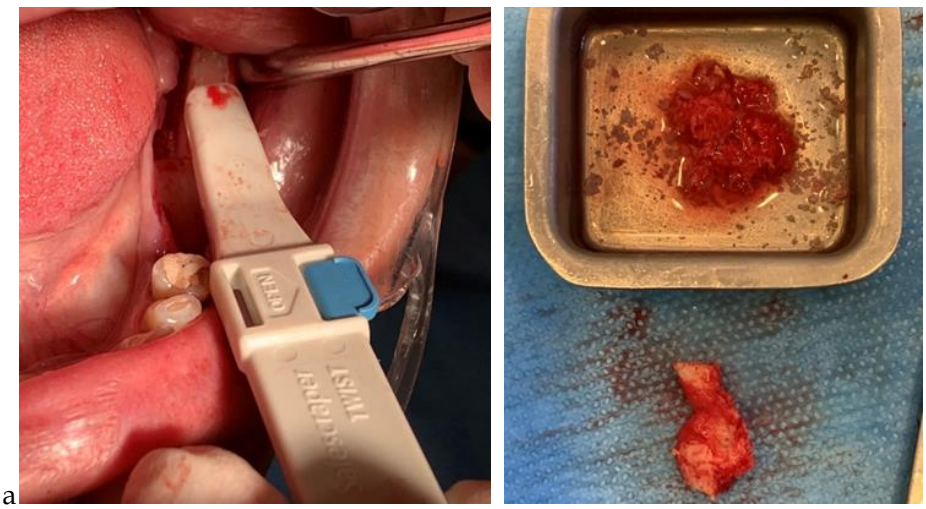


Figure 5. Harvesting bone particles; a) Cleaning the site with a "safescraper"; b) Bone particles (top) and bone block (bottom)

The donor site was covered with a PRF membrane obtained from the patient's blood.

After rounding the sharp edges and rounding the edges of the bone block, it was fixed at a distance of about 5-6 mm from the vestibular cortex of the donor site by means of two titanium screws (Figure 6), specially designed for bone augmentation by bone grafts (1.3mm x 11mm).

To the scraped bone particles was added the plasma (Figure 5b) removed after pressing the blood plugs in the manufacturing step of the PRF membranes. This is basically a physiological serum of its own, which mixed with the bone particles, will help to handle them more easily. The particles were condensed in the newly created space (Figure 7).

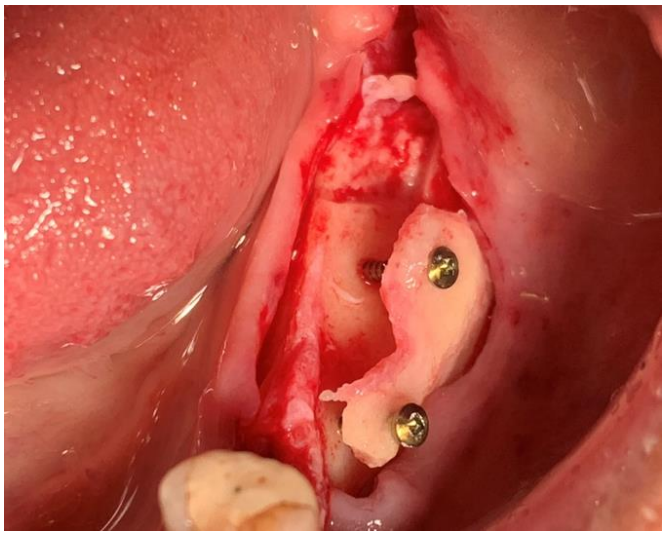


Figure 6. Bone block fixed in position

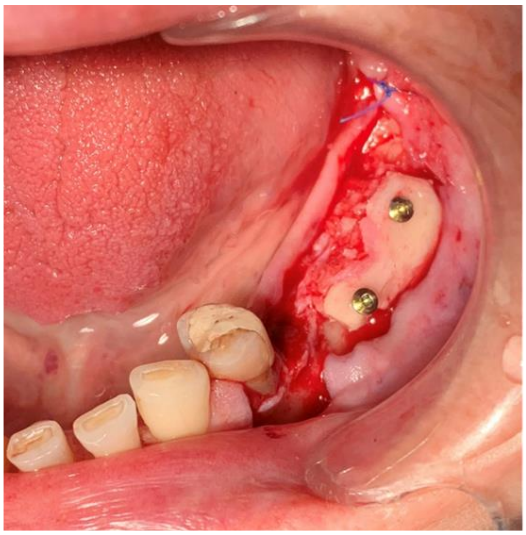
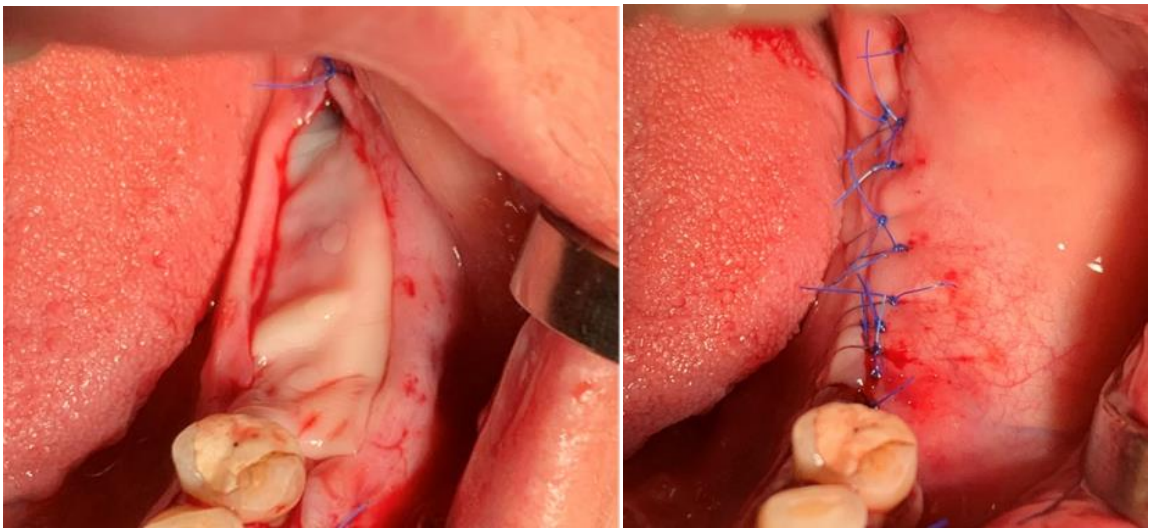


Figure 7. The space between the graft and the site donor, loaded with bone particles

After a periosteal detachment from the rest of the flap (for lengthening and detensioning) was performed, it was sutured at the anterior-superior key point to avoid tensioning the flap and its unsightly healing, the surgical site was examined, then covered with a pericardial membrane of bovine origin (Figure 8a), a barrier against connective and epithelial tissue, which will create a favorable environment for subsequent bone regeneration. The final suture of the flap is performed (Figure 8b).



a **b**

Figure 8. Final suture; a) Pericardial membrane above the surgical site; b) Suture line

RESULTS

After 5 months, a control CBCT was performed (Figure 9). It can be seen that the screws have engaged both cortices, giving excellent primary stability to the bone block. Criteria for graft survival were met: absolute immobilization, minimally invasive surgical technique, and early revascularization. After the healing period (4 to 6 months), a flap is raised, the screws can be removed and the implants can be placed for prosthetic rehabilitation.

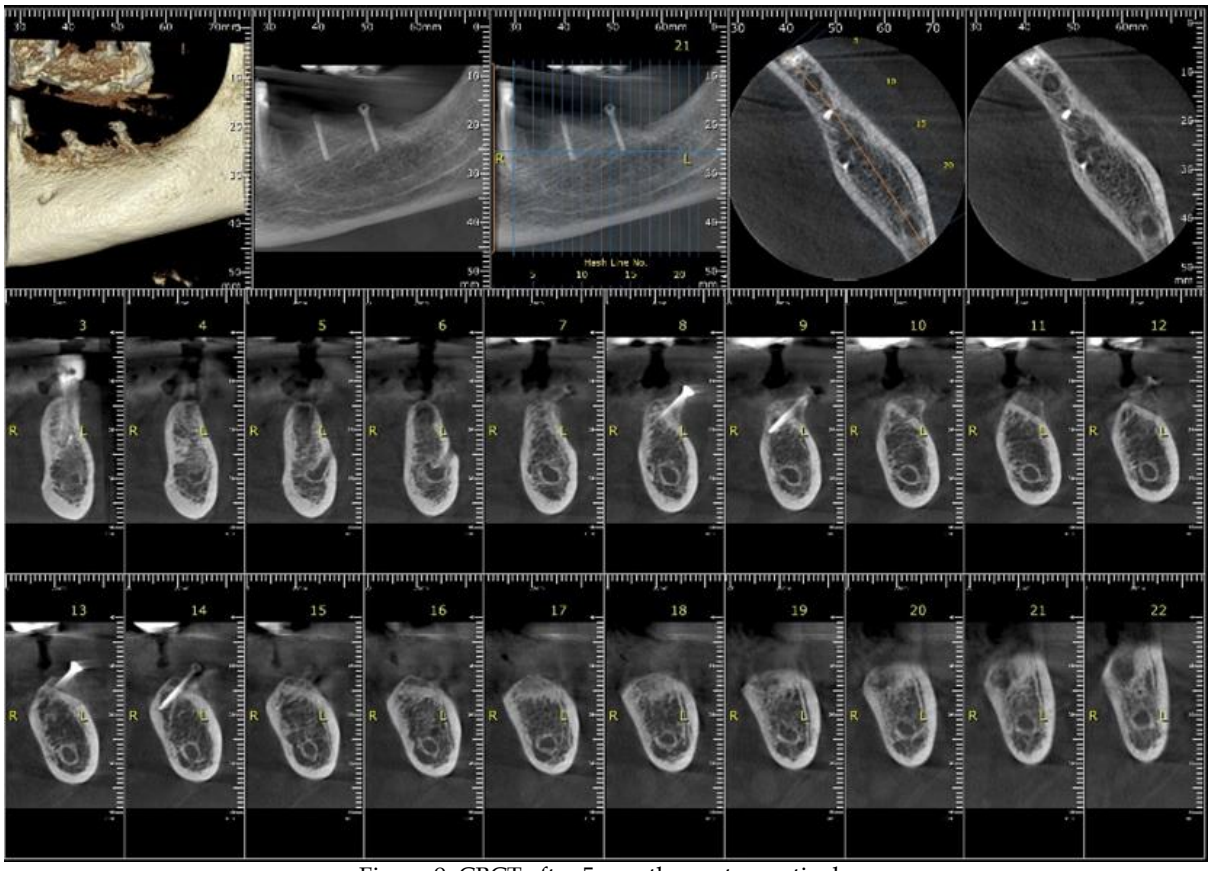


Figure 9. CBCT after 5 months postoperatively

DISCUSSIONS

The problems raised by autogenous full block transplants reported in the literature are resorption rates of 21%-25% [16-18].

The technique described by Khoury in 2007, which involves the interposition of thin cortical plates harvested from the ascending ramus with cancellous bone harvested from the same site, has proven effective in achieving alveolar ridge augmentation in horizontal bone defects, up to 5 mm [19-21].

Unlike cancellous grafts, block grafts take longer to integrate [22]. In these situations, a staged surgical approach is recommended, as opposed to placing the implants simultaneously with the bone graft [23,24].

When autologous bone is obtained, trauma occurs at the donor site. The Khoury technique should be avoided in cases with limited donor sites or risk of nerve injury. In these situations, the use of membranes is the complementary option. The Khoury technique does not use exogenous materials that can induce host responses, potentially affecting the results of the regenerative act [25-27].

The use of PRF in bone augmentation plays an important role in the stabilization of clots, preventing the migration of non-osteogenic tissues into the area. The main growth factors of PRF are: vascular endothelial growth factor, transforming growth factor-1, bone morphogenetic proteins (BMP-1), platelet-derived growth factors and insulin-like growth factors [22,28].

Another problem that arises in this surgical technique of bone augmentation is the restoration of soft tissue defects. In certain clinical situations, soft tissue grafts have given good aesthetic results in soft tissue restoration and prevention of peri-implant marginal recession [29].

CONCLUSIONS

Rehabilitation of the atrophic mandible is a challenge when there is a severe loss of bone mass. A general recommendation for the best way of treatment cannot be given, the decision of the treatment option also depends on the skills and surgical experience of the dentist. Khoury technique involves harvesting only cortical bone laminae, thus avoiding the possibility of damaging the underlying neurovascular structures.

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Therapeutic Management in Early Loss of Primary Anterior Teeth

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Abstract

The aim of this study was to present two different therapeutic options of space management in the anterior region.

Material and methods: The working protocol for the fabrication of a removable and a fixed space maintainer was described for a clinical case of a child who had prematurely lost all upper temporary incisors because of advanced cavities. A silicone key was used to position the teeth in the acrylic base.

Results and discussions: Restoring the integrity of the dental arches has a positive impact on the patient's psychological welfare. Compared to the removable space maintainer, the use of a fixed space maintainer eliminates the patient's compliance factor, even though both are well tolerated.

Conclusions: Since the loss of anterior teeth does not cause as much space deficit as in the posterior region, restoring the integrity of the dental arches is essential in preventing tongue interposition and the onset of other bad oral habits.

Keywords: early loss of anterior teeth, space maintainer, palatal plate, primary teeth

INTRODUCTION

In paediatric dentistry, early loss of temporary teeth is a very common problem and is usually caused by dental trauma, caries and hypodontia [1].

The loss of front teeth can have a negative impact on the children's quality of life, and the treatment is usually challenging. A developing child can suffer significant functional and emotional impairment caused by the missing teeth on the arch [2].

There is a wide range of treatment options when the upper incisors are missing and many clinicians opt for a Gropper appliance (a fixed aesthetic space maintainer), a fibre-reinforced pontic prosthesis, a removable partial denture designed specifically for children [3,4], or even dental implants and bridges in permanent teeth severe hypodontia cases [5]. For removable appliances, there is essentially one design with various modifications [6]. It is important that paediatric dentures are carefully planned and executed to accommodate the changing oral structures in growing children [1]. Dentures are often used to prevent psychological, speech or swallowing problems in preschool children with significant tooth loss [7].

Among the disadvantages of prosthodontic options are the increased resorption of the alveolar bone and periodontal problems of the remaining teeth [5].

When the oral rehabilitation in these children is achieved using space maintainers, these appliances replace one or more temporary teeth and their primary function is to maintain the space for the permanent successors. They can also restore the shape and the function of the dental arch to prevent future malocclusions [8,9].

The main advantage of a fixed appliance over a removable one is the elimination of the patient's compliance factor. The aesthetic component of the fixed appliance improves the patient's acceptance [10]. The removable space maintainers cover a large area of oral tissue, which sometimes leads to irritation and discomfort. However, removable space maintainers are cost-effective, and with proper patient and parent counselling and adequate motivation, removable space maintainers are a viable treatment option [11].

Aim and objectives

The aim of this article was to present a complete workflow and clinical application of a fixed and a removable space maintainer designed similar to an orthodontic plate with acrylic teeth to restore the integrity of the dental arches in a growing patient.

MATERIAL AND METHODS

We present the case of a patient with the loss of temporary teeth in the anterior region because of advanced cavities which led to pulpal complications. In the first phase, an alginate impression was taken using Hydrogum 5 (Zermack). Two dental casts were poured from class IV white hard plaster, one for the removable space maintainer and one for the fixed space maintainer.

For the removable space maintainer, a palatal plate was fabricated, with four Stahl clasps made of Ø 0.7 mm wire. A wax model was made on the dental cast. The base of the wax plate had to be precisely adapted to the dental cast and acrylic teeth replacing 5.2, 5.1, 6.1, 6.2 were mounted in the anterior region. An impression of the dental cast was taken with Zetalabor putty silicone in order to obtain a silicone key.

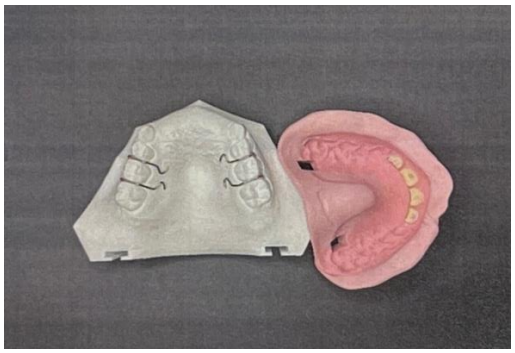

Figure 1. Positioning the anterior teeth in the silicone key

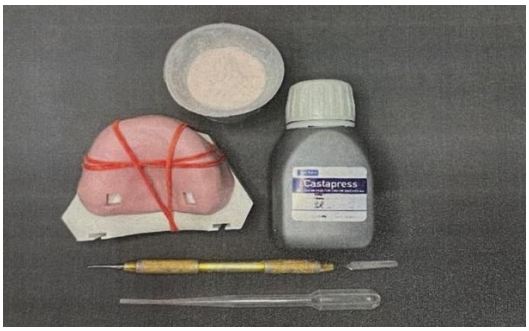

Figure 2. Fabricating the acrylic base

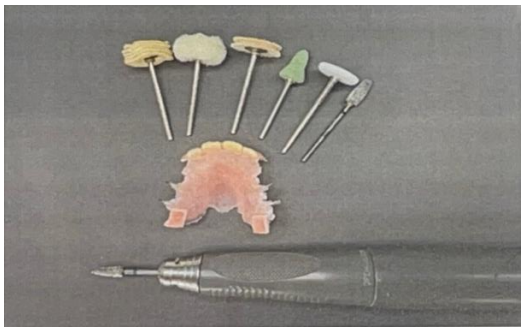

Figure 3. The tools used in the polishing phase

The thermobaropolymerization of the acrylic base was followed by the finishing and polishing phase using special burs, stones and polishing brushes (Figure 3).

The acrylic base was cut posteriorly to suppress the patient's gag reflex (Figure 4). The base can also be fitted with a median expansion screw when there is a space deficit in the upper arch or the transverse expansion of the maxilla is needed.

Figure 4. Upper removable space maintainer

To fabricate a fixed space maintainer, two orthodontic bands have to be cemented on the first permanent molars. The bands must fit properly on the teeth in order to provide good stability and retention for the appliance.

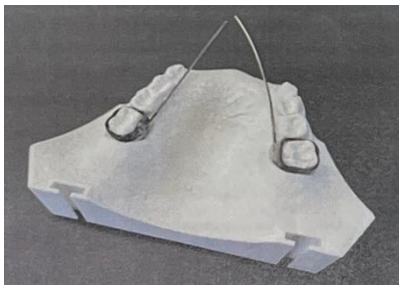

Figure 5. Welding the wire arms to the orthodontic bands

Figure 6. The silicone key

Two wire extensions were welded to the middle third of the palatal surface of the orthodontic bands (Figure 5). The wire extensions had to be adjusted at approximately 1 mm away from the marginal periodontium, following the contour of the palatal surface of the crowns of the temporary molars. Activation loops are placed on each side to compensate for the growth of the maxilla. The wire is bent in the anterior region to create mechanical retentions for the acrylic base segment, which will accommodate the aesthetic component (the acrylic teeth). The acrylic base segment, the silicone key (Figure 6) and the attachment of the acrylic teeth of the upper fixed space maintainer (Figure 7) were fabricated following the same steps as for the removable space maintainer.

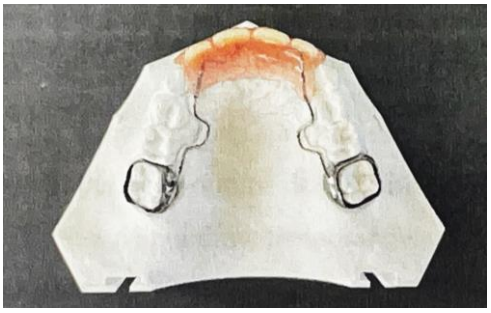

Figure 7. Upper fixed space maintainer

DISCUSSIONS

One of the main reasons for the premature loss of maxillary anterior teeth in school-aged children is dental trauma, which is a psychological burden for both the patient and the parents. The treatment option in this case is to use a space maintainer, which can be either fixed or removable, in order to preserve the space and to restore the aesthetic function [10].

In a study case, Da Silva et. al found that the application of space maintainers led to good results in both clinical cases in terms of phonetic, functional and aesthetic restoration; the visual improvement had a positive effect on the children's self-esteem, as shown by the visible change in behaviour in the social environment, shortly after the patients received the fixed appliances [12].

In adolescents, the loss or the absence of permanent front teeth at an early age has an important psychological impact. When a permanent tooth is lost, the teeth adjacent to the gap have a tendency to tip mesially or distally, causing a space deficit. The child's cooperation in wearing removable space maintainers and attending recall visits play an important role in regaining the space on the arch. Fixed appliances offer several advantages over removable ones, including less discomfort, lesser need for patient's compliance and more control over tooth movement in all three spatial directions. For these reasons, a short course of treatment with fixed appliances — such as the modified fixed 2 x 3 appliance — followed by a fixed functional space maintainer may be the best course of action [13].

Waggoner and Kupietzky state that parental desire is the primary motivator for applying cosmetic appliances in the anterior region. There is little evidence that a child's growth and development are significantly affected by the early loss of upper incisors, although space conditions, speech development, masticatory function and tongue habits may be somewhat influenced [14]. Options include fixed or removable appliances, both of which may or may not have a functional component [3, 10]. The child's stage of dental development, the missing teeth, the affected dental arch, the status of the teeth adjacent to the missing teeth, appliance maintenance and modifiability, the patient's compliance, among other considerations, all play a role in the selection of the appliance [10]. The goal of prosthetic therapy should always be to ensure optimal phonation, masticatory performance, aesthetics and occlusal stability. These elements give the child more self-confidence and contribute to their acceptance [15].

Domínguez and Aznar conducted a study using removable prostheses to promote proper development of the upper and lower jaw in two children who received removable acrylic dentures with a special S-shaped metal handle (loop) that guided the eruption of the first permanent molars [7]. These prostheses were modified as the children grew. By replacing missing teeth, several oral functions were restored, upper and lower jaw development was promoted, and each child was able to harmoniously develop socially and psychologically [7].

Along with constantly evolving technologies, digitally designed space maintainers also appeared. Guo et. al conducted a study in which he used a new version of the 3Shape software, so that the frames and artificial teeth were designed in the same design mode, thus achieving a complete integrated design [16]. According to the authors, there are few studies reporting the use of CAD/CAM for the design and fabrication of removable space maintainers in paediatric dentistry, this method being able to overcome the problems associated with traditional manufacturing – cost and lack of cooperation from children, as well as the size of intraoral scanners, as they are sometimes too large for use in the primary dentition [16].

Normally, dental implants as a tooth replacement option are limited to individuals who have completed their craniofacial growth and development. The placement of implants in children or teenagers is avoided as it could lead to various adverse effects, including possible damage to developing dental structures, difficulty in dental eruption of the adjacent teeth and limitations in multidimensional growth of the craniofacial skeleton [1].

Furthermore, the functional and aesthetic results of oral rehabilitation are only temporarily acceptable. However, in a small number of paediatric patients, congenitally suffering from severe syndromic hypodontia and oligodontia such as ectodermal dysplasia, conventional prosthetic rehabilitations are inadequate. Kramer, Baethge and Tschernitschek reported the case of a boy with ectodermal dysplasia who had extended oligodontia and was treated with implants in the anterior mandible at the age of 8 years; the implants were functionally loaded and resulted in high patient satisfaction. The authors recommend the early placement of dental implants in children with severe hypodontia [1].

According to the results of Nadelman et. al in a study on speech disorders, children who lost anterior teeth had a higher risk of speech distortion than children without tooth loss ($p=0.005$), but with a low certainty of evidence, because of the small sample size. They concluded that the consequences of space loss for the deciduous dental arch require further investigation [17].

In general, most studies show that children's self-confidence improved after treatment with removable orthodontic appliances or space maintainers that restored the morphofunctional and aesthetic integrity of the dental arches [2, 5, 10, 17].

CONCLUSIONS

Both fixed and removable space maintainers offer good oral rehabilitation for the growing patient. These appliances are well tolerated by patients and fulfil the current aesthetic criteria, having a positive effect on the patients' psychological status.

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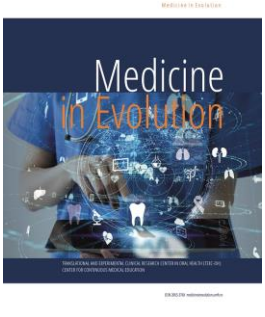
Dental Bleaching Associated to Prosthetic and Endodontic Treatments



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Abstract

The demand for teeth whitening is marking a pivotal shift in cosmetic dentistry. This study aims to explore the efficacy teeth whitening methods in different clinical scenarios. It focuses on the importance of appropriate technique and patient-specific treatment planning.

Materials and Methods

The study uses visual measurement systems pre and post-treatment, with particular attention to light-activated whitening gels. Two distinct cases were examined: a 30-year-old female post-prosthetic treatment patient, receiving in-office Light Whitening treatment (32% hydrogen peroxide) to harmonize dental shades; a 48-year-old male undergoing both internal and external whitening for a devitalized incisor;

Results and Discussions

Significant improvement in tooth whitening and colour uniformity was achieved across the cases. Treatments were tailored to individual patient needs, with a focus on enhancing aesthetic outcomes. The study discusses the effectiveness and safety of dental bleaching materials and highlighting the need for professional supervision.

Conclusion

This research underscores the effectiveness of personalized whitening treatments in achieving desired aesthetic outcomes. It highlights the evolving landscape of dental whitening, where patient education, careful treatment planning, and the use of advanced materials play crucial roles.

Keywords: teeth whitening, hydrogen peroxide, carbamide peroxide

INTRODUCTION

Recognizing the natural darkening of teeth as an aging process and the pigmentation due to medications or chemical incorporation during enamel and dentine formation, this paper addresses a pressing aesthetic concern in modern society. As the quest for youthfulness intensifies, patient demand for restoring bright, white smiles has surged, signifying a boom in cosmetic dental services. The dramatic rise in teeth whitening products over the past quarter-century underscores its critical role in dental practices, catering to both in-office and at-home treatments under professional supervision [1,2].

Case studies endorse the safety and efficacy of peroxide-based teeth whitening. However, many dental practitioners remain hesitant, often due to subjective interpretations of aesthetic outcomes. The last decade has seen heightened interest in dental aesthetics, spurring continuous efforts to optimize the active substance concentration for effective, long-lasting results with minimal side effects [3].

Aim and objectives

This paper aims to highlight the significance of choosing appropriate whitening techniques in various clinical scenarios. Adhering to whitening protocols and accurate case selection are key to predictable outcomes. This study adopts an approach where fundamental research outcomes guide practical solutions, focusing on the intricacies of tooth structure, discoloration types, and whitening methods for effective treatment planning.

MATERIAL AND METHODS

This investigation is designed to examine a spectrum of aesthetic dental rehabilitation scenarios, utilizing diverse teeth whitening approaches that range from basic to advanced. A pivotal element of this study is the integration of materials and techniques that incorporate desensitizing agents, aiming to alleviate dental sensitivity both during and after the whitening treatments. An additional focus is placed on the dental practitioner's role in comprehensively understanding and addressing patient needs and expectations to formulate an optimal treatment plan that yields the desired outcomes.

Materials and Instruments

The study employed a comprehensive array of dental tools and materials:

- A standard dental consultation kit.
- Advanced ultrasonic scaling tools, along with various polishing pastes and brushes for the professional cleaning.
- Oral retractors, protective eyewear for safety of both practitioner and patient.
- Colour measurement tools including Vita Classical and Vita 3D-Master colour keys, complemented by the Vita EasyShade electronic colour measurement device.
- Dental supplies like cotton rolls and saliva ejectors, light-curing resin for dental isolation.
- A three-wavelength whitening device designed for versatility in treatment (Beyond whitening lamp).
- A selection of whitening gel formulas suitable for various clinical scenarios.
- UltraEZ Ultradent desensitizing gel, containing 3% Potassium Nitrate and 0.25% Sodium Fluoride, to mitigate sensitivity post-whitening.

The study methodologically employed both "manual" and electronic systems for color measurement before and after the whitening treatments across all cases. Specific attention

was given to cases necessitating light-activated whitening gels, utilizing a specialized lamp equipped with white, red, and violet light sources. This lamp featured touch-screen functionality and adjustable wavelength settings to meet the individual requirements of each case.

For all the patients were obtained both the medical history and informed consent. A comprehensive oral examination was conducted to determine the suitability of the whitening treatment. The procedure involved professional oral hygiene a day prior to whitening, followed by a methodical preparation of the workspace. Patient expectations were discussed, and initial tooth shade was determined using both "manual" and electronic methods. Oral and gingival protection was applied, including the use of mouth retractors and Vitamin E. The teeth were isolated with cotton rolls and light-curing resin. Post-treatment steps included gel removal, isolation system removal, final shade evaluation and recording, and the application of a desensitizing and remineralizing gel. Postoperative care instructions were provided to the patient.

Clinical Case I:

A 30-year-old female patient, post-prosthetic treatment of tooth 2.2 with an indirect single-unit zirconia restoration, sought teeth whitening to harmonize dental shades and enhance aesthetic appearance in the maxillary anterior region. Initial colour assessment using the Vita Classical colour key revealed a discrepancy between the prosthetic restoration (shade A1) and the natural teeth (shade A2), further confirmed by the VITA Easy-Shade electronic device. The in-office Light Whitening system (32% hydrogen peroxide by WHITE smile) was selected, requiring light activation and promising rapid, effective results. The system's composition includes potassium nitrate and fluoride to minimize dental sensitivity during and after the whitening process. The kit comprised a dual syringe with self-mixing 32% HP gel, gingival protection resin, and a desensitizing/remineralizing gel containing potassium nitrate, fluoride, and xylitol (Figures 1-3).

Figure 1. Vita classic shade guide before bleaching- shade A2

Figure 2. Liquid dam for protecting the marginal gingiva

Figure 3. Vita classic shade guide after bleaching- shade A1

Clinical Case II:

For a 48-year-old male patient, the treatment focused on both internal and external whitening of a discoloured, devitalized incisor. This involved endodontic treatment and carefully sealing the root canal with glass ionomer cement plug to prevent bleaching agent infiltration around endodontic filling. Whitening agents specifically designed for devitalized teeth were used, followed by post-treatment assessments and applications for tooth stability and aesthetics. The shade of the teeth was identified with both Vita Classical shade guide and 3D Master shade guide. The liquid dam was applied and light cured to protect the gingiva.

Since the tooth presented sever discoloration the external bleaching was associated with internal bleaching in the same session. The access cavity made into the oral surface and the bleaching gel Opalescence Endo 35% peroxide hydrogen (Ultradent) laid in the dental crown. The bleaching agents were activated with the Beyond UV lamp for 30 minutes.

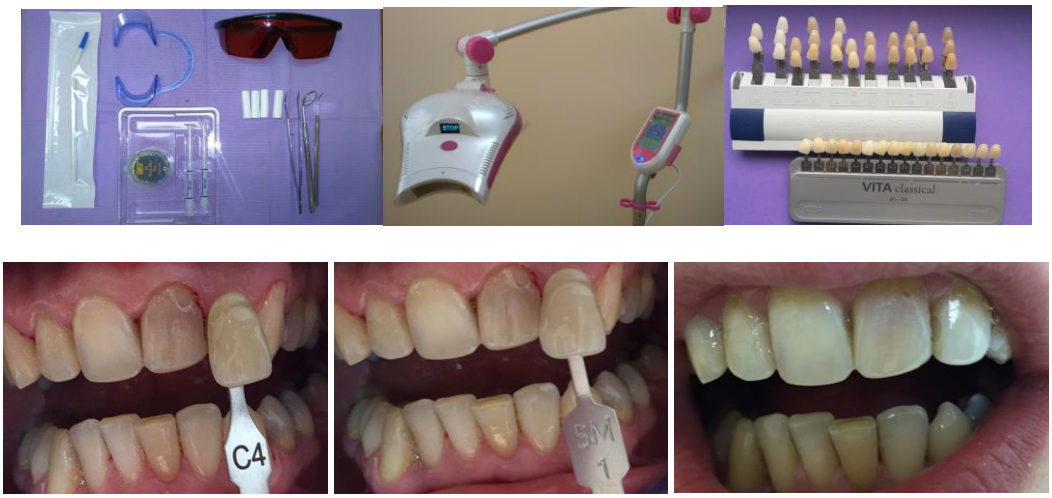

Figure 4. Bleaching gel, UV Beyond lamp and Vita Classical and 3D Master Shade guide

RESULTS

In the first case (harmonizing dental shades post-prosthetic treatment) using the Light Whitening system (32% hydrogen peroxide), successful harmonization of dental shades was achieved, bridging the colour discrepancy between the prosthetic restoration and natural teeth. The treatment also ensured minimal dental sensitivity due to the inclusion of potassium nitrate and fluoride in the whitening system. Initial colour assessment used the Vita Classical colour key and VITA Easy-Shade device, followed by the application of a specialized whitening kit, including a dual syringe with self-mixing HP gel and a gingival protection resin.

In the second case (internal and external whitening of a devitalized tooth), effective whitening of the devitalized tooth was achieved, with careful management of potential risks associated with internal whitening. Post-treatment assessments indicated improved tooth stability and aesthetics. The treatment involved endodontic therapy, root canal sealing to prevent bleaching agent infiltration, and application of whitening agents specifically formulated for devitalized teeth.

These cases demonstrate the effectiveness and safety of various whitening procedures tailored to individual patient needs, emphasizing the importance of patient education and careful treatment planning in cosmetic dentistry.

DISCUSSIONS

Hydrogen peroxide

Hydrogen peroxide is widely recognized and used in professional dental whitening treatments due to its effectiveness in bleaching tooth enamel. A 32% concentration of hydrogen peroxide is relatively high and typically used for in-office treatments under professional supervision. This concentration can provide significant whitening results in a shorter period compared to lower concentrations. While effective, higher concentrations of hydrogen peroxide can increase the risk of tooth sensitivity and irritation to gums. Therefore, professional application and patient monitoring are essential. Hydrogen peroxide acts as an oxidizing agent, penetrating the enamel and dentin to break down the compounds causing discoloration, which results in a whitening effect. The use of hydrogen peroxide in dental treatments is subject to regulation in many countries, with specific guidelines on safe concentrations and application methods to minimize risks [4,5].

At-Home Teeth Whitening Kits

At-home whitening kits have demonstrated substantial effectiveness in lightening tooth color for a broad user demographic. These kits typically incorporate lower concentrations of bleaching agents, such as hydrogen peroxide or carbamide peroxide, compared to their professional counterparts. General safety is acknowledged when these kits are used as directed. However, potential side effects, including tooth sensitivity and gum irritation, are noted, often correlating with the bleaching agent's concentration, usage duration, and the user's dental health status. Comparative studies indicate that while professional treatments offer more rapid and pronounced results, at-home kits present a viable, more affordable, and convenient alternative, albeit with more gradual outcomes. Adherence to manufacturer-provided instructions is crucial. Non-compliance may result in uneven whitening, heightened sensitivity, or dental damage. The long-term effects of at-home whitening kits on tooth enamel and dental health are varied. Moderate, guideline-adherent use is typically safe, whereas excessive use might lead to enamel degradation. Seeking professional dental advice, particularly for users with pre-existing dental conditions or sensitivity concerns, is advocated in some research circles. The effectiveness of at-home whitening kits can vary significantly, influenced by factors such as the nature and extent of tooth stains, the whitening agent's concentration, and overall dental health [6-8].

Carbamide Peroxide 35% in Teeth Whitening

This concentration is generally recognized as effective, decomposing into active bleaching agents like hydrogen peroxide and urea. It provides notable whitening outcomes. Owing to its high concentration, 35% carbamide peroxide is predominantly administered in professional settings, typically in custom-fitted tray-based systems. The duration and frequency of treatments are tailored to individual needs to mitigate gum irritation and sensitivity. High concentrations may heighten risks such as tooth sensitivity and gum irritation, underscoring the need for professional oversight. Dentists often employ desensitizing agents and adjust protocols accordingly. Research delineates the trade-offs between efficacy and potential side effects across different concentrations of carbamide peroxide. The prolonged use of high concentrations is studied for its potential impact on tooth enamel and gum health [9,10].

Whitening of Devitalized Teeth of Internal and External Whitening

Internal whitening is effective for discoloration due to internal factors like necrosis, while external whitening addresses surface stains. Internal whitening typically involves the placement of a whitening agent inside the tooth, requiring potentially multiple applications. External whitening usually applies a peroxide-based agent externally. Internal whitening necessitates careful monitoring due to risks such as root resorption. The predictability and permanence of internal whitening results can be less assured compared to external methods. Some cases may benefit from a combination of both internal and external whitening for optimal aesthetic outcomes. Recent research focuses on enhancing the safety and effectiveness of treatments for devitalized teeth, exploring new materials and methods [11,12].

Personalization of Treatment

Each clinical case mandates a tailored approach, considering individual patient requirements and specific discoloration aetiologies. The evolving field of dental whitening research underscores the significance of personalized treatment strategies to optimize both efficacy and safety [13].

Limitations and regulations regarding home bleaching should be considered since the access to bleaching agents and devices especially on internet is not limited. These products and especially home bleaching should be done only after a dental consult and at the dentist’s recommendations [14].

CONCLUSIONS

The study successfully examined a spectrum of aesthetic dental rehabilitation cases, employing a range of whitening techniques from basic to advanced. These included the use of desensitizing agents to reduce dental sensitivity during and after treatments. A significant emphasis was placed on the dentist's comprehensive understanding of patient needs and expectations. This holistic approach enabled the formulation of optimal treatment plans leading to desired outcomes.

The research emphasizes the significance of personalized treatment approaches in dental whitening, catering to specific patient needs and the unique causes of tooth discoloration. The findings advocate for a patient-centric approach in cosmetic dentistry, integrating advanced materials and methods to enhance both the efficacy and safety of whitening treatments.

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Dental Sealings in a Group of Young Adults with Occlusal Stains – A One Year Follow up Study

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Abstract

Aim and objectives: The aim of the present study is to determine the rate of survival of dental sealings applied in a group of young adults (mean age 24) on lateral teeth which present occlusal stains that cannot be clinically diagnosed as caries. **Material and methods:** The study group consisted of 21 patients with 111 teeth to be sealed. After performing the sealings, the follow up was recorded in two sessions at 6 and 12 months, investigating the integrity of the dental sealings and any modification of the occlusal stains. **Results:** We recorded a global percentage of complete presence of sealings at 1 year of 92.79%. No sealing was completely lost and none of the occlusal stains under the sealings presented visible signs of evolution towards cavity. **Conclusion:** Dental sealing can be a viable and conservative option in young adults with occlusal stains that cannot easily be diagnosed as dental caries.

Keywords: Dental sealing, occlusal stains, young adults

INTRODUCTION

Sealing, often used in caries prevention, is one of the most efficient methods for a dental practitioner to prevent the appearance of pit and fissure caries on the occlusal, buccal and oral surfaces of newly erupted teeth, as well as those with a longer period of time of persistence at the level of the dental arches. Often used in national and international dental prophylaxis programs, sealing helps patients to keep their teeth healthy for as long as possible, knowing the destructive potential of caries on hard dental tissues [1]. Although the occlusal surfaces represent approximately 12.6% of the area of the dental surfaces, 60% of the total carious lesions are grafted into the fissures and pits at this level, presenting an increased vulnerability to the cariogenic attack, for various reasons [2]. Evidence show us that sealants could minimize the progression of initial lesions (non-cavitated occlusal carious lesions) that receive a sealant [3]. The consensus appears to be that dental sealants are intended to be used mainly for children, whose teeth are in the early developmental stage, and teenagers. Yet, when applying them to adults, less attention is given to the preventive long-term aspects [4].

Aim and objectives

The purpose of this study is to evaluate the short- and medium-term retention of dental sealants in teeth with discoloration in the occlusal fissures and pits, which cannot be clically diagnosed as caries in the dentin, in young adult patients.

MATERIAL AND METHODS

The study we carried out is an experimental, analytical, prospective one. We selected a study group, made of a number of 21 subjects, aged between 23 and 27 years. We considered several criteria for choosing the teeth that were to be sealed, excluding those with fillings on the surface to be sealed, carious lesions presenting a cavity, previous sealings or other resinous materials, resulting in a total of 111 teeth to be sealed. All selected teeth presented stains in their pits and fissures. All patients agreed to participate in the study, giving their informed consent. A single operator examined the 21 patients, chose the teeth to be sealed and performed the sealings in order to avoid distortions (bias) that may occur when there are several clinicians who must record similar data and/or perform similar treatments in a group of patients [5].

After choosing the teeth to be sealed, we proceeded to perform the sealings, following the well-known clinical steps of the procedure. Isolation during the procedure was done with absorbent rolls and saliva aspirator, no rubber dam was used. After performing the sealings, the patients were discharged, being called for control at 6 months and at one year. We monitored the evolution of the seals through the clinical consultation and photographs, which helped us establish the results of the study.

We have selected a material widely used and easy to find on the commercial dental market, namely Fissurit F from Voco. The chosen material has the following advantages: quick and direct application by means of the syringe, white color favorable to the control during and after sealing, excellent flow properties and low viscosity, does not incorporate air bubbles, increased stability and good adhesion to enamel, prolonged release of fluoride.

The first evaluation took place approximately six months after the dental sealings were performed, with the main objective of controlling the presence of the sealing material. In the case of its partial loss, we did not proceed to restore or complete the sealing in order to have the possibility to re-evaluate exactly the same sealing one year after it was performed, without any additional intervention.

The second evaluation took place approximately one year after the dental sealings were performed and consisted of a new check of their presence and the condition of the sealed teeth. In the case of their partial loss, this time we proceeded to restore or complete the sealing.

The data recorded during the 3 clinical sessions were introduced into tables created in Excel (Microsoft), then we performed the statistics to observe the evolution over time of the sealings performed.

RESULTS

In this study, we monitored the retention of the sealings performed on a group of 21 patients, of which 12 were male and 9 were female, with a mean age of 24 years, to whom we applied a total of 111 sealings. The follow-up period was 1 year, starting in March 2011 and ending in June 2012, with professional checkups every 6 months. All the teeth included in the study presented stains in pits and fissures at the beginning of the study and all the sealings were made with the same material - Fissurit F. We applied sealings both on the molars (33), especially the mandibular ones, and on the premolars (78), with the latter the results being more favorable.

We recorded a global percentage of complete presence of sealings at 1 year of 92.79%.

At six months, following the examination, we detected a partial loss of retention at the level of 6 molars, and at 1 year we observed another 2 partially lost sealings, but none presented secondary caries or marginal staining, and there was no clinical sign of evolution in depth of any possible incipient dental caries covered by the sealing material. At the last evaluation, the one from 1 year, most of the sealings presented some mechanical wear, transposed by the loss of surface gloss and slight color changes, especially in the male sex, where we also found staining due to tobacco at the level of all teeth.

There was a significant difference between the sealings performed on premolars and those performed on molars. At the level of the premolars, out of 78 seals, all were fully maintained on the occlusal surface, thus having a 100% positive result in terms of strength and durability for one year, while at the level of the molars the success rate was lower, with differences related to sex. From the total of sealings performed on molars (33), we found the partial loss of 8 sealings, their success being 81.81% at 6 months and 75.75% at 1 year. The integrity of sealings related to the teeth groups is presented in Chart 1.

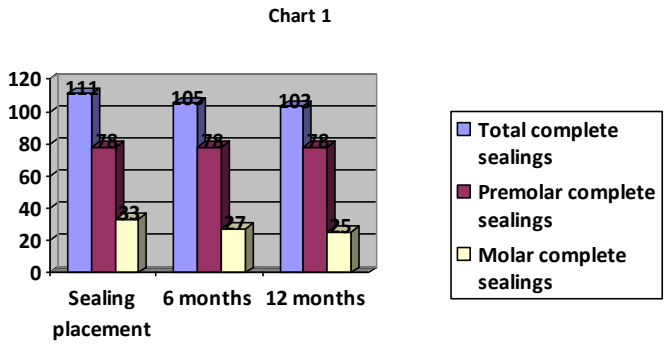

Chart 1. The integrity of sealings related to the teeth groups

Regarding gender, from 36 sealings performed on females, we recorded a favorable status and a retention of 100% at 6 months and 1 year, compared to the percentages of 92% at 6 months and 89.33% at 1 year, obtained in males from the total of 75 sealings performed on them. For the males, where the seals were partially lost, the sealing material changed over time in appearance and color, appearing more matte and darker in color compared to how it looked at the application session. The integrity of sealings related to patients' sex is presented in Chart 2.

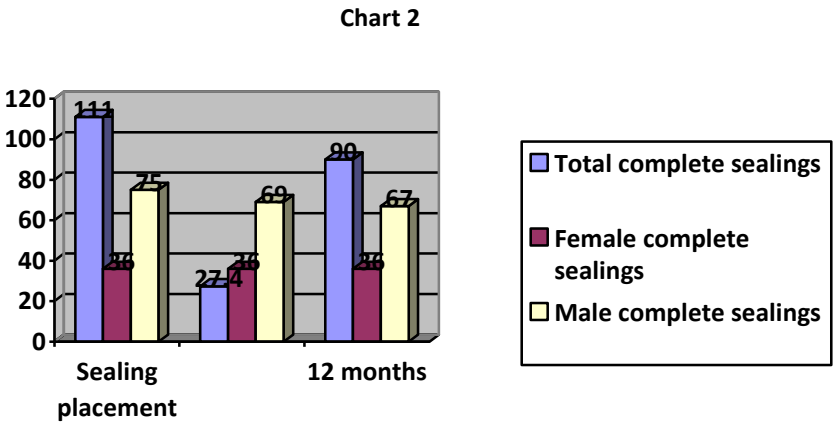

Chart 2. The integrity of sealings related to patients' sex

DISCUSSIONS

The results presented here demonstrate the possibility of measuring the quality of a seal or a material, using a simple criterion to define the seal as satisfactory or unsatisfactory, namely the retention of the material at the level of the sealed fissure or pit, but also widely used by other studies [6] being easy to understand and apply without being time-consuming. The results obtained were satisfactory, but the study has some limitations, which must be mentioned.

One of these may be the relatively small number of patients, respectively of sealings and the disproportionate ratio between sealings performed on premolars compared to molars. Thus, the seals made on the premolars showed a retentiveness of 100%, and those on the molars only 75.75% after one year after performing the sealings, such results being also reported by other studies [7]. In the analysis by gender, we obtained a percentage of retention of 100% in females and 89.33% in males after one year, but it must be considered that in males we performed a double number of sealings than in females, as the sealings performed on the premolars were in much higher numbers than those made on the molars. Although the specialized literature informs us that the retention of the seals is superior at the level of premolars compared to molars [7], in this study we did not perform the same number of seals on the two groups of teeth, so the result in this sense cannot present verisimilitude. We can conclude that the lack of integrity of the material at the level of one wisdom tooth and seven second molars reside in the difficulty of achieving a perfect technique and good isolation, especially in terms of maintaining the isolation, which encounters some problems, given the access to the area respectively, under the conditions of using cotton rolls as absorbent means. In similar cases we consider that the use of rubber dam should be recommended, although placing a rubber dam around a 3rd molar is known to be quite difficult – we did not find significant studies regarding the placement of rubber dam around the third molar – and we consider this to be a necessary future direction to research.

Another weak point of the study was the age of the subjects to whom we applied the seals. All patients are close in age and are already at a young adult age so, some of the teeth recommended to be sealed had been affected by caries in the past and present occlusal fillings. In this age group the perception of oral health and hygiene may be different than in children and especially teenagers – we did not find significant studies to support this statement, and we also consider this to be a future direction to research – they pay more attention to oral care. Although most of the subjects present a problematic dental status, they currently have very good oral hygiene, with low or even zero bleeding and plaque indexes, and also present a reasonably good socio-economic status and a positive attitude towards the preventive measures. As general criteria, there were no patients that could be placed in the category of high caries risk. We placed them in the risk category that requires sealing based on the DMF-T/DMF-S indices, i.e. the dental status.

However, this aspect of age can also be considered a positive thing for the purpose of the study, since, usually, the sealings are mostly performed in children and adolescents, 2-3 years post-eruption, and less in adults, so it can be a reflection of the behavior of seals on some mature teeth, from an oral environment in which the factors determining and favoring the appearance of caries have already left their mark. The age of the patients also helped us, being able to perform a correct sealing technique, all patients being compliant to the procedure.

In the case of partially lost seals, it was unexpected and surprising that in most cases the change occurred in less than 6 months and up to a year no further loss of material occurred. Therefore, it cannot be a question of a gradual degradation of the retention of the seals, but on the contrary, they seem to maintain themselves very well over time, once they have passed the first months after application. The variables related to the technique and the material used can be related to this aspect. In this case, as far as the technique is concerned, it was only one hand (so one operator), we strictly followed all the clinical steps, and the material chosen has superior qualities and a proven clinical success, having a different color than that of the teeth, thus being easy to evaluate. Therefore, we consider the results obtained to be accorded to reality.

The sealing material that we applied is one that releases fluoride, so the expectations are for remineralization of the incipient caries under it, an aspect that we could not evaluate, considering the fact that the potential occlusal caries lesions remained sealed. But, at the control sessions, we could observe the fact that none of the sealed teeth showed any edifying symptoms or clinical signs for an evolution towards a more advanced stage of caries.

CONCLUSIONS

According to literature, the durability and resistance of dental sealings can be a measure of their quality evaluation in dentistry.

After the one-year evaluation we recorded a percentage of 92.79% of intact sealings and 7.21% of partially lost sealings with no completely lost sealings.

Regarding the evolution of stains, out of the total number of sealed teeth, none developed an active cavity under the sealing material.

The procedure for applying a dental sealing is easy, within the reach of any dentist and even dental hygienists, bringing great benefits for occlusal caries prevention not only for children and teenagers but also for young adults.

When occlusal stains are present without the certainty of dental caries a conservative approach should be considered, consisting in dental sealing with regular follow-up.

When performing dental sealings in young adults on teeth presenting occlusal stains we recommend supplementary caution in males' molars since retention of sealings on these teeth seems to be most difficult to achieve.

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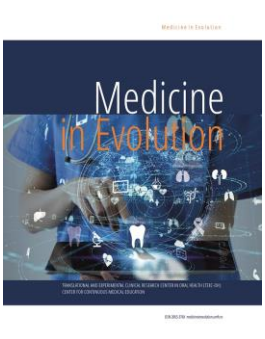
Fracture of the Angle of the Mandible. Case Report



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Abstract

One of the most frequently fractured site of the mandible is the angle. The most common cause of mandibular angle fractures are:accidents or trauma involving a blow to the face.This may be the result of a motor vehicle accident, industrial accident, recreational or sports injury, battle grounds or iatrogenic injury.Patients who are referred to the emergency room with facial trauma need a rigorous intraoral and extraoral examination centering the head and neck region.Computed tomography with 3D reconstruction is an essential tool for precise diagnostics.After the correct diagnosis is confirmed the physician will evolve the correct treatment plan.

Keywords: Mandible fracture, trauma, angle fracture, fracture of the angle of mandible

INTRODUCTION

One of the most common fractures is the mandibular angle fracture which represents approximately 20%-30% of all mandibular fractures [1]. Most angle fractures are simple or complex and involve the terminal molar. The presence of the impacted third molar may be considered a weak point. According to Moore [2], the change in the direction of the bone where the horizontal body of the mandible meets the vertical ramus, is also considered a weak point and multiplies the possibility to fracture. Mandibular fractures are typically result of trauma. A fall directly onto the chin or a an assault, a direct hit a punch from the side. In rare cases mandibular fracture can occur in pathological bone and may refer to osteonecrosis or tumors. The severity of the force, the direction and the impact influence fracture patterns [3]. Mandible fracture causes vary by the time period and the region. Assaults, road traffic accidents, battle grounds, iatrogenic complications of third molar removal may be considered principal causes [4,5]. Symptoms of mandibular fractures include pain, swelling, malocclusion, lower lip paesthesia, loose teeth crepitation while performing palpation [6]. Angle fractures with displaced fragments and diastasis can rarely be reduced only by maxillomandibular fixation alone [7-8]. Open reduction with internal fixation, osteosynthesis is the therapy of choice that should be performed.

MATERIAL AND METHODS

We present the case of an 18-year-old patient with a mandible fracture of the angle with post-traumatic malocclusion, focal swelling and tenderness over a segment of the mandible. Other symptoms included trismus, anesthesia in the left distribution of the inferior alveolar and mental nerve. Cause of the fracture was an assault at the club. Routine blood investigations were carried out and all the values were in normal limit. The computed tomography confirmed the angle fracture (Figure 1).

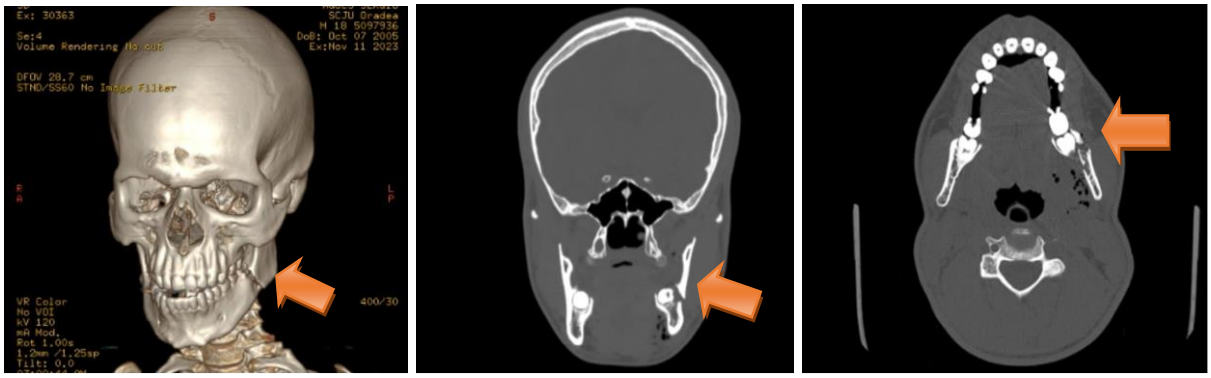

Figure 1. Fracture of the angle of mandible with diastasis, 3D reconstruction, coronal and axial

Discontinuity of the angle of the mandible can be seen. Antibiotic and antiinflamatory therapy was started. The first step of the treatment was the fixation of the maxillary and the mandible with Erich arch bars and interdental wiring (Figure 2). The maxillo-mandibular fixation (MMF) was performed with guiding elastics. The second step of the treatment was the opened reduction with internal fixation under general anesthesia with nasal intubation. Two titan plates with eight screws were placed with optimal reduction (Figures 3, 4).

Figure 2. Erich arch bars with fixation of the occlusion

Figure 3. Exposure of the fracture

Figure 4. Bone plating

RESULTS

Evolution of the patient was favorable, he respected the indications but the compliance was a little bit difficult because of the age. The parents were compliant and helped a lot in the positive outcome of this case. Patient had a good healing. Pain and discomfort after the procedure were managed with medication. Mentally he was optimistic and understood the need of the MMF (maxilla-mandibular fixation) which in this case was performed with guiding elastics for three weeks. Although there are hazards when using elastics for MMF in this case this was the best option because the patient couldn't withstand the rigid MMF. Postoperative x-rays are taken within the first days after surgery. Follow-up x-rays are taken after 3-4 weeks. Patient was examined approximately 1 time per week postoperatively to check the stability of the occlusion, to check for infection of the surgical wound and for replacement of the intermaxillary elastics (Figure 5). During each visit, we evaluated the patient's ability to perform oral hygiene. Patient tolerated quite well the liquid diet.

Figure 5. Orthopantomography 3 months after opened reduction with internal fixation with two plates and eight screws

DISCUSSIONS

The goal of fracture management is to restore occlusion, mechanical strength of the fractured area, and to achieve maximum normal masticatory muscle function. Integration of the fracture is one of the main targets for successful treatment other than occlusion. Although there are many classification schemes for the oral and maxillofacial trauma in the literature each case is considered particular and there isn't a globally accepted pattern between practitioners.Our department is following the AO surgery reference for the field of oral and maxillofacial trauma.The AO (CMF) Craniomaxillofacial is a worldwide network of clinicians from the field of oral and maxillofacial surgery, plastic surgery, ENT head and neck surgery ophtalmology and neurosurgery.The section covers the following topics: trauma, sequela, orthognatic, reconstruction and congenital deformities.The mandible trauma classification : parasymphysis and symphysis simple and complex fracture;body of mandible simple and complex fracture; angle of mandible simple and complex ,ramus and condyle fracture. The fracture of the angle of the mandible is influenced by the forces of the muscles of mastication. [2,6,9]. Regarding the presence of the third molar in the line of the mandibular fracture. Approximately 50% of fractures of the mandible occur in teeth bearing area and whether teeth situated in the line of fracture should be extracted or retained has always been a subject of heated debate [10]. Consistent extraction of teeth in the line of mandibular fracture has no scientific basis and has distinct disadvantages. Extraction of tooth entails further trauma to bone tissue and also presents technical difficulties when the fragments are highly mobile. Extraction of the tooth also increases the risk of the contamination of the fracture through the empty alveolus, which may sometimes be difficult to suture [11,12]. Our department preffers to wait. We consider the extraction of the third molar in the line of the fracture only if the tooth is symptomatic.

CONCLUSIONS

Mandibular angle fractures are common fractures in the oral and maxillofacial area but it can sometimes represent a provocation for the surgeons.Depending on the complexity of the fracture the key to success is proper diagnosis,fracture simplification with adequate three-dimensional fragment reduction and proper alignment of the alveolar segments to restore preoperative occlusion (habitual occlusion).Complete history regarding the events

that lead to the trauma along with a rigurous intraoral and extraoral examination of the head and neck region together with proper radiographic evaluation, the gold standard, computed tomography with 3D reconstruction are the main elements in the diagnosis and treatment plan of these fractures.A distinctiveness of the angle fractures is the action of the muscles of mastication which may mobilize the bone fragments.The displaced fragments usually require open treatment with internal fixation.Whether the physician decides to use a single plate at the linea obliqua (Champy's principle), two plates with transbuccal trocar instrumentation or a large reconstruction plate for comminuted fractures, the goal is to achieve proper fixation of the mandible and preoperative occlusion.

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Plaque Removal Efficacy of Manual Tooth Brushing in Crowded Mandibular Frontal Teeth

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Abstract

The aim of the present in vivo study was to evaluate the efficacy of two different bristle stiffness, in plaque control of crowded mandibular teeth. To classify the patient mandibular frontal teeth irregularity, the quantitative Little´s Irregularity Index was used. To quantify the dental plaque accumulation, the Distal-Mesial Plaque Index (DMPI) was assessed by a single examiner. After each plaque accumulation period, which lasted for 24 hours, the plaque removal efficacy of a soft or medium stiff manual toothbrush were measured. The mean interproximal DMPI of the irregularity group with mild and moderate crowding was, prior to brushing with the soft bristle toothbrush, 1.87 on the facial surfaces, 1.93 on those of the lingual surfaces, and 1.90 on both the facial and lingual surfaces. The new mean interproximal DMPI after brushing of the facial teeth surfaces was 1.54. On the lingual surfaces an index of 1.58 and on the facial and lingual surfaces combined an index of 1.56 was measured. Considering the percentage of the remaining interdental plaque, on the severely crowded surfaces, the toothbrush with medium bristle stiffness was slightly, with two percent, more effective in removing interproximal plaque with a percentage of 23%, compared to the toothbrush with a soft bristle stiffness removing 21% of the interdental plaque. In conclusion, the manual toothbrush with round-ended medium stiffness bristles was slightly more effective in removing interproximal plaque compared to the toothbrush with round-ended soft bristle stiffness. In comparison, there was a slight difference interdental plaque removal between the soft and medium stiff round-ended toothbrushes, independently of the crowding degree.

Keywords: dental plaque, crowding, plaque control, oral microbiome

INTRODUCTION

A key component of dental education and health promotion initiatives has always been to promote effective plaque reduction through mechanical methods. There is no question that promoting frequent brushing has contributed, at least in part, to the reduction in periodontal and caries diseases. The patient's ability to regulate supragingival biofilm at home is the most crucial factor in achieving and preserving oral health. The most frequent regions for plaque to accumulate are the interproximal regions of the anterior and posterior teeth (1). A study on anterior crowding noted that crowding makes it more difficult to maintain adequate oral hygiene, and those patients with average oral hygiene were shown to have greater plaque retention (2). Since the most prominent, age-related physiologic change in the dentition is distinguished to be the crowding of the frontal teeth, especially the lower incisors, the efficient plaque removal in these hard to reach interproximal tooth areas is very important (3). For this reason, daily use of dental floss, an interdental brushe, and other interdental cleaning devices are advised. Nevertheless, these cleaning instruments are still uncommonly used and often only the toothbrush is utilized. Additionally, nowadays there are a variety of toothbrushes with various bristle stiffness and patterns flooding the market, each claiming to be more effective in removing plaque. Without any professional guidance, the common person may find it difficult to choose the right toothbrush because of this and frequently choose brushes based on price, accessibility, familiarity, and promotional claims (4). Furthermore a hard toothbrush, also called a firm-bristled brush, causes more soft tissue trauma, and it is because of this knowledge, increasingly difficult to find in stores (5).

According to one of the definitions, dental plaque is a particular but very changeable structural entity, composed of bacteria and their products, incorporated in a highly structured intercellular matrix. It is a representation of a true biofilm made up of various microorganisms engaged in a variety of molecular, metabolic, and physical interactions (6). Clinically, dental plaque has been described as the soft, tenacious substance that forms on the surfaces of teeth and is difficult to remove with simple water rinsing (7).

In general there are four stages in the process of microbial adhesion to surfaces in an aquatic environment. The initial transportation of bacteria to the tooth surface is the first stage. Contact could occur randomly by different molecular movements. In the second phase, the initial adhesion, a reversible adherence that is brought on by the interaction of long and short range forces between the bacterium and the surface at a given distance (50 nm).

After initial adhesion, particular interactions (covalent, ionic, or hydrogen bonding) after direct contact or by bridging real extracellular filamentous appendages create a firm attachment between bacteria and surface. In the last phase, microcolonies or a biofilm may form as a result of the increasing, firmly attached microorganisms and the continued attachment of the newly formed bacterial clusters (8).

On the teeth, with the number of those co-adhesion processes the microbial colonization and the development of biofilm is started (9).

The oral microbiome contains up to 750 different types of microbes, creating it a complex ecosystem (10). Aerobic (i.e. oxygen-tolerant) bacteria, including Neisseria and Rothia. are frequently the initial or primary colonists (10). The majority of the earliest colonizers are cocci, particularly streptococci, which make up between 47 and 85% of the cultivable cells discovered within the first four hours following a professional tooth cleaning (10).

Streptococcus mutans, Streptococcus sanguinis, and Streptococcus mitis make up the majority of the streptococci, while Streptococcus salivarius are often less common (11). Early

colonists alter the environment by their metabolism, such as by increasing the anaerobic state of the environment after they consume oxygen (12).

As oxygen level of plaque falls, gram-negative, anaerobic (i.e., oxygen-intolerant) species predominate in later plaque development stages and the subgingival plaque. However, there is proof that oxygen cannot reach the dental plaque deeper than 0.1 mm. With this, some of them, such Treponema, Porphyromonas, Prevotella, and Fusobacterium species, may also be seen in early plaque (10).

Since there can be a wide range in the composition of plaque microorganisms, the consequences of dental plaque affecting the oral health can largely vary.

The metabolism of dietary sugars through bacterial microorganisms creates an acidic accumulation in the dental plaque. When the pH of plaque decreases under der critical value of 5.5, hydroxyapatite becomes soluble and demineralization of enamel is initiated (13). Acid production, acid tolerance, and the formation of intracellular and extracellular polysaccharides are characteristics linked to cariogenicity that are not unique to one species. By building food chains with other plaque bacteria, like Veillonella species, which transform lactate into weaker acids, or by the creation of alkali by salivary components, acid production can be counteracted (12). In events, for instance of high sugar consumption or low salivary flow rate, there are proportionally only few acid- counteracting microorganisms the pH of the plaque rapidly decreases from 7.0 to below 4.5. With the continuous maintenance of such low pH, the balance of demineralization and remineralization is lost and the dissolution of the tooth structure creates carious cavitation (10). Therefore, regular plaque removal is mandatory to protect dental tisuues especially in hard to reach areas.

Aim and objectives

The aim of the present in vivo study was to evaluate the efficacy of two different bristle stiffness, namely soft and medium bristle stiffness, of a manual toothbrush. The final goal of this experimental study is to be able to recommend patients the right bristle hardness of a manual toothbrush that can be more effective in removing interproximal plaque from the lower anterior teeth, according to the patient's individual degree of crowding. Thus, the null hypotheses underlying the present study is that there is no different effect of tooth brushing in interproximal areas depending on the bristle stiffness, as determined by the plaque removal efficacy.

MATERIAL AND METHODS

This interventional study was performed during July – September 2023 on a sample of 25 randomly selected patients who underwent following inclusion criteria:

1. Presence of all natural six permanent mandibular frontal teeth
2. Good general health
3. Affiliation to one of the Little´s Irregularity Index Classification

Exclusion criteria were represented by the presence of orthodontic appliances or retainers on the mandibular teeth, prosthetic devices and the presence of large plaque retaining cavities on mandibular frontal teeth.

To classify the patient mandibular frontal teeth irregularity, the quantitative Little´s Irregularity Index was used. According to this system, measurements straight from the mandibular arch have been taken while holding a caliper (Fig. 1) parallel to the occlusal plane. Thereby, the linear displacement of the neighboring anatomic contact points of the mandibular incisors was calculated and the sum of the five measurements represented the case´s Irregularity Index value (14).

Using the criteria shown in table 1, each subject was evaluated subjectively on a scale from 0 to 10.

Table 1. Little´s Irregularity Index (14)

Degree of Irregularity (mm)	Little´s Irregularity Index
0	Perfect alignment
1-3	Minimal irregularity
4-6	Moderate irregularity
7-9	Severe irregularity
10	Very severe irregularity

Each patient was then assigned to one of three main groups with 1 - no crowding, 2 - minimal and moderate crowding, 3 - severe and very severe crowding. In this way, it was later possible to compare the extent to which the interproximal plaque of the three main groups could be removed more or less effectively with the respective bristle hardness of the toothbrush.

To start with the same plaque accumulation preconditions, the selected subjects received a professional tooth cleaning, by brushing their teeth with a slow speed hand piece, ultrasonic scaling and interdental flossing. The patients were then instructed to discontinue their daily oral hygiene measures on the mandibular frontal teeth.

After each plaque accumulation period, which lasted for 24 hours, the plaque removal efficacy of a soft or medium stiff manual toothbrush were measured. Thereby the starting bristle stiffness of the toothbrush were randomly selected and both, the patient as well as the examiner were blind to the identity of the toothbrush bristle stiffness. To insure the original bristle stiffness, the brush was disposed of after each single use.

To begin with, the patient was instructed to thoroughly rinse his mouth to remove of all food particles and thick saliva. Hereafter, dental plaque was disclosed with plaque revelator (Mira- 2- tone, Hager Werken) by direct application with impregnated single use appliers on the lower frontal teeth. The subject was then asked to rinse again with tap water immediately after the application of the plaque disclosing agent. The older and thicker accumulated plaque was then visualized as blue and the newer and thinner plaque as red or pink color.

To quantify the dental plaque accumulation, the Distal-Mesial Plaque Index (DMPI) was assessed by a single examiner. Plaque accumulation on each of the interproximal areas (Fig. 1), naming the areas disto-occlusal (DO); disto-middle (DM); disto- gingival (DG), as well as the mesio-occlusal (MO); mesio-middle (MM) and mesio-gingival (MG), were scored (Tab. 2) on the lingual as well as on the labial tooth surface.

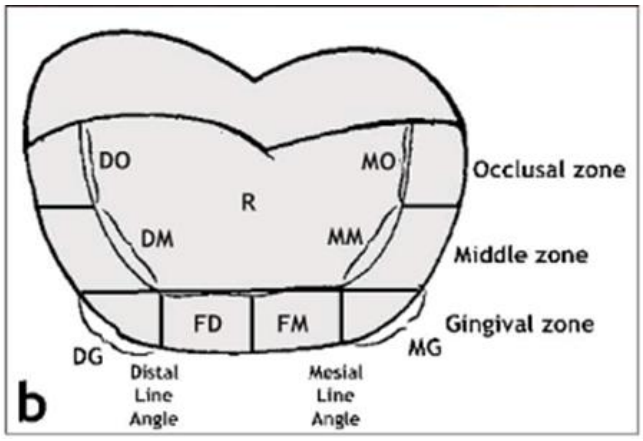

Figure 1. The DMPI zones (15)

Table 2. Numerical values of the DMPI (15)

0	**No plaque present**
1	1/3 of the area covered by plaque
2	2/3 of the area covered by plaque
3	Complete area covered by plaque

After grading each of the six lower frontal teeth, from canine to canine, a mean plaque score of each tooth was calculated and noted down. Photos of the stained teeth were taken for the documentation. Next, the manual toothbrush, with for the examiner unknown bristle stiffness, was immersed into tap water for 75 seconds and afterward, the toothbrush was taped twice against the water glass to remove excessive water. One trained right-handed examiner, standing on the right side of the patient, brushed the lower frontal teeth of the patient with equal force and in absence of a dentifrice. In order to obtain excellent plaque reduction with a concurrent protection of the oral tissues against mechanical irritation, the modified Bass technique is frequently advised for manual tooth brushing. First, the orientation of the toothbrush head was oblique and apically directed, causing the bristles to make a 45-degree angle with the tooth axis. Because of this angle, the tips of some bristles got slightly inserted into the gingival sulcus while others filaments brushed the gingival margin. Within the sulcus, back and forth motions with small horizontal amplitudes were used. The bristles could then enter the interproximal gaps with a stronger pressure. After those movements, the toothbrush head was rotated in an occlusal direction, from the gingival tissue to the tooth surface, to wipe out debris. Although the toothbrush was positioned vertically at the level of the lingual surfaces of the anterior teeth, the movements were the same on the lingual surfaces (16,17).

With the general recommendation for a brushing time of minimum 2 minutes for the whole dentition in both arches (18), the calculated brushing duration for the lower frontal teeth segment amounts 20 seconds. Dividing those 20 seconds for all six lower frontal teeth, the brushing time results in 10 seconds for the labial as well as 10 seconds for the lingual surfaces.

Following the tooth brushing, again the plaque was visualized by using the plaque disclosing agent Mira- 2- tone dye and the stained plaque was reexamined according to the DMPI plaque interproximal areas. Once again, intraoral photos were taken for documentation.

At the end of the study, the mean DMPI before and after tooth brushing as well as the efficiency to remove the interproximal plaque of the respective toothbrush bristle stiffness were calculated and compared with the collected data.

RESULTS

In order to quantify the interproximal plaque removal efficacy, the under mentioned diagram (Fig. 2) shows the mean interproximal DMPI of the irregularity group of no crowding before and after tooth brushing, with particular respect to percentage of the remaining dental plaque after tooth brushing with a soft bristle hardness toothbrush.

Before tooth brushing, the mean interproximal DMPI revealed on the facial teeth surfaces 1.79, on the lingual teeth surfaces 1.20 and summed on the facial as well as the lingual teeth surfaces of 1.49. In comparison with the mean interproximal DMPI of the facial teeth surfaces with 1.48, the remaining plaque after tooth brushing revealed 82%, the lingual surfaces with 1.03 manifested 86% and in combination of the facial and lingual surfaces 1.25 DMPI, the remaining interproximal plaque after tooth brushing evidenced 84%.

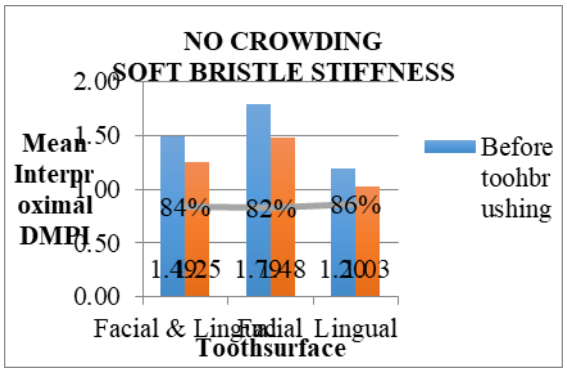

Figure 2. No crowding irregularity: Mean interproximal DMPI with the soft bristle stiffness toothbrush

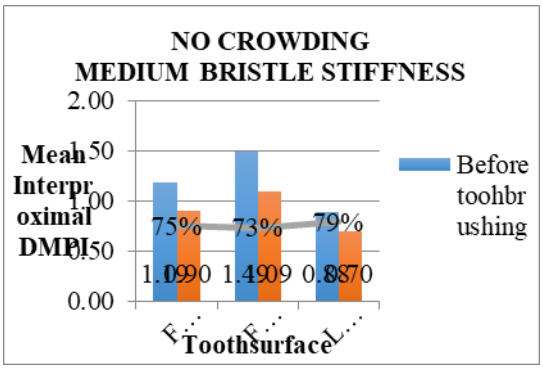

Figure 3. No crowding irregularity: Mean interproximal DMPI with the medium bristle stiffness toothbrush

The same irregularity group without crowding showed the following results with regard to the medium bristle stiffness toothbrush (Fig. 10). Before using the medium bristle toothbrush, the mean interproximal plaque DMPI on the facial tooth surfaces counted 1.49, 0.88 on the lingual tooth surfaces, and 1.19 when the facial and lingual surfaces were added together. The interproximal plaque that was still present after brushing was 73% in relation to the remaining mean interproximal DMPI of the facial tooth surfaces, which is 1.09. On the lingual surface, there was has a mean interproximal DMPI after tooth brushing of 0.70 and the combination of the facial and lingual surfaces, showed a mean interproximal DMPI after tooth brushing of 0.90. With this outcomes, the percentages of the remaining dental plaque after brushing revealed 79% on the lingual tooth surface and 75% on both surfaces together.

The comparison of this case demonstrates that the medium bristles of a toothbrush were more effective, facial and lingual surfaces with a total of 25%, in removing the given interproximal dental plaque without accessory auxiliary interdental cleaning devices than the medium bristle toothbrush, facial and lingual surfaces together with a total of 16% (Fig. 4).

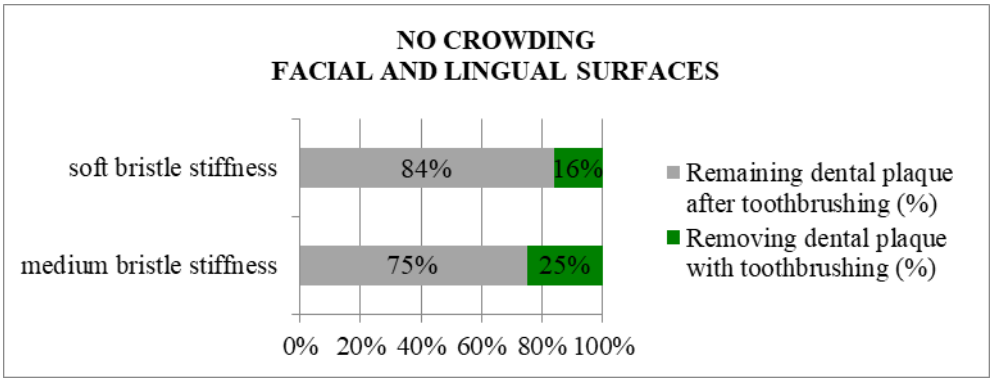

Figure 4. Comparison soft and medium bristle stiffness – no crowding

The mean interproximal DMPI of the irregularity group with mild and moderate crowding is shown in the diagram below (Fig. 5).

Prior to brushing with the soft bristle toothbrush, the mean interproximal DMPI was 1.87 on the facial surfaces, 1.93 on those of the lingual surfaces, and 1.90 on both the facial and lingual surfaces.

The new mean interproximal DMPI after brushing of the facial teeth surfaces was 1.54. On the lingual surfaces an index of 1.58 and on the facial and lingual surfaces combined an index of 1.56 was measured. The percentages of plaque left over with the soft bristle toothbrush counted 82% on both the facial, the lingual surfaces. With those results, in

combination of these two surfaces, the total remaining dental plaque after tooth brushing listed as well 82%.

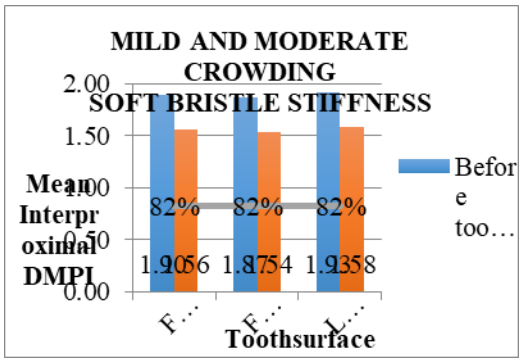

Figure 5. Mild and moderate crowding irregularity: Mean interproximal DMPI with the soft bristle stiffness toothbrush

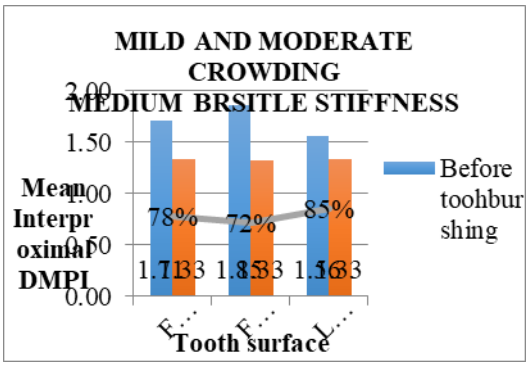

Figure 6. Mild and moderate crowding irregularity: Mean interproximal DMPI with the medium bristle stiffness toothbrush

Figure 6 shows the data of irregularity group of mild and moderate crowding in consideration with the medium bristle stiffness toothbrush.

Regarding the mean interproximal DMPI on the facial tooth surfaces, it numbered 1.85 before and 1.33 after tooth brushing, which resulted in a remaining plaque of 72%. On the lingual surface after the plaque accumulation, it showed a mean DMPI value of 1.56 and after brushing 1.33, giving a percentage of 85 remaining interproximal dental plaque. The two surfaces together displayed before tooth brushing a value of 1.71 and afterward a value of 1.33, resulting in a total amount of 78% remaining dental plaque with the medium bristle toothbrush.

Comparing the data of this irregularity group with the soft and medium toothbrushes, it could be concluded that the medium toothbrush removed a slightly greater amount of plaque with a efficacy of removing the interproximal plaque with 22% compared to the 18% with the soft toothbrush (Fig. 7).

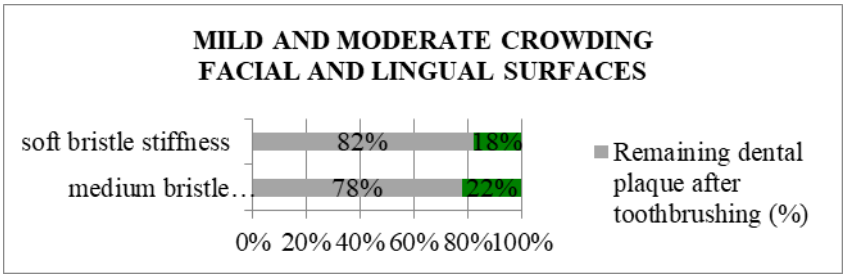

Figure 7. Comparison soft and medium bristle stiffness – Mild and moderate crowding

The data of the severe and very severe crowding irregularity group in reference to the mean interproximal DMPI are outlined in the two following charts.

Figure 8 illustrates the information regarding the soft bristle toothbrush. On the facial surfaces of the six lower frontal teeth a mean interproximal DMPI was measured with initially 1.89 and 1.44 afterward. The remaining dental plaque after brushing counted 76%. The lingual surfaces revealed an incipient index of 1.78 and subsequent index of 1.46. According to these facts, a percentage of 82 of plaque remained right after the brushing. Both, the facial in addition with the lingual surfaces, yield in a mean DMPI of 1.83 prior and 1.45 after brushing the teeth. With this, the persisting interdental plaque accounted for both areas 79%.

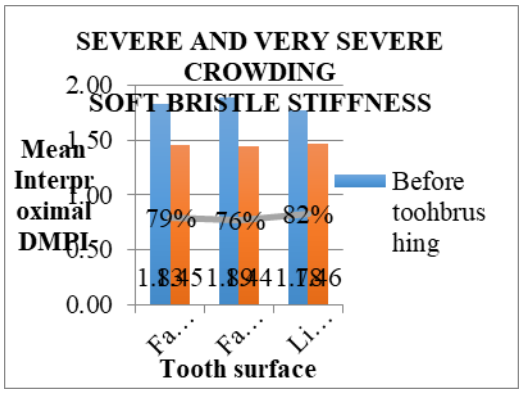

Figure 8. Severe and very severe crowding irregularity: Mean interproximal DMPI with the soft bristle stiffness toothbrush

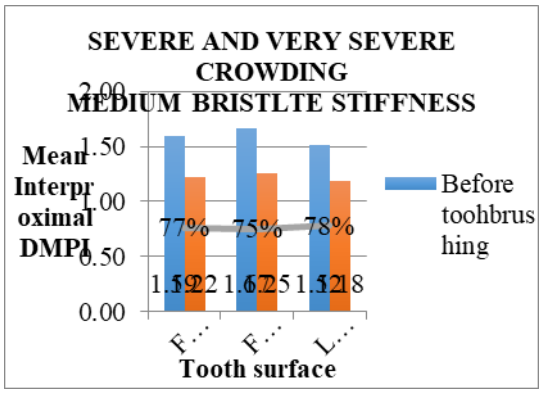

Figure 9. Severe and very severe crowding irregularity: Mean interproximal DMPI with the medium bristle stiffness toothbrush

Information regarding the mean interdental DMPI with a medium bristle tooth brushing in the group of severe and very severe crowded lower frontal teeth is presented in Figure 16. Before tooth brushing the mean interproximal DMPI of the facial, 1.67 and the lingual surfaces, 1.52, added up together to an index of 1.59. After tooth brushing the mean interdental DMPI of the facial, 1.25, and the lingual surfaces, 1.18, resulted combined in an in the mean DMPI of 1.22. The remaining dental plaque after tooth brushing showed a percentage of 77 for both surfaces together, 75% for only the facial, and 78% for just the lingual surfaces.

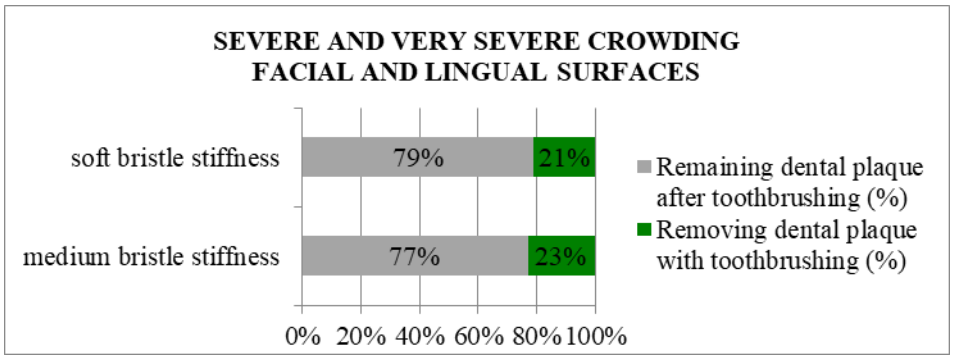

Figure 10. Comparison of soft and medium bristle stiffness – Severe and very severe crowding

Considering the percentage of the remaining interdental plaque, the toothbrush with medium bristle stiffness was slightly, with two percent, more effective in removing interproximal plaque with a percentage of 23%, compared to the toothbrush with a soft bristle stiffness removing 21% of the interdental plaque (Fig.10).

DISCUSSIONS

The purpose of this clinical study was to survey the efficacy of manual toothbrushes with different bristle stiffness, soft and medium hardness, to achieve oral hygiene in terms of interproximal plaque removal capacity without additional interdental cleaning measurements.

The evaluation was based on the DMPI of patients with different Little´s irregularity indices after a plaque accumulation period of 24 hours and after tooth brushing with the respective bristle rigidity.

The DMPI was chosen due to its ability to precisely measure which bristle hardness is more effective in removing interproximal plaque from individual tooth surfaces.

The advantage of this index is that it was possible to determine very precisely how much the bristles of the toothbrush could remove the plaque in the interproximal area.

On the contrary, due to the high specificity of this index, the evaluation was time-consuming and the possibility of introducing mistakes was higher. Trained examiners should therefore only use it.

To circumvent possible errors regarding the accuracy of the real plaque amount, in the study by Otsuka et al., pictures were taken to document and measure the plaque clearance area, using a digital single-lens reflex camera for dental purposes. The number of pixels were analyzed by Adobe Photoshop CS5 Extended in each image and used to calculate the plaque removal area (19).

In other studies, which also investigated plaque removal capacity of toothbrushes in interproximal areas, the selected plaque indexes were not as specific to the particular areas of a tooth surface. Many studies, which investigated the interdental plaque removal efficacy of toothbrushes with different bristle stiffness, used the Quigley and Hein´s plaque index, the Rustogi modification of Navy plaque index as well as the Loe and Silness index, which are all less specific to the interproximal areas and therefore not as informative as the DMPI (1).

Referring to Zimmer et al., hard-bristled manual toothbrushes were found to be more effective at removing plaque from proximal surfaces as well as from free smooth surfaces than soft-bristled toothbrushes of the same type. This improved cleaning performance, though, was linked to more soft tissue abrasion. For the medium toothbrushes, the findings were in between (20,21).

According to findings like those, there are more toothbrushes with soft and medium bristles on the market, than hard-bristles toothbrushes. Through this fact, the toothbrush with hard bristle stiffness was not investigated and only the manual toothbrushes with medium and soft bristles were examined in this current study.

An in vitro study, published in 2019 and performed by Otsuka et al., investigated properties of commercially available manual toothbrushes influencing the plaque removal of interproximal surfaces. Experimental tooth plaque was reduced following the brushing test, however, each plaque removal rate was under 50%. Brushes with any bristle type, including the difference between soft and medium bristle stiffness, had difficulty in getting contact around the artificial tooth. It was discovered by using mixed effect modeling to analyze the data, that the variations, like the bristle hardness, the number of tufts, and the length, all affect the plaque removal rate from interproximal surfaces (19).

According to the findings in the in vivo study of Zanatta et al., medium toothbrushes effectively eliminated more dental biofilm than soft toothbrushes, regardless of whether toothpaste or not was used (22).

Additionally, Rosema et al. as well as Caporossi et al., stated that the presence or absence of toothpaste had no impact on the plaque removal (23).

On the other hand, Keller et al. stated, that a toothbrush with toothpaste was much more efficient in plaque removal than using only water during tooth brushing (24).

Since there are various measurements here, it would also be useful to compare the different bristle stiffness with and without toothpaste.

Since the previous studies examined the plaque removal efficacy of manual toothbrushes with different bristle hardness for patients considering all present dentition areas, this current study focused especially on the crowding degree of patients, more specifically on the mandibular frontal teeth.

The results of the current study should be considered for recommendations of manual toothbrushes to patients with certain degrees of irregularities in the lower frontal teeth.

To give emphasis on the selected variable of the toothbrush, the bristle stiffness, all other parameters were kept constant e.g. toothbrush bristle design, toothbrush head shape, bristle arrangement and tooth brush brand.

In the present study, round-ended bristles and no dental dentifrice were used.

Caporossi et al. found out, that tapered filaments were less effective in plaque removing from tooth surfaces, inclusively the interproximal surfaces, compared to end-rounded filaments, regardless of with or without toothpaste was utilized. In contrast to this, Dorfer et al. found that in comparison to toothbrushes with end-rounded bristles, tapered brushes removed more plaque (23). Referring to the study of Cifcibasi et al., the bristle arrangement of a toothbrush had little impact in the role of plaque removal (25).

On the opposite side, in 2021 it has been concluded in a systematic review with meta-analysis, that in consideration of interproximal surfaces, tapered-tip bristle toothbrushes may produce superior outcomes than end-rounded bristle toothbrushes (1).

According to these different statements, further studies could take into account that there might be differences between soft and medium hard bristles with tapered bristle ends, which might give different results than with round ended ones.

For this study, the modified Bass tooth brushing technique was applied by a single, trained examiner, to assure constantly the same type of brushing movements and forces for all tests. This brushing technique was chosen for this current study since it was analyzed by Payato-Ferra et al., demonstrating that the modified Bass technique approach significantly outperformed conventional brushing techniques in eliminating supragingival plaque from both the buccal and lingual sites (26).

In other studies, like in the systemic review by Mueller-Bolla et al. it is stated that when a certain age of child, more precisely over 7 years of age, is reached, there would be no difference in tooth brushing techniques in terms of plaque removal (16).

It should be also considered, that nowadays more and more people are able to financially afford an electric toothbrush, which does not involve any particular brushing technique.

Once again, it would be recommended to combine the study of ideal bristle hardness for certain crowding degrees with other types of brushing techniques, as well as with an electric toothbrush, in order to figure out the most effective way of plaque removal without further additional interdental cleaning devices.

However, this study had several important limitations, which should be taken into account for further investigations in this specific field of research.

Due to the fact, that this study was an in vivo study, there were advantages and disadvantages. On the one hand, there were uncertain parameters, such as the patient compliance dependency, the dietary habits and the saliva composition. Those types of disadvantages can be excluded in vitro studies.

On the other hand, this study presented real dental plaque as well as real teeth and gingival tissue, which presented the real situation compared to in vitro studies.

To gain more distinct results, a greater amount of patient examinations, a longer time of plaque accumulation and defined eating habits would be necessary to improve the outcome.

This interventional study only focused on the irregularity degree of the lower frontal teeth.

An improvement of the study could be, to take into consideration the overall irregularity degree of patients, in order to be able to recommend patients the bristle stiffness of a toothbrush, which could remove more interproximal plaque compared to another bristle stiffness if the patient is not using additional interdental cleaning devices.

CONCLUSIONS

In conclusion, the manual toothbrush with round-ended medium stiffness bristles was slightly more effective in removing interproximal plaque compared to the toothbrush with round-ended soft bristle stiffness. In comparison, there was a slight difference interdental plaque removal between the soft and medium stiff round-ended toothbrushes, independently of the crowding degree. Thus, the original null hypothesis can be rejected. The greatest difference of plaque removal with the medium bristle stiffness of nine percent more than soft bristle stiffness was present in the group of no crowding. In the irregularity group of mild and moderate crowding, the medium bristle stiffness removed four percent more than the soft one and in the severe to very severe crowding degrees only two percent more.

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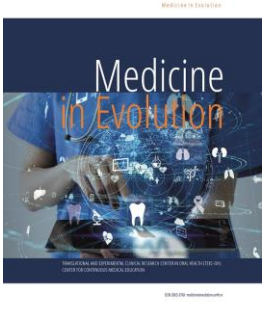
Biomimetic Restorations for Dental Aesthetics - Case Report



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Abstract

In the field of dental aesthetics, we aim to obtain restorations that imitate natural teeth. Using the right materials and technique is thus very important.

Aim and objectives: to explore and evaluate the potential of biomimicry in direct aesthetic restoration of anterior teeth.

Materials and methods: The direct restorations were realized with a nanohybrid composite resin- Filtek Ultimate (3M ESPE), using the celluloid strip technique.

Results: The direct restoration of teeth affected by enamel fractures was successful, highlighting an aesthetic and natural appearance.

Conclusions: Simplification and predictability are the key directions in the continuous improvement of the quality of direct restorations for tooth enamel fractures.

Keywords: Aesthetics, biomimetic restoration, composite resins, predictability

INTRODUCTION

Direct and conservative aesthetic restoration of anterior teeth is a common procedure in dental practice. According to the biomimetic principle, when there is a localized lack of tooth substance, adhesive ceramic restorations are not necessarily needed. Instead, we can opt for the use of direct composite resins.

Given the constant evolution in the field of dental materials science, a significant development of esthetic restorative materials has been observed. One of these materials is represented by resin-based composites (RBC), which offer both improved aesthetic and physical properties.

An ideal restorative material must have properties similar to dental tissues. Resistance is an important aspect, the material must withstand masticatory forces, wear (attrition and abrasion) and chemical insults (erosion), ensuring thermal insulation of vital dental tissues against thermal variations. In terms of aesthetics, the material must match the shade, translucency and natural texture of the surrounding teeth. It must also present permanent adhesion to the dental structure, be easy to apply and manipulate, being able to initiate the process of repair or regeneration of damaged or missing tissues.

Currently, resin-based composites (RBC) are the most widely used aesthetic restorative materials, due to their universal use, minimization of tooth structure loss, and the possibility of direct application, without the need for additional laboratory procedures. Advances in resin-based materials and application techniques have resulted in almost complete fulfillment of the ideal criteria for a restorative material.

But besides the material used, the technique is also very important for the predictability of the restoration. One can use either silicone index technique, which is very predictable, or celluloid strip technique or even free hand technique, if the practitioner is very skilled.

Aim and objectives

The aim of this paper was to explore and evaluate the potential of biomimicry of composite resins, for the esthetic restoration of anterior teeth. The study aimed to identify first the specific characteristics of natural teeth and translate them into restorations that are as close as possible to natural appearance and functionality.

The study also aimed to improve the quality of aesthetic dental treatments through the applicability of biomimicry principles regarding the development and use of composite resins.

MATERIAL AND METHODS

The patient (female, 18y) came into dental office with the request of improving smile aesthetics. Her major complaint was represented by the enamel fractures (incisal angle) at the level of maxillary front teeth (dental trauma by falling).

The aesthetic diagnosis was: dental disharmony of shape and position with class I Ellis fractures. (Fig. 1)

Figure 1. Initial aspect of smile (a) and dental composition (b)

The materials used for the aesthetic restoration of upper frontals were:

- Filtek Ultimate (3M ESPE) - nanohybrid composite resin
- Enamel acid and bonding resin (3M ESPE)
- LM Arte restoration kit (LM Instruments)
- Diatech ShapeGuard polishing set (Coltene), polishing paste and brush.

The method used for direct restoration was the celluloid strip technique.

The restoration protocol included the following: color analysis, enamel beveling, adhesion steps, composite resin stratification, finishing and polishing of the restoration.

Color analysis was realized in 2 steps: basic color determination with Vitapan Classical Shade Guide and drawing of chromatic map (Fig. 2 a, b).

Figure 2. Color analysis: a. determination of basic color; b. drawing of chromatic map

After beveling the enamel - classic straight bevel (fig.3.a), the stages of adhesive substrate followed (fig.3.b).

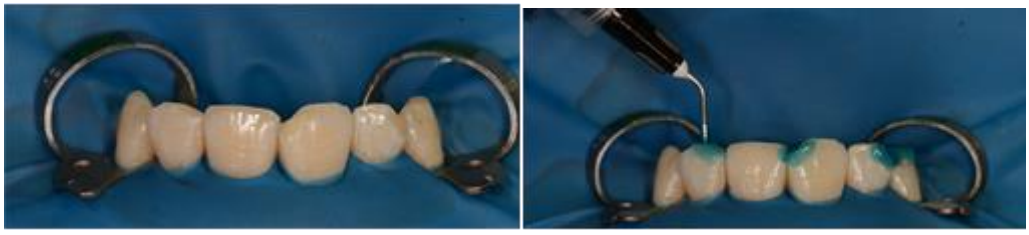

Figure 3. a. Classic straight enamel bevel; b. Enamel etching

Then we moved on to the layering of the composite resin (fig.4), using celluloid strip technique.

Figure 4. a, b Composite resin stratification with celluloid strip technique

The protocol of finishing and polishing the restoration was realized with Diatech ShapeGuard polishing set (Coltene), polishing paste and brush (fig.5).

Figure 5. a, b Aspects of restoration polishing

RESULTS

The use of resin composite in the restoration of anterior teeth requires precise technique and advanced skills to achieve aesthetically satisfactory and durable results.

The results obtained following the aesthetic restoration of the front teeth affected by dental enamel fractures were favorable, highlighting an aesthetic and natural appearance. The patient declared herself satisfied with the result. She is going to receive an orthodontic treatment in the near future, to improve not only the aesthetics but also the function.

Figure 6. Final aspect of smile (a) and dental composition (b) at the end of treatment session

DISCUSSIONS AND CONCLUSIONS

The aesthetic restoration of the anterior upper teeth is a major concern in dentistry, because these teeth are of particular importance in the aesthetic appearance and masticatory functionality. One of the main materials used is composite resin. However, the performance of these restorations can be improved by using composites with properties similar to natural teeth through biomimicry. Biomimicry refers to inspiration from nature to develop materials or technologies that imitate natural structures. The biomimetic approach can bring significant improvements in the aesthetic restoration of anterior teeth, leading to sustainable, functional and aesthetic results.

Simplification and predictability are the key directions in the continuous improvement of the quality of direct restorations for tooth enamel fractures, providing patients with full satisfaction regarding the aesthetics and functionality of dental restorations.

The use of nanohybrids, such as 3M ESPE Nanohybrid - Filtek Ultimate, is recommended in both anterior and posterior dental restorations. These materials have demonstrated excellent handling, wear resistance, easy polishing and long-term surface gloss retention. They also adapt well to the shape of cavities and provide predictable and reliable esthetic results.

In conclusion, composite materials represent a modern and effective solution for dental restorations, with advantages such as natural aesthetics, resistance to wear and the

possibility to choose from a wide range of shades, satisfying both the needs of patients and the requirements of dentists.

The key factors for achieving success are the clinician's knowledge of the following: choice of color, dental micro- and macro-anatomy, the basics of adhesion and occlusion, the work protocol. Choosing appropriate materials and applying the correct protocols can help reduce the difficulty of the procedure and achieve predictable esthetic and functional results.

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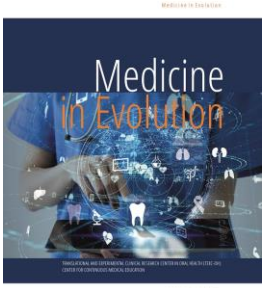
The Background of Preventive Dentistry among Dentists from the First Year of General Dentistry Residency Program, in Bucharest, Romania



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Abstract

Aim and objectives: The main objective of this study is to find what is the background of preventive dentistry (interest and knowledge) of dentists from the first year of the General Dentistry Residency Program, in Bucharest Romania. **Material and methods**: 30 dentists enrolled in this program answered to 10 closed-ended questions about their attitude and knowledge related to preventive dentistry from their private practice. **Results**: More than 80% of the dentists performed regular dental check-ups, applied topical fluorides or recommended mouth wash and dental floss to their patients. Unfortunately, more than 60% did not perform dental sealings when needed. **Conclusion**: Dentists enrolled in this study shows some interest and knowledge in preventive dentistry related to their private practice but some parts still need to be improved.

Keywords: Preventive dentistry, general dentistry, residency

INTRODUCTION

General Dentistry Residency is a three years post-graduated training program consisted of 12 stages, including Preventive Dentistry (two months). The dentists are included in this program by passing an exam. Most of the dentists are already working in the private sector and they had the opportunity to provide clinical preventive procedures to their patients.

Questionnaire is a strong tool often used to measure oral hygiene pattern of the children by using the answers provided by their parents [1,2]. Practice related to preventive dentistry is also often evaluated using questionnaires. The main points followed are diet counseling, education for manual or electrical toothbrushing, professional- and self-applied topical fluorides, pit-and-fissure sealant procedures, prescribing mouthwash and interdental aids, regular dental check-ups [3].

In Romania are less studies which used questionnaire for evaluating the background of preventive dentistry. Most of them did use questionnaire as a tool for measuring the level of knowledge and habit of oral hygiene and preventive dentistry for parents and their children [1] or just collected oral health data [4].

Aim and objectives

The main goal of this study is to find what is the background of preventive dentistry (before Preventive Dentistry stage) of dentists from the first year of the General Dentistry Residency Program, in Bucharest Romania.

MATERIAL AND METHODS

30 dentists from the first year of General Dentistry Residency Program in Bucharest, Romania, were asked to complete a questionnaire about preventive dentistry. The questionnaire used in this study contained 10 closed-ended questions, namely:

1. Did you do dietary counseling with your patients?
2. Did you perform dental sealants?
3. Did you apply topical fluorides?
4. Did you provide guidelines for manual/electrical toothbrushing instructions to your patients?
5. Did you recommend mouth wash to your patients?
6. Did you recommend dental floss to your patients?
7. Did you provide guidelines for patient's self-care procedures for teeth or implant-supported fixed (or removable) prostheses?
8. Did you provide guidelines for oral self-care procedures for patients with orthodontic appliances?
9. Did you provide oral cancer prevention and control?
10. Did you tell your patients to come back for regular dental check-ups?

The answers of questions presented above were entered into a computer and analyzed with the version no. 24 of SPSS software (trial version).

RESULTS

The mean age for the dentists involved in this study was 29.4 years (± SD = 6.65). An analysis of questions about prevention of caries and periodontitis were graphically exposed in figures no. 1, 2 and 3.

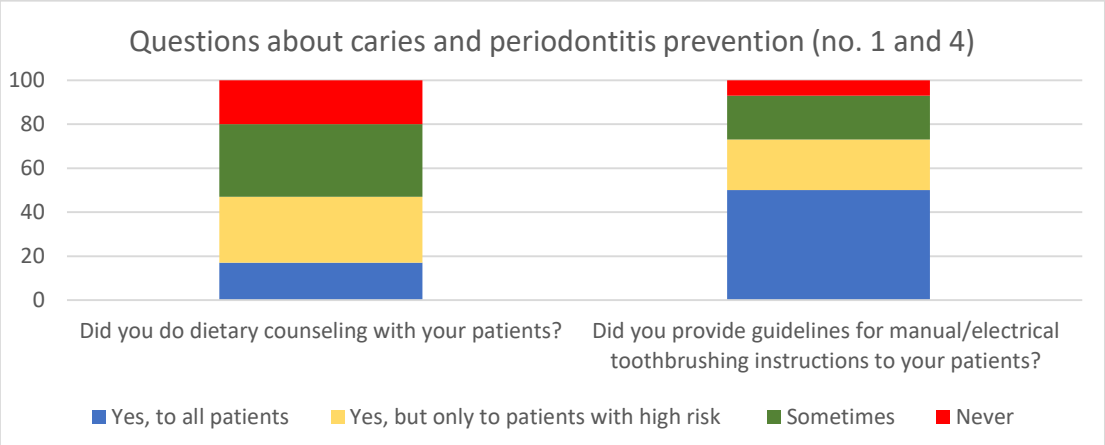

Figure 1. An analysis of the answers for questions no. 1 and 4

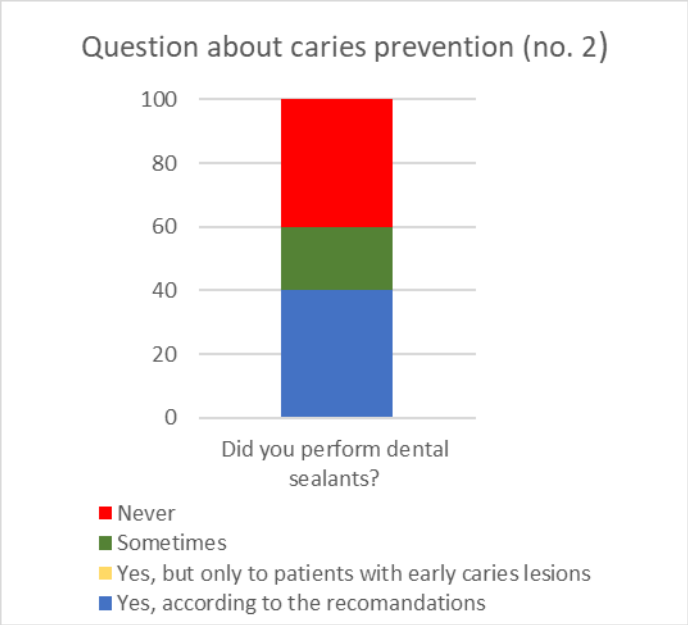

Figure 2. An analysis of the answers for question no. 2

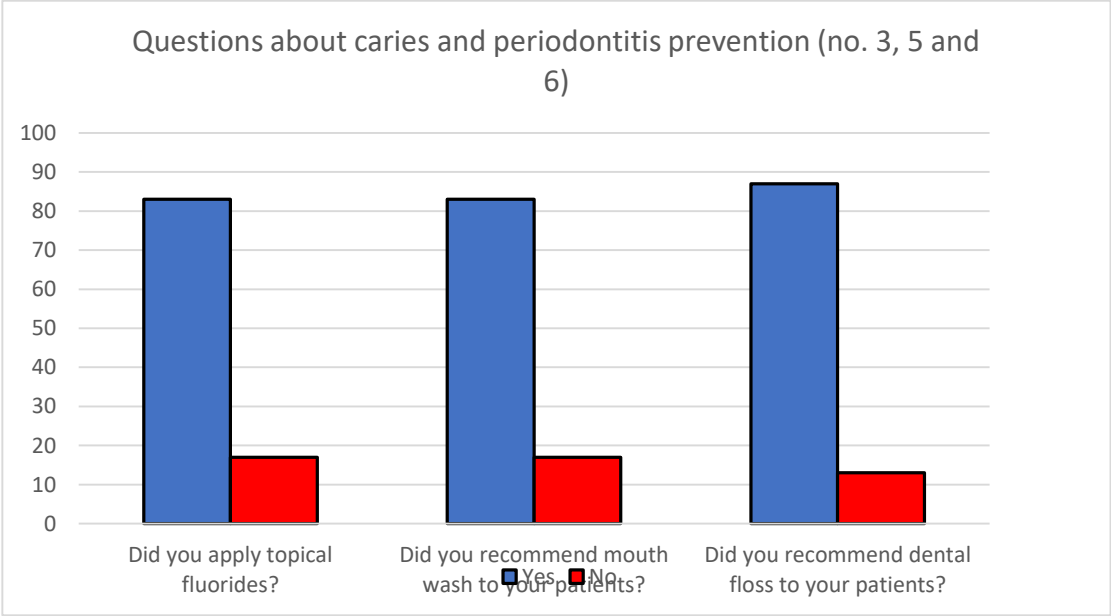

Figure 3. An analysis of the answers for questions no. 3, 5 and 6

The answers for the questions related to patients with special treatments or to regular check-ups are analyzed in figures no. 4 and 5.

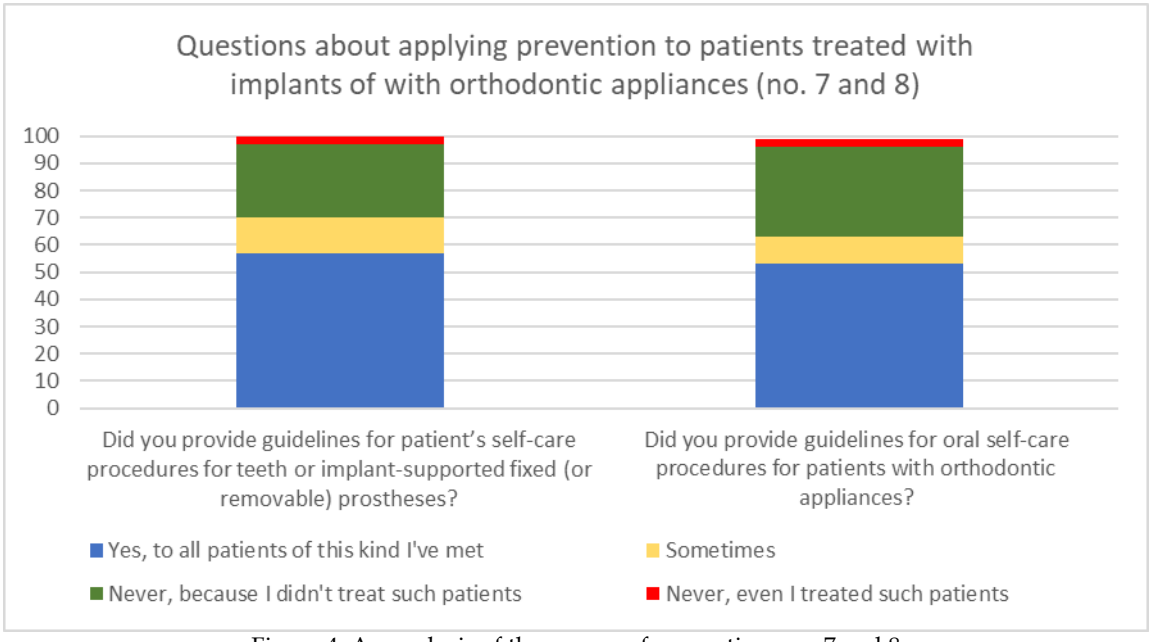

Figure 4. An analysis of the answers for questions no. 7 and 8

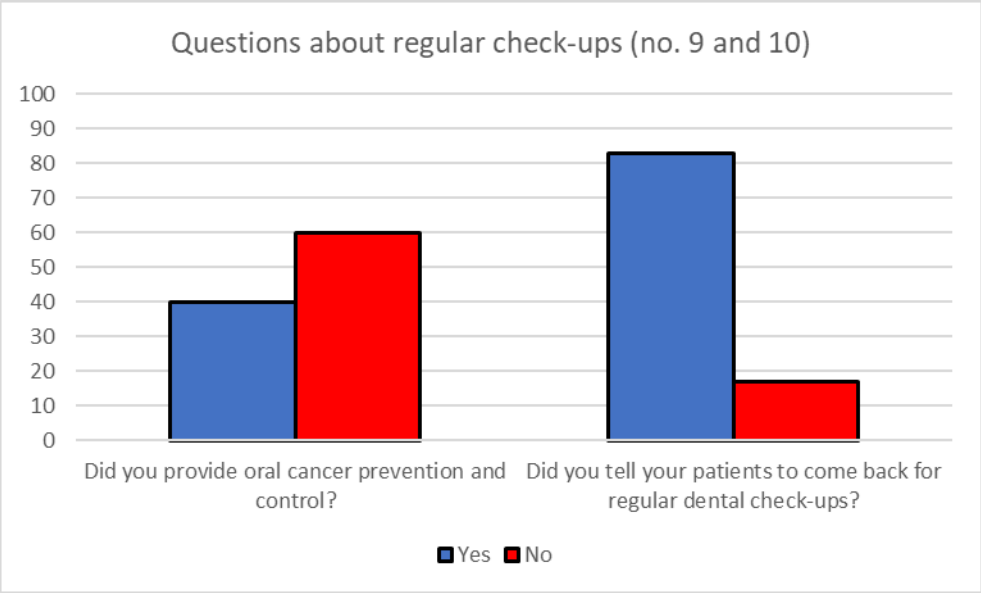

Figure 5. An analysis of the answers for questions no. 9 and 10

DISCUSSIONS

Our study revealed that only half of the dentists provides information related to toothbrushing and to mechanical plaque control procedures to their regular patients or to those who received special dental treatments (implants or orthodontic appliances) and much less (17%) spoke to them about diet and caries. Even if over 80% percent of the dentists recommended dental floss or mouth wash and applied topical fluorides to their patients, still 40% of them did not perform at least one time the pits and fissure sealant clinical procedures.

The general idea of our study is that prevention is part of the current practice of young dentists. Young dentists (with under 5 years of experience) are also found in other studies having more knowledge and a favorable attitude in relation with prevention compared to their older colleagues [5].

One of the preventive measures that did show less interest from the dentists involved in our study (17%) or in other studies (21%) [6] was dietary counseling.

Yokohama et. al for example, studied dentists' practice patterns regarding caries prevention among 185 Japanese dentists with 10 to 30 years of clinical experience. Their results indicated a low pattern compared to our study: 35% of dentists provided oral hygiene education, 26% in-office fluoride applications, 27% diet counseling [6].

Regular dental check-ups and oral cancer screening are important clinical procedures provided by any dentist. Even if over 80% from the dentists enrolled in our study inform their patients about the importance of regular dental check-ups, only half of this percent (40%) provided oral cancer screening clinical procedures. This is a very small percent compared to other studies when oral cancer screening is performed by more than 90% dentists when they examine a new patient [7].

CONCLUSIONS

Dentists from the first year of General Dentistry Residency Program show some interest and knowledge in preventive dentistry related to their private practice but some parts still need to be improved such as oral cancer prevention or dental sealing.

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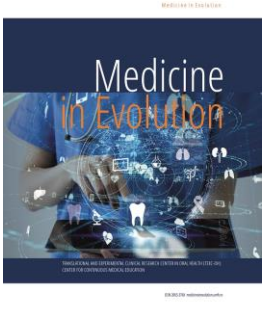
Dental Erosion in Children and Adolescents from Timiș County – a Statistical Study



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Abstract

The study that we conducted highlights the role of the level of awareness among legal representatives of minor patients regarding dietary habits, interest in dental hygiene, and the presence of potential conditions that may influence the occurrence of dental erosion. Through a questionnaire, the study will examine both the parents' or caregivers' knowledge level on these aspects and the dietary behaviors of the children and adolescents in question.

Dental erosion is the consequence of dental wear through the contact of an acid substance with the dental surface, without bacterial component being involved. The first side effect, which is also pointed out by the patient is flagged by the loss of dental hard substance, which brings with it the unaesthetic appearance of the teeth. Before reaching dental sensitivity or pain, the patient faces the unaesthetic aspect of lesions. This effect is increasingly common as, in recent times, more and more individuals emphasize aesthetic appearance. Regarding pediatric patients, their requirements are not very demanding initially, gaining significance later when they are integrated into a collective environment.

Keywords: erosion, tooth substance, minor patients, dietary habits

INTRODUCTION

Dental wear is a more general term, that includes various processes, these leading to an irreversible loss of dental hard tissue. Dental wear is also known of being the result of three main processes: erosion, attrition and abfraction (1).

Dental erosion is the result of dental wear resulting from the interaction of acid substances with the dental surface, without the involvement of bacterial components. The initial noticeable consequence, as reported by the patient, is the loss of tooth structure, leading to an aesthetically undesirable appearance of the teeth. Prior to the onset of dental sensitivity or pain, patients grapple with the unattractive aspect of these lesions. This phenomenon is becoming increasingly prevalent, particularly as contemporary individuals place a growing emphasis on aesthetic concerns.

In the case of pediatric patients, their aesthetic requirements may not be highly demanding initially but gain significance as they become integrated into a communal environment. The shift towards aesthetic considerations is especially noteworthy in recent times, reflecting the evolvement of societal values.

Due to the thinner enamel layer and lower mineralization, primary dentition is much more susceptible to erosion, increasingly prevalent among children. It has been reported that the prevalence of dental erosion in children varies between 10% and 80% (1).

Understanding the basic structure of teeth is crucial for comprehending pathological processes. Enamel, due to its mineralization, is vulnerable to demineralization caused by acids, and since it cannot be replaced, a balanced diet and perfect oral hygiene are necessary (2).

Dental erosion is defined as the irreversible loss of tooth material through a chemical process, with no involvement of bacterial components. The prevalence ranges from 8.9% and can reach up to 46% among healthy children and adolescents. This condition is associated with intrinsic and extrinsic factors (3).

More commonly seen in pediatric dentistry, with dental complications such as dental sensitivity, alteration of aesthetics, feeding difficulties and loss of vertical occlusal dimension (4).

Dental erosion is a condition that extends over a longer duration of life, encompassing multiple stages, including the erosive activity period and the latency period. The only means to prevent the onset and progression of these lesions are early identification and removal of intrinsic and extrinsic etiological factors (5).

DENTAL ATTRITION

The confirmation of dental wear occurs after analyzing various signs and symptoms that the patient may present, such as:

- Alteration of the aesthetic appearance of the tooth;
- Sensitivity to contact with chemical, mechanical, or thermal stimuli;
- Cracking/fracturing of teeth or prosthetic restorations;
- Loss of centric stops as well as vertical occlusal dimension (6).

Currently, the term dental wear is considered a result of four mechanisms:

- Erosion – the result of a chemical process, where erosive potential factors can be of extrinsic or intrinsic origin, and the loss of dental tissue occurs progressively without the presence of bacteria;
- Abrasion – the result of an abnormal mechanical process, not caused by occlusal contacts during masticatory functions;

• Attrition – occurs due to dento-dental contacts during mastication (physiological) or as a result of engaging in parafunctional habits (pathological);
• Abfraction – the result of exaggerated occlusal forces (6).

Aim and objectives

The purpose of this article is to highlight, through a questionnaire, the level of awareness among legal representatives of minor patients regarding their dietary habits, interest in dental hygiene, and the presence of any potential illnesses that may influence the occurrence of dental erosion. Subsequently analyzing a number of patients, we will attempt to observe the changes that occur in the dental structure as a result of the interaction with various intrinsic or extrinsic substances, as well as the etiology of these lesions among children and adolescents.

MATERIAL AND METHODS

For this study, the decision was made to employ the questionnaire method. The objective was to observe the factors leading to the occurrence of dental erosion, as well as the situations that promote the development of this condition.

The questionnaire was addressed to a group of 288 parents but can also be completed by other legal representatives of the children. Before distributing the questionnaire, the consent was requested in order to participate in this conducted study.

The questionnaires were distributed in Timiş County. The questionnaire also included a series of general information regarding the participants like: demographic data that concerned the sex, age and the environment origin (urban/rural).

The questions analyze when was the first visit of the child to the dentist, what was the reason for the visit, how often the child brushes his teeth, if the child uses mouthwash and if the child complains of tooth sensitivity or pain.

The parents were asked if they had heard of dental erosion and if they had been informed by the dentist that this condition is present in their child's teeth.

Other questions analyze whether the child is being administered medication, if the child has been diagnosed with a medical condition, if they consume carbonated beverages, citrus juices, energy drinks, or fruit teas and when and how often he consumes them.

RESULTS

A total of 288 responses were received for the distributed questionnaire. Over the course of several months, 37 patients, along with their legal representatives, presented themselves at the Department of Pedodontics within the Faculty of Dental Medicine. Following the evaluation, it was found that out of those presented, 5 exhibited signs of dental erosion.

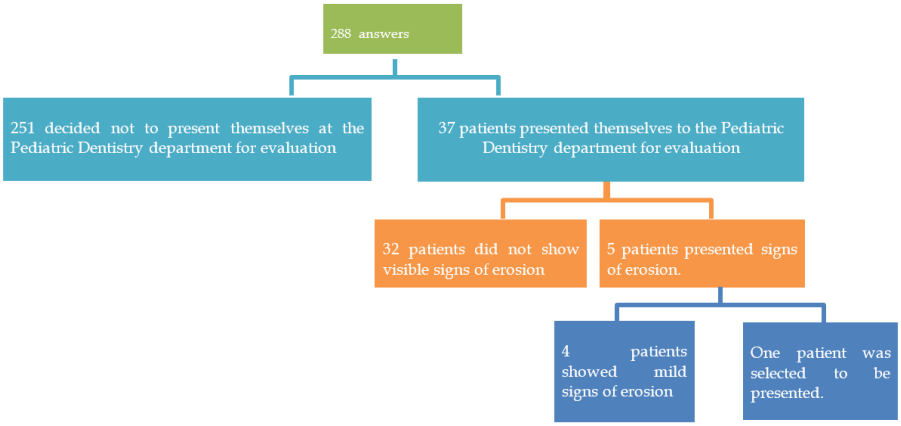

Figure 1. Participation rate and exclusion criteria

Analyzing the responses to the question regarding the first visit to the dentist, it was concluded that out of the total of 288 completed questionnaires, most children were taken to the dentist for the first time by the age of 10. Between 3 and 5 years, there were 133 children (39.2%), between 6 and 10 years, there were 111 children (38.5%), over the age of 11, there were 37 children (12.8%), while the number of children who have never been to the dentist is low, only 27 children (9.4%).

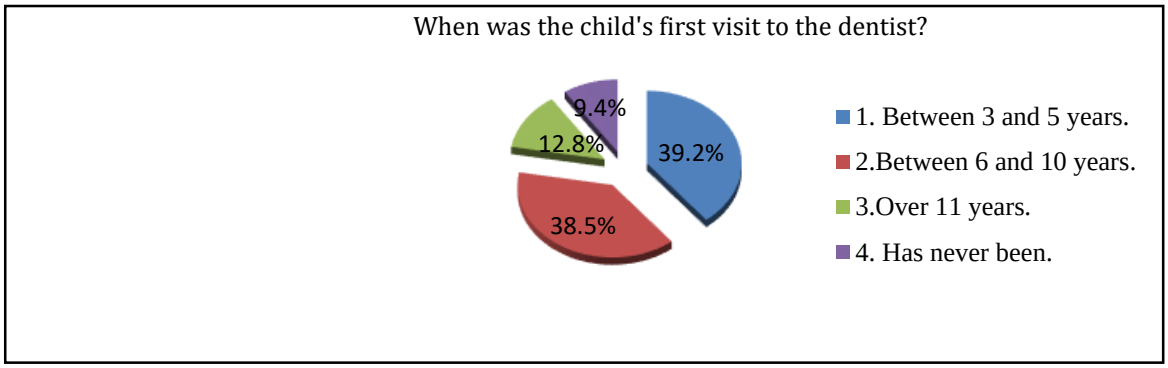

Figure 2. First visit to the dentist

Upon analyzing the responses, it was found that a large number of 236 children (81.9%) consume at least one of the following: carbonated beverages, citrus juices, energy drinks, fruit teas, while only 52 children (18.1%) do not consume the mentioned beverages.

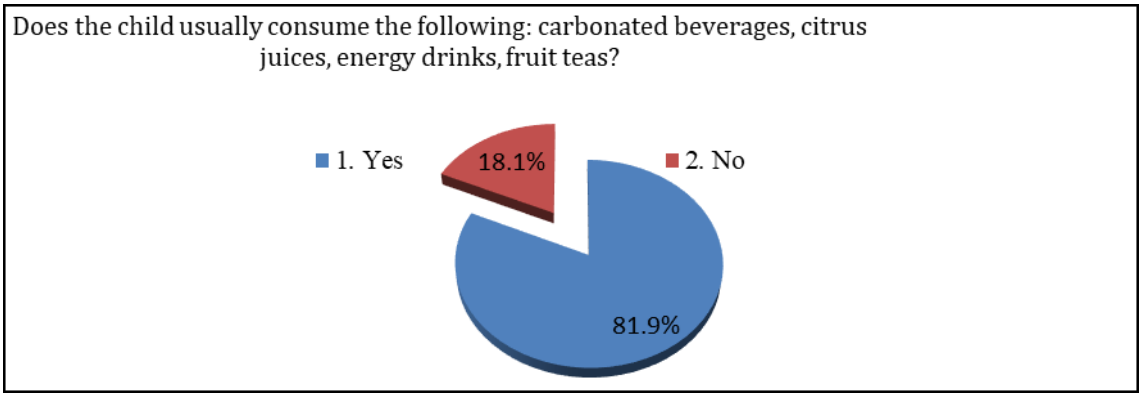

Figure 3. Different beverages consumption

Dividing into two categories the reason for the first visit, we noticed that 158 children (54.9%) were taken to the dentist only for a routine check-up, while a number of 130 children (45.1%) were taken to the dentist only when they experienced pain.

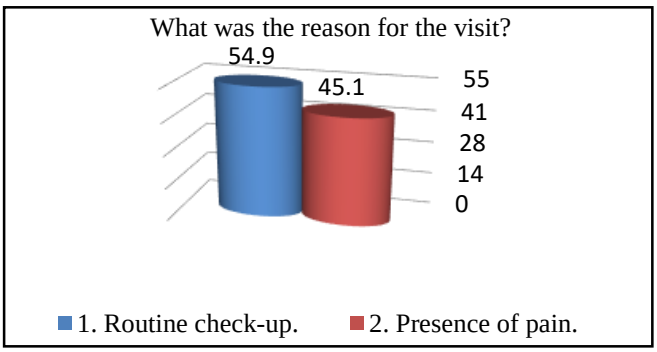

Figure 4. The reason for the visit

Analyzing the responses received, out of the 288 responses, it is evident that: a total of 190 children (66.0%) brush their teeth twice a day, 70 children (24.3%) brush once a day, while only 28 children (9.7%) brush their teeth once every few days.

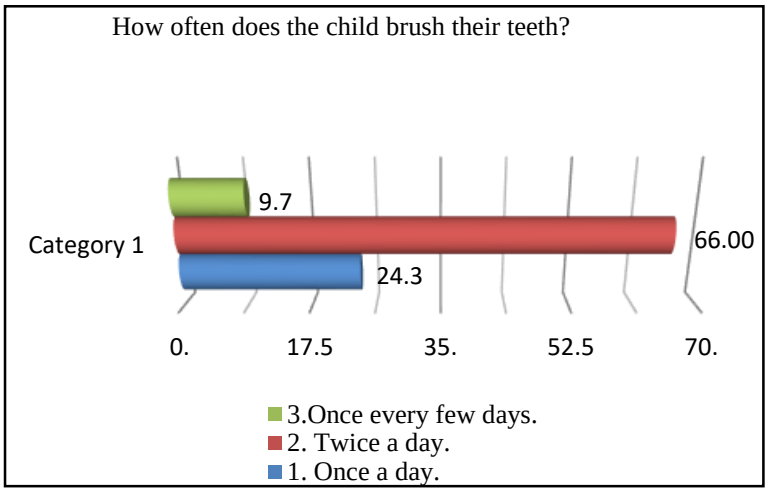

Figure 5. How often does the child brush their teeth

Out of 288 responses received, meaning 288 children, it was found that only 81 children (28.1%) use toothpaste without fluoride, while the larger proportion, representing 207 children (71.9%), use toothpaste with fluoride.

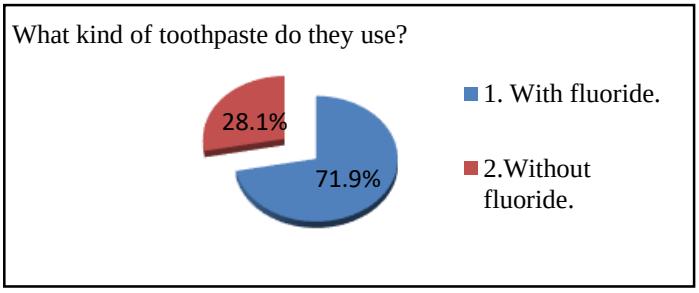

Figure 6. The type of toothpaste used

The responses indicating that children complain of dental sensitivity are relatively fewer than those who do not have this issue. Out of a total of 288 children, 123 belong to the first category (42.7%), while 165 children belong to the second category (57.3%).

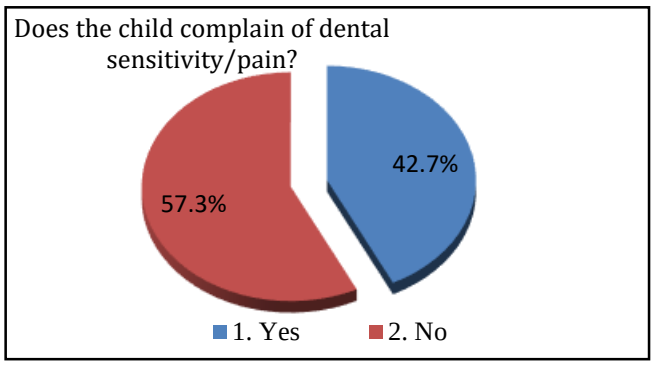

Figure 7. Dental sensitivity complaint

Among those who responded to the questionnaire, 85 legal representatives (29.5%) were informed by the dentist that dental erosion is present in their child's teeth, while 203 legal representatives (70.5%) were not alerted to the presence of the condition in their child.

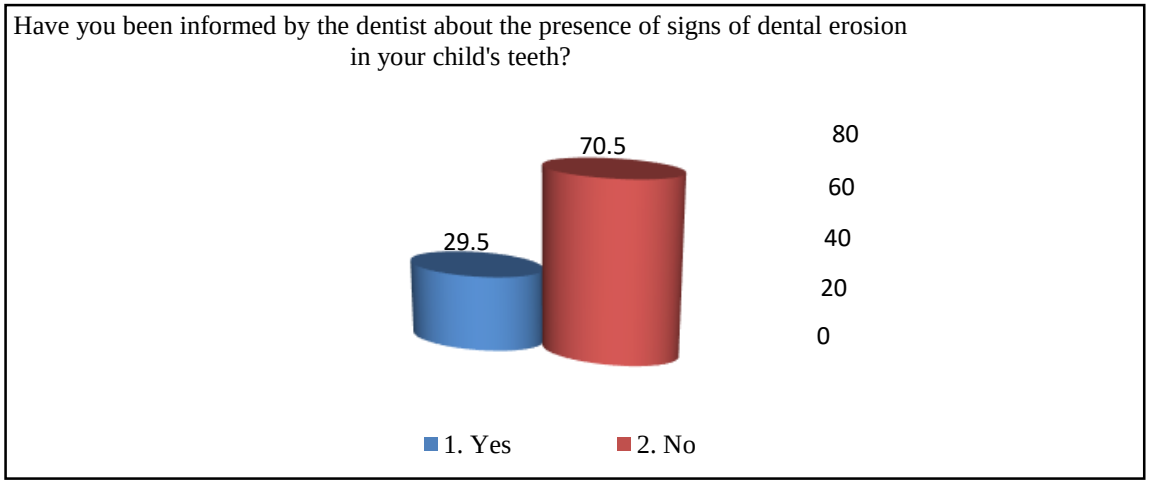

Figure 8. Awareness of dental erosion

Out of a total of 288 children, a number of 168 are not undergoing any medical treatment, representing more than half of the total responses (58.3%). Vitamin C supplements are administered to 55 children (19.1%), treatment for bronchial asthma is taken by a smaller number, only 24 children (8.3%), 13 responses (4.5%) were recorded for antidepressants, and the remaining 28 responses (9.7%) were selected by legal representatives whose children are given iron supplements.

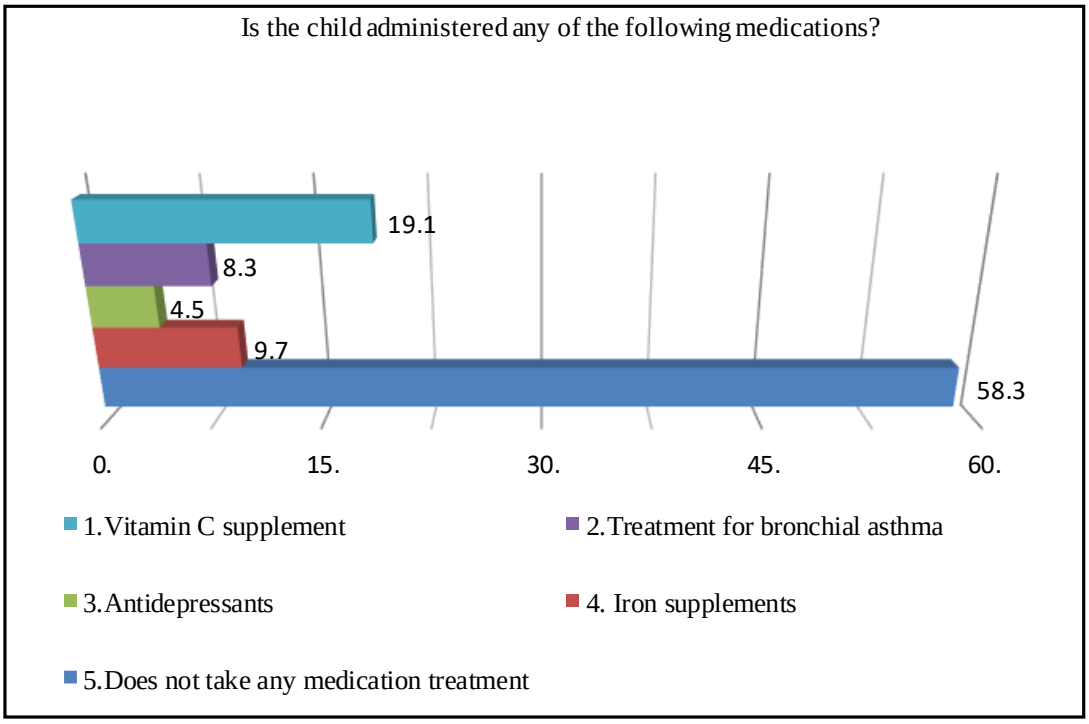

Figure 9. Medication administration among subjects

209 legal representatives (72.6%) stated that their children have not been diagnosed with any condition, while 39 children (13.5%) experience frequent vomiting, and 40 children (13.9%) have been diagnosed with Gastroesophageal Reflux Disease (GERD).

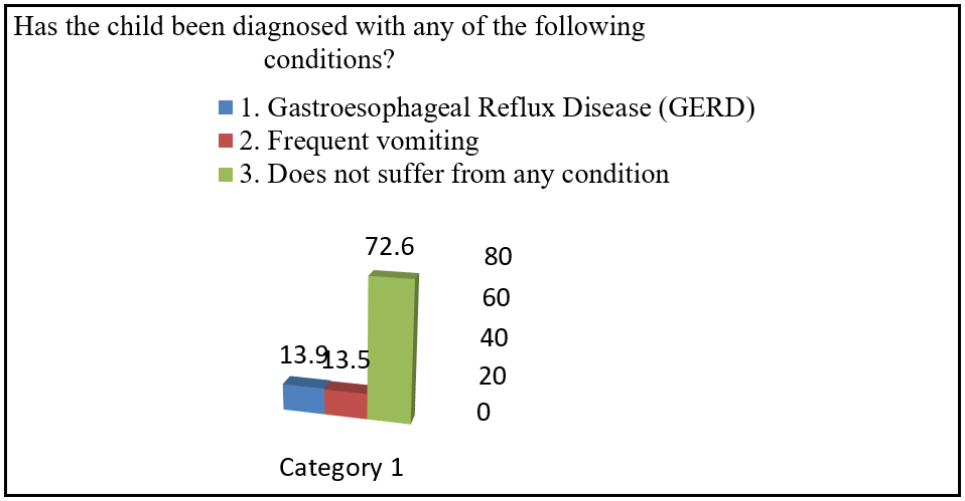

Figure 10. Medical conditions that affect the subjects

DISCUSSIONS

Following the analysis of responses and their interpretation, it was observed that the occurrence of dental erosion is influenced by multiple factors.

Studies have shown that the population with a higher intake of citrus juices and carbonated beverages is more likely to experience dental erosion. The frequency of beverage consumption, the duration of contact between the drink and teeth, and the manner of consuming these beverages are crucial factors (7). Garduno-Picazo MG et al., 2020,

emphasized the importance of informing parents about the risks associated with such drinks to reduce the prevalence of dental erosion, which has negative effects on oral health (8).

In the current study, no positive relationship was found between the timing of food intake and the occurrence of erosion, contrary to the findings of L. Marques Martinez et al., 2019, which associated nighttime consumption of fruit juices with a higher rate of dental erosion (9).

On the other hand, a shared conclusion with the studies of L. Marques Martinez et al., 2019, is that socioeconomic status is among the factors that increase the likelihood of developing dental erosion. The analysis of responses revealed that parents with lower education levels generally come from rural areas, situations where the number of children in the family is higher, the first visit to the dentist occurs when pain arises, and awareness of dental erosion is directly proportional to the parents' level of education (9).

Another observed factor is the difference between patients with certain conditions such as Gastroesophageal Reflux Disease (GERD), frequent vomiting, bronchial asthma, and those without any health issues. The analysis showed that patients with certain conditions are more prone to dental sensitivity and dental erosion. This finding aligns with other studies conducted by Ulla Moberg Sköld et al., 2022, and L. Marques Martinez et al., 2019, which demonstrated an association between dental erosion and medications for certain conditions (9,10).

In the case of patients with bronchial asthma, bronchodilators induce the relaxation of smooth muscles, which could lead to significant relaxation of other smooth muscles, including the lower esophageal sphincter. This relaxation causes disturbances, leading to gastric reflux, a recognized significant cause of dental erosion (10).

Ulla Moberg Sköld et al., 2022, suggests that asthma medications, with a pH of approximately 5.5, and sweeteners in inhaled medications can be predisposing factors, as important as the child's lifestyle and dietary habits (11).

The study concludes that conditions like Gastroesophageal Reflux Disease (GERD) and frequent vomiting contribute to the occurrence of dental erosion, acting as intrinsic factors. In the received responses, children with any health condition, including GERD and frequent vomiting, are more prone to dental sensitivity. This result aligns with the research conducted by Meenakshi Ganesh et al., 2016, which showed that the acidity and lower pH of gastric juice increased the prevalence of dental erosion (12).

It is important to note, considering research on the prevalence of erosion among the population, that deciduous dentition is much more vulnerable to dental erosion. This vulnerability is due to the thinner enamel layer compared to permanent dentition. In the case of deciduous dentition, enamel is affected in the majority of cases (>80%), dentin between 21% and 48%, and dental pulp is extremely rarely affected. Lesions are mostly localized on the maxillary incisors, followed by the occlusal surfaces of molars (13).

It is crucial to emphasize that the presence of erosion is not determined by gender, whether discussing deciduous or permanent dentition. The prevalence of this pathology primarily depends on the dietary and behavioral habits of the respective population, making anyone susceptible to its undesirable effects (13).

Therefore, early diagnosis, correct intervention, and prevention are key factors in minimizing the factors that lead to the occurrence of dental erosion.

CONCLUSIONS

As a result of the research conducted on the chosen topic through consulting specialized literature and numerous studies, the following findings have been identified:

- Dental erosion is not prevalent in a significant number of children and adolescents in our analyzed group.
- The primary cause of dental erosion is associated with Gastroesophageal Reflux Disease (GERD), frequent vomiting, and other gastric disorders affecting the esophageal sphincter, leading to the entry of gastric acid into the oral cavity.
- Children undergoing medication treatment more frequently experience dental sensitivity.
- Diet is also an indicator of risk in the occurrence of dental erosion, especially with the consumption of acidic beverages and citrus juices, and dental sensitivity becomes more prevalent with advancing age.
- Parents who take their children to the dentist earlier tend to have higher levels of education. The primary reason for their visits is routine check-ups, and they are more knowledgeable about dental erosion.
- Given the limited number of legal representatives who are aware of dental erosion, redirecting attention to informing parents about this condition is of great importance. It is crucial to present the factors contributing to the occurrence of dental erosion and the means of preventing it.

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Parents' Perspective on Their Children's Dental Treatments Covered by Public Health Insurance in Romania – a Pilot Study

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Abstract

Aim and objectives: This study evaluates Romanian parents' attitudes and behaviors concerning their children's dental treatments covered by public health insurance. Material and methods: A cross-sectional survey involving 40 parents whose children received dental care reimbursed by the National Health Insurance was conducted. Participants provided data through a 14-question questionnaire on oral hygiene, dental treatment history, and sociodemographic information. Results: The majority of treatments were reactive rather than preventive, with fillings being the most common procedure. Despite limited budgets, satisfaction with the quality of treatments and the treatment environment was high among parents. Conclusions: Although dental care was often sought only in emergencies, the overall satisfaction with the services provided suggests a positive acceptance of the current insurance system. The findings underscore the need for policies that encourage preventive dental care practices for children.

Keywords: dental health insurance; parental perspectives; community dentistry; dental treatment satisfaction; Romania

INTRODUCTION

Oral diseases are the highest noncommunicable disease, affecting approximately 3.5 billion people worldwide [1]. They range from dental caries and periodontal disease to oral cancer and congenital disease such as cleft lip. Most of the oral disease are dental caries affecting both deciduous and permanent teeth and the majority of them are left untreated, with 2 billion cases affecting permanent teeth and 510 million cases affecting deciduous teeth [1]. The main reason why they are left untreated is because they are expensive to treat. In 2015, dental diseases were the third most expensive health condition to treat, surpassed only by diabetes mellitus and cardio-vascular diseases [2]. Left untreated, oral disease and its complication lead to disabilities that affect the quality of life [3].

The oral disease is not uniformly distributed across population and it can be seen to affect the most vulnerable and disadvantages groups across societies [3]. The connection between socio-economic status and oral diseases is well known, meaning that the low income countries are more affected by oral disease, and the access to dental services is limited because the treatments have to be sustained out-of-the-pocket [4,5]. The expenditures of oral health are very unequal both globally and across regions and countries, and the level of expenditure is not necessarily corelated to better or worse oral health status. Out of the pocket costs can be major barriers for better access to oral care. On average, out-of-pocket expenditure for oral health care within the 28 countries of the European Union was more than 60% of the treatment costs, and in some Member States, it was close to 100% due to complete exclusion of oral health care from health coverage [4].

The Romanian public system is alike many other European systems, granting insurances through the national taxation system. The health insurance is guaranteed to children and adolescents under 18 years old, employees and retired people. It covers access to both public and private medical institutions if they opt to collaborate with the National Health Insurance House (NHIH). The majority of dental care offices are private and some of them opt to collaborate with the National Insurance House, offering the possibility for reimbursement to their patients. The procedures that are offered are fixed such as: preventive treatments (annual examination and professional cleaning (once a year for adults and twice a year for children under 18 y.o.), fissure sealing (one every 2 years), topical fluoridation (for children between 6 y.o. and 14 y.o.), conservative treatments (fillings), endodontic treatments, periodontal treatment (non-surgical), fixed prosthetic treatments (resin/metal-resin crowns), removable prosthetic treatments (acrylic dentures (one every 4 years)), orthodontic treatments (removable, space maintainers, functional appliances), surgical treatments (extractions, splint after traumatic dental lesions, TMJ repositioning), and oral pathology treatments (specific oral mucosa lesions)[4]. Moreover, there are fixed prices established by the NHIH for these dental procedures and the percent of coverage is either 100% for children under 18 years old, students under 26 years old and adults who benefit from special social security rights, or 60% for employed or retired adults [6]. The standard budget offered by the NHIH for dental care services is limited to 4000 Romanian Lei (RON) (approx. 800 EUR, per month per general dentist, a budget that is increased by 50% for a general dentist that works in rural areas, on the one hand, and by 20% for a dentist specialized in a specific field of dentistry. The purpose of the study is to assess the experience of covered dental treatments of a group of Romanian patients as a starting point for establishing the need for favourable public health policies conductive to dental treatments among children using the health insurance system.

Aim and objectives

In the present study, the survey was designed to evaluate the parents' attitude and behaviour regarding previous experiences of their children with dental treatments through the National Health Insurance.

MATERIAL AND METHODS

The present cross-sectional study was conducted by both clinicians and a group of academic staff from two faculties of dentistry, in Romania, during 2023.

The participants of the current survey are parents whom children had treatments provided and reimbursed through the National Health Insurance from Romania. The subjects were selected from a patient pool of dental clinics in Bucharest that provided treatments for children reimbursed through the National Health Insurance from Romania. All participants agreed to participate. The inclusion criteria were adults (>18 years old), parents of children that have had at least one dental procedure that had been covered by the National Health Insurance. The sample consisted of 40 adults, the majority of them (75%, n=40) living in urban areas, with and educational background of either secondary (60%, n=24) or tertiary studies (40%, n=16).

The self-administered anonymous questionnaire consisted of 14 questions, both open-ended or single/multiple choice questions, addressing 3 main aspects: (1) dental attendance pattern, (2) behavior and opinion about their child history of dental treatments covered by the public health insurance and (3) socio-demographic data. The section referring to the previous dental treatments provided to their children and covered by the national health insurance, the questions aimed to evaluate: the type of dental treatments, the reason why they opted to have them through the National Health Insurance, the possible limitations regarding the dental treatment plan or time frame due to conditions required by the public health insurance system and the level of satisfaction regarding the coverage experience. The estimated fill-in time for the questionnaire was 5 minutes.

RESULTS

In the studied group, the majority of the subjects were treatment oriented, 19 (47.5%) were visiting the dental office only when they considered their children needed treatment (when symptoms arise), 17 (42.5%) declared they go with their children a few times a year, 4 (10%) go twice a year (Table 1). None of them were visiting the dentist for the first time. The majority of them (53.5%, n=21) declared that their children were provided regular treatments, a third of them (35%, n=14) were provided emergency treatment and rarely (10%, n=4), they seek regular check-up (Table 2).

Table 1. Frequency of dental visits

Question	N (%)	Urban N (%)	Rural N (%)	Secondary education N (%)	Tertiary education N (%)
Frequency of dental visits					
A few times year	17 (42.5%)	17 (100%)	0 (0%)	8 (47.05%)	9 (52.95%)
Twice/year	4 (10%)	3 (75%)	1 (25%)	1 (25%)	3 (75%)
Once/year	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Based on the need	19 (47.5%)	10 (52.63%)	9 (47.37%)	15 (78.95%)	4 (21.05%)

Table 2. The Main Reason for The Latest Dental Visit

Question	N (%)	Urban N (%)	Rural N (%)	Secondary education N (%)	Tertiary education N (%)
The Main Reason for The Latest Dental Visit					
Routine check-up	4 (10%)	3 (75%)	1 (25%)	2 (50%)	2 (50%)
Pain/Emergency	14 (35%)	6 (42.85%)	8 (57.15%)	11 (78.57%)	3 (21.43%)
Treatment	21 (52.5%)	20 (95.23%)	1 (4.77%)	9 (42.85%)	12 (57.15%)
No answer	1 (2.5%)	1 (100%)	0 (0%)	1 (100%)	0 (0%)

The previous dental treatments the children were provided range from fillings (67.5%, n=27), to extractions (37.5%, n=15), root canal treatments (30%, n=12), and only rarely (12,5%, n=5) were provided prophylactic treatments such as hygiene sessions or sealing (Table 3).

Table 3. Previous Dental Treatments Covered by the Public Health Insurance

Question	N (%)	Urban N(%)	Rural N(%)	Secondary education N (%)	Tertiary education N (%)
Previous Dental Treatments Covered by the Public Health Insurance					
Fillings	27 (67.5%)	23 (85.19%)	4 (14.81%)	10 (37.03%)	17 (62.96%)
Pain/Emergency	16 (40%)	10 (62.5%)	6 (37.5%)	10 (62.5%)	6 (37.5%)
Root canal treatment	12 (30%)	8 (66.66%)	4 (33.33%)	5 (41.66%)	7 (58.33%)
Extraction	15 (37.5%)	13 (86.6%)	2 (13.3%)	5 (33.3%)	10 (66.6%)
Hygiene session/sealings	5 (12.5%)	4 (80%)	1 (20%)	1 (20%)	4 (80%)

Most of the children (70%, n=28) were treated in a private clinic, and the other part (30%, n=12) were treated in a public clinic. None of them were treated in a public hospital nor in a university. Regarding the available budget to reimburse the costs, most of the participants (64.7%, n=22) declared the treatments were provided as scheduled, with no need to delay it or split it across multiple months because of the insurance limit and almost a third (29.41%, n=10) had to split it across multiple months. The reason for the need of splitting the treatment across multiple months being the fact that they needed complex procedures. When choosing a dentist that could provide to their children treatments that can be reimbursed, the majority (62.5%, n=25) of the participants declared that they did it because of financial reasons (Table 4).

Table 4. Reason for choosing covered dental services

Question	N (%)	Urban N (%)	Rural N (%)	Secondary education N (%)	Tertiary education N (%)
Reason for choosing covered dental services					
Financial reasons	25 (62.5%)	20 (80%)	5 (20%)	14 (56%)	11 (44%)
Dentist' suggestion	8 (20%)	6 (75%)	2 (25%)	4 (50%)	4 (50%)
Standard procedure	10 (25%)	9 (90%)	1 (10%)	3 (30%)	7 (70%)
A right to benefit from	9 (22.5%)	8 (88.88%)	1 (11.11%)	1 (11.11%)	8 (88.88%)
More trust in services reimbursed	5 (12.5%)	2 (40%)	3 (60%)	5 (100%)	0 (0%)
Don't know	2 (5%)	2 (100%)	0 (0%)	2 (100%)	0 (0%)

Regarding the level of quality of treatments, all of the participants declared themselves satisfied with the treatments provided and the clinic where the treatments were provided (Table 5).

Table 5. Satisfaction Regarding Various Aspects of the Covered Dental Services

Question	N (%)	Urban N (%)	Rural N(%)	Secondary education N (%)	Tertiary education N (%)
Satisfaction Regarding Various Aspects of The Covered Dental Services					
Variety of treatments offered	Yes 33 (82.5%)	25 (75.75%)	8 (24.24%)	18 (54.54%)	15 (45.45%)
	No 7 (18.5%)	5 (71.42%)	2 (28.58%)	5 (71.42%)	2 (28.58%)
Quality of treatments	Yes 40 (100%)	30 (75%)	10 (25%)	25 (62.5%)	15 (37.5%)
	No (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Quality of environment where they were provided	Yes 40 (100%)	30 (75%)	10 (25%)	23 (57.5%)	17 (42.5%)
	No 0%	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Necessary formalities	Yes 32 (80%)	27 (84.37%)	5 (15.63%)	17 (53.12%)	15 (46.88%)
	No (0%)	3 (37.5%)	5 (62.5%)	6 (75%)	2 (25%)
Waiting time for coverage	Yes 26 (65%)	19 (73.07%)	7 (26.93%)	14 (53.84%)	12 (46.16%)
	No (0%)	12 (85.71%)	2 (14.29%)	9 (64.28%)	5(35.72%)

DISCUSSIONS

For the past years, the World Health Organization has advocating for a universal dental coverage, as part of a universal health coverage [3,7]. Currently, the percentage of covered oral health services offered by different countries varies from 40 to 80%. In Romania, the 60% coverage is characteristic to low-to-middle income countries [1]. In order to enable people to access dental treatments regardless their income, an appropriate dental insurance system should be designed.

When addressing the dental visits, the majority of participants (47.5%) of the current study declared they visit the dental office based on their needs, similar to the participants in another study conducted in Romania, where the patients where adults and the percentage was alike (40.7%) [6]. In both Romanian studies, the participants are more treatment oriented and less preventative oriented – in the current study the participants were addressing the dental office for dental hygiene sessions or sealings only for 12.5%, whereas in other European countries patients request this type of treatment more often [9].

The most requested procedure is dental fillings 67.7%), similar to the adult patients from Romania (45.7%), and other European countries such as Germany and France [8].

Regarding the available budget for reimbursement, currently, it is limited to 4000 Romanian Lei (RON), and even if it is double than the available budget in 2021, when a

quarter of the participants had to split the treatments in to multiple months [6], in the current study the percentage is even higher, almost a third (29.41%).

The increased needs for dental treatments in children and the high costs for treatment are the main reason why the participants chose reimbursed treatments, in opposition with the adult participants, who chose it because it was either a standard procedure or it was a right they wanted to benefit from, meaning that both education and awareness of the consequences of neglecting oral health in children must be improved.

CONCLUSIONS

In the studied group, despite the main reason why this type of service was chosen – all of the participants were satisfied both with the quality of the environment and the quality of the treatments provided.

Most of the participants were addressing this type of service for treatments and less for routine check-up and most of the times the treatment provided was direct restorations (fillings). The least addressed procedures were preventive, such as scaling or sealing.

Despite the fact that the participants had access at reduced cost, one third of them chose to visit the dental office only in case of pain or emergency. Parent's satisfaction related to the quality of the treatments and the environment are high, and this should encourage more people to address this type of dental treatments, in agreement with universal oral health coverage for all.

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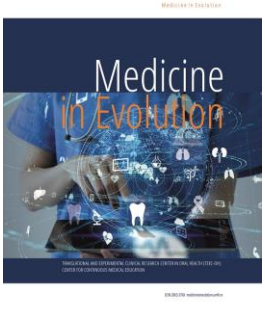
Digitization of Dental Services



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Abstract

Technology has taken over so many aspects of the world, especially in medicine. Dentistry is no exception. The transition to digital dentistry has grown more and more and a number of digital devices used in dental offices already go unnoticed but incorporate very advanced digital technology. The most common and frequently used form of dental dentistry is digital x-rays. The benefit of this technology is not only a much smaller volume of X-rays compared to the classic technology, but they allow a better and early detection of cavities. The delivery of contemporary oral healthcare should be guided by cutting-edge technology focused on achieving patient-centred outcomes. The integration of digitalization into dentistry will enhance oral healthcare to its highest potential. The emphasis in forthcoming decades should lie on research endeavours pertaining to digitization within the healthcare domain, particularly within dentistry. The primary objective should be the enhancement of data acquisition methodologies and the management of large datasets, while concurrently addressing the safety and security concerns associated with "Big Data".

Keywords: digitization, augmented reality, virtual reality, tele-medicine, tele-dentistry

INTRODUCTION

Digital dentistry is a broad term that encompasses any dental technology that involves the use of computer-based components such as hardware devices and software solutions. The goal is to enable dental professionals to deliver treatment using computer-aided tools.

Digital dentistry refers to the integration of digital technologies and tools into various aspects of dental practice, including diagnosis, treatment planning, treatment execution, and practice management. It encompasses the use of advanced digital devices, software, and techniques to improve efficiency, accuracy, patient outcomes, and overall dental care [1-5].

Areas of use of digital technology in dentistry

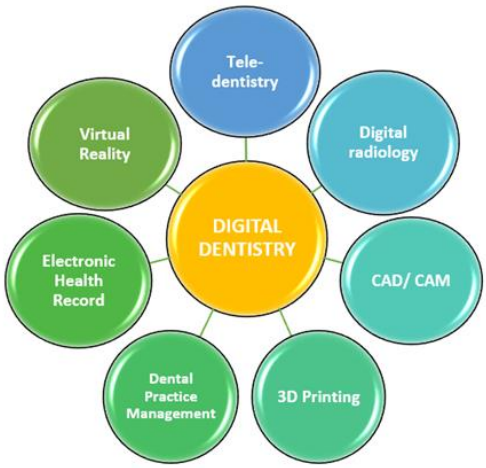

Figure 1. Types of digital dentistry

Digital imaging. Digital imaging technologies such as intraoral cameras and cone beam computed tomography (CBCT) provide high-resolution 3D images of the oral cavity. This helps in accurate diagnosis, treatment planning and communication with the patient. With digital dental X-rays, the image can be zoomed in, zoomed out, and the brightness, contrast, or sharpness can be edited to better detect cavities as early as possible. The actual digital sensor is also much more comfortable inside the mouth than regular films [6,7].

Intra-oral scanning. The scanner is a new tool that helps detect the smallest and earliest cavities. These devices can provide 90% accuracy in detecting occlusal cavities on the upper surfaces of teeth that even a dental explorer cannot detect. They can detect with about 80% accuracy the interproximal cavities found between the teeth. Based on the reading from the device, the dentist will have a better knowledge of how advanced the cavity is and can provide you with the appropriate treatment plan, whether it is a filling, an inlay or onlay, or a crown [8,9].

3D scanning of the mouth not only helps in the creation of dentures by sending the information directly to the laboratories electronically, but also allows the dentist to provide the best treatment better and more accurately [10-13].

Dental CAD/CAM machines enable same-day crown fabrication in the office. This is a huge convenience for you as the patient to not have to come back for a second visit.

Digital impression systems replace traditional putty impressions with intraoral scanners, capturing precise digital models of teeth and soft tissues. This eliminates the need for uncomfortable impressions and improves the accuracy of various restorative and orthodontic procedures. Choosing the exact shade of the prosthetic restoration fa

Not only can digital dentistry scan and create dentures, but there are also scanners to choose the perfect shade for dentures. Increased accuracy, speed and convenience make these improvements increasingly popular in dental practices.

Computer-aided design and computer-aided manufacturing (CAD/CAM): CAD/CAM technology allows the creation of digital impressions, the design of dental restorations (e.g., crowns, bridges, veneers) and their fabrication using milling or 3D printing techniques. This simplifies the restoration process, reduces chairside time and allows for same-day restorations [15-17].

Augmented reality and virtual reality. These technologies provide virtual simulations and treatment planning tools that help both dental professionals and patients visualize expected treatment outcomes. This improves treatment planning, patient education and shared decision making [12].

Surgery with guided implants. Digital tools such as 3D imaging, computer-guided implant planning, and surgical guides allow precise implant placement. This improves the accuracy, predictability, and success rates of dental implant procedures [16,17].

Tele-dentistry. Digital platforms and telecommunications technologies enable remote consultation, diagnosis, and monitoring of patients. Tele dentistry facilitates virtual appointments, provides oral health education, and enables case triage, expanding access to dental care in remote or underserved areas [18,19].

Education and training: Digital platforms offer online courses, webinars, and virtual training tools for dental professionals. This enables continuing education, improves skills, and keeps professionals up to date with the latest advances and techniques [20,21].

Management of digital cabinets. Digital technologies support practice management tasks, including electronic medical records (EDRs), appointment scheduling, billing, and inventory management. This improves efficiency, improves communication, and facilitates secure data storage and retrieval.

Adopting digital dentistry offers numerous benefits, including improved diagnostics, improved treatment planning, more accurate restorations, simplified workflows, improved patient experiences and efficient practice management. However, it is essential that dental professionals receive adequate training, ensure data security and privacy, and consider the cost-effectiveness of implementing digital technologies in their practices.

In the framework of this study, we aimed to highlight the use and openness for the digitalization of dental medical services in the Western area of Romania. At the same time, we tried to highlight the type of digital technology used in dental medical practice, to analyse the openness of patients from the western region of Romania to digitalization, the population's perception of the use of digital technology in the administration of dental offices, the population's perception the application of digital technology within dental treatments and in education the general population [23,24].

Table 1. The socio-demographic characteristics o the group

Variable	batch distribution	
Age	Avg Age = 47,4 yrs ± 11,3 yrs Minimum age = 19 yrs Maximum age = 69 yrs	
19 – 25 yrs	16	14,68%
26 – 35 yrs	25	22,93%
36 – 50 yrs	38	34,86%
51 – 60 yrs	21	19,27%
Over 61 yrs	9	8,26%
Male	51	46,68%
Female	58	53,32%
Urban	73	66,97%
Rural	36	63,03%

MATERIAL AND METHODS

The method used was the retrospective observational study carried out between August 2023 and January 2024. The research was carried out in 10 medical offices. A total of 109 participants were selected, who completed a questionnaire regarding their perception related to the digitalization of dental services.

The socio-demographic characteristics of the groups are similar as can be seen in the adjacent table. The data obtained from completing the questionnaires and oral assessments were entered into a database in Microsoft Excel 365, where they were processed.

RESULTS

The first aspect taken into analysis was the patients' perception of medical imaging and digital radiographs. The data obtained from the study are summarized in the table 2.

Table 2. Digital imaging and digital radiography services

Digital imaging and digital radiography services						
Variable		Very bad/ Totally disagree	Bad / Disagree	Neutral	Good / Agree	Very good / Totally agree
General perception of digital imaging	Count	8	10	12	23	56
	%	7,34%	9,17%	11,01%	21,10%	51,38%
Digital technology has reduced the time to complete work	Count	3	5	8	21	72
	%	2,75%	4,59%	7,34%	19,27	66,06%
Digital technology has reduced the discomfort of labor.	Count	3	19	33	23	31
	%	2,75%	17,43%	30,28%	21,10%	28,44%

From the data presented above, it can be seen how a technology already implemented for a long time came to be known, accepted and at the same time appreciated by its beneficiaries. More than 85% of the respondents saw the advantage of the shorter time to perform the work and almost half 49.54% appreciate a decrease in the discomfort caused by taking a dental x-ray.

Regarding the use of digital technology in the management of health records, the perception of patients is shown in the following table. From the data analysis it can be concluded that patients are not very informed about the use of digitized technology in this field of dental medicine, 38.53% not being able to indicate a clear answer to this question. As a result, the results on questions about improving the accuracy of data, its accessibility, and the easy exchange of information with other health care providers were flawed.

The grouping of almost 85% of respondents around the option "Neither agree nor disagree" signifies a lack of information. This fact is even more evident in the last question regarding the EHR, where an absolute majority (84.4%) considered that information technology did not in any way facilitate the faster transfer of information to other health service providers.

Table 3. Electronic Health Records (HER)

Electronic Health Records (EHR)						
Variable		Totally disagree	Disagree	Neutral	Agree	Totally Agree
The use of EHR in dental practices	Count	19	23	42	17	8
	%	17,43%	21,10%	38,53%	15,60%	7,34%
HER improved data accuracy and accessibility	Count	12	25	52	15	5
	%	11,01%	22,93%	47,71%	13,76%	4,59%
HER facilitated the exchange of information with other health care providers	Count	71	21	15	1	1
	%	65,13%	19,27%	13,76%	0,92%	0,92%

Closely related to EHR, information technology can also be used in dental office management. Of the 109 participants in the study, 63 (57.8%) stated that digital technology is not used for the management of patients and dental practice in the practice they visited. But those 46 respondents who stated that they benefited from this facility recognized the benefits both in terms of the duration and efficiency of the appointments (76%) but also as a simplification of memorizing and recalling the calendar with appointments in the office (85%). – table 4.

Table 4. Dental practice management software

Dental practice management software						
Variable		NOT used/ Totally Disagree	I don't think it is use/Disagree	I think they use / I don't care.	Use of Software /Agree	100% certain use/ Totally agree
The office uses patient management software (109 r.)	Count	42	21	11	9	26
	%	38,53%	19,27%	10,09%	8,26%	23,85%
Software increased efficiency and decreased time (46 answ)	Count	1	1	9	21	14
	%	2,17%	2,17%	19,57%	45,65%	30,43%
The reminders received increased the convenience of appointments (46 answers)	Count	0	0	7	11	28
	%	0%	0%	15,22%	23,91%	60,87%

Another relatively recently implemented technology in Romania is CAD/CAM, which involves the realization of the design of a prosthetic restoration as well as its actual manufacture using digital technology. Analysing the collected data, we can conclude that 47.71% of the respondents were not confronted with this innovative technology. However, of the 57 respondents who benefited from the technology, 65% highly appreciate the quality of the resulting works and another 25% consider them good. Only 10% of beneficiaries are undecided about the benefits offered. The data is also similar in the case of time gained by using these technologies, 78.95% appreciating a significant time saving. All data is centralized in the table 5.

Table 5. Using CAD/CAM technology

CAD/CAM technology						
Variable		Don't know/ don't answer	Disaccord	Neutral	Accord	Totally Agree
I benefited from CAD/CAM technology (109 respond.)	Count	52	11	9	23	14
	%	47,71%	10,09%	8,26%	21,10%	12,84%
CAD/CAM technology reduced working time (57 answ.)	Count	52	3	9	22	23
	%		5,26%	15,79%	38,60%	40,35%
CAD/CAM technology has increased quality (57 answ.)	Count	52	1	5	14	37
	%		1,75%	8,77%	24,56%	64,91%

Analysing the recorded data related to tele-dentistry, we can see a great familiarity of patients with this field, 89% affirming that at least once they have benefited from such services. The answers are polarized when the question tries to identify the extent to which tele-dentistry has improved the process of solving the problem, to which 50% of the respondents answered "No". Dissatisfaction was not due to poor patient-physician communication as 97% of study participants said it was at least as good as or better than direct communication in the office (see table 6).

Table 6. Using Tele- Dentistry

Tele-dentistry						
Variable		NO Appoint-ment ---------- Totally Disagree	One Appoint-ment ---------- Disagree	Two Appoint-ments ---------- Neutral	Three Appoint-ments ---------- Agree	Four ore more app. --------- Totally agree
Benefited from a remote consultation	Count	12	8	26	31	32
	%	11,01%	7,34%	23,85%	28,44%	29,35%
Tele-dentistry has improved access to dental care	Count	33	21	9	32	14
	%	30,28%	19,27%	8,26%	29,35%	12,84%
Tele-dentistry has improved doctor-patient communication	Count	1	2	31	43	32
	%	0,92%	1,84%	28,44%	39,45%	29,35%

The analysis of the degree of patient involvement and education using digital technology revealed a relatively even distribution of those who did not benefit from this (29.36%), those who were indifferent (29.36%) and those who used by her (41.28%). What is worth noting in this chapter is the fact that just over 28% of respondents admit that digital tools have increased their engagement in dental care, with 50% stating that these resources have not been of any use to them. The situation is slightly more positive regarding treatment options where 41% of respondents stated that they identified information regarding treatment plans.

Table 7. Digital technology used in patient engagement and education

Digital technology used in patient engagement and education						
Variable		Totally disagree	Disagree	Neutral	Agree	Totally agree
Access to online platforms or educational resources	Count	21	11	32	4	41
	%	19,27%	10,09%	29,36%	3,67%	37,61%
Increased the degree of involvement in oral hygiene	Count	32	22	23	17	14
	%	29,36%	20,18%	21,11%	15,61%	12,84%
The resources received helped identify treatment plans	Count	9	24	31	39	6
	%	8,26%	22,02%	28,44%	35,78%	5,50%

The general perception of the impact of digitization in the activity of dental practices is overwhelmingly positive, with almost 91% of respondents recognizing the positive aspects brought by information technology.

Table 8. Analysis of the overall impact of digitization

Analysis of the overall impact of digitization						
		totally unsatisfied	unsatisfied	Indifferent	Satisfied	Totally satisfied
The degree of satisfaction with the digitalization of dental services	Number	3	7	16	41	42
	%	2,75%	6,43%	14,68%	37,61%	38,53%

DISCUSSIONS

Digital platforms and telecommunications technologies enable remote consultation, diagnosis, and monitoring of patients. Tele dentistry facilitates virtual appointments, enables case triage, and enables access to dental care for underserved or remote populations. It also supports post-treatment follow-up and patient education [19, 24].

Digital practice management software automates administrative tasks, appointment scheduling, billing, and inventory management. It improves workflow efficiency, improves

patient communication, and provides data analytics for informed decision making and practice growth [25, 26].

Digital tools such as patient portals, educational websites and mobile apps improve patient engagement and education. These platforms provide access to oral health information, appointment reminders, treatment videos and interactive tools for self-assessment and oral hygiene instructions [26,27].

Advanced software enables digital treatment planning and simulation, allowing dental professionals to visualize and plan complex procedures in a virtual environment. This aids in precise implant placement, orthodontic treatment planning and smile design, improving treatment predictability and patient outcomes [27, 28].

Digital platforms provide opportunities for dental professionals to access online courses, webinars and virtual conferences for continuing education and professional development. This promotes lifelong learning, keeping dental professionals up to date with the latest advances and techniques in the field [29].

Digitizing dental services offers numerous benefits, including improved diagnostic accuracy, improved patient communication, increased treatment efficiency, and simplified practice management. However, it is important to ensure data security, respect for confidentiality and adequate training to maximize the benefits and mitigate potential challenges associated with digital technologies in dental care [30].

CONCLUSIONS

From the study we undertook it could be seen that overall, the perception is positive regarding digital dentistry and its impact on dental care. In the fields where the technologies have been implemented for a longer time, the level of knowledge about them is higher, which makes the trust of the beneficiaries higher.

Patients appreciated the efficiency and convenience offered by digital dentistry. They reported a reduction in office time using CAD/CAM technology and digital impression systems. Tele dentistry has been seen as a convenient option for remote consultations and follow-ups, especially for those in remote or underserved areas. Analyzing the data in conjunction with the locality where the respondents live, we can appreciate that tele-dentistry is especially appreciated by patients who do not have access or have difficult access to dental assistance.

It is worrying that online information resources are used to identify alternative treatment options rather than prevention and oral care.

There are areas of digital technology that are currently not being fully utilized or that patients do not identify as being used. Better promotion of them would increase the level of trust.

Overall, the study demonstrates a positive perception of digital dentistry among participants, highlighting its benefits in terms of efficiency, accuracy, patient engagement and practice management. It emphasizes the importance of continuing education and training to maximize the potential of digital technologies in dental practices. Effective implementation of digital dentistry can improve patient outcomes, enhance the patient experience, and streamline the delivery of dental care.

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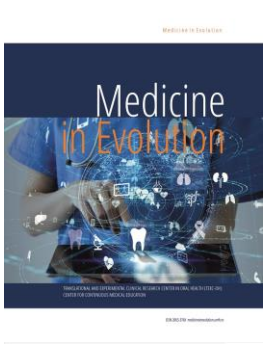
Management of Dental Care for Elderly Patients



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Abstract

Geriatric dentistry is a specialized field within dentistry focusing on the oral healthcare needs of the aging population, particularly those individuals experiencing chronic physiological, physical, and/or psychological changes or morbid conditions/diseases. The World Health Organization (WHO) has highlighted the importance of adopting 'active ageing' policies and programs to enhance the health, independence, and productivity of older adults. The imperative to plan and implement such initiatives is underscored by the WHO's assertion that "the time to plan and act is now". This review aims to provide an overview of age-related changes affecting the oral cavity and to explore interdisciplinary approaches for the treatment and prevention of oral diseases and disabilities among the elderly. The main aim of the research is to evaluate the management of elderly patients in dental medical services and to find solutions to improve case management for them.

Keywords: geriatric dentistry, oral health, patient management, active aging, dental health services

INTRODUCTION

The process of aging often brings about significant changes in the oral cavity, contributing to a higher prevalence of oral diseases among elderly individuals. These changes encompass various aspects of dental health, including alterations in tooth structure and morphology. It's common for aging teeth to exhibit diminished translucency and surface detail, which can impact both aesthetics and functionality [1-5]. Furthermore, the internal structure of teeth undergoes transformation, characterized by the formation of secondary dentin and the development of pulp stones, often leading to a reduction in the size of the dental pulp and potential sclerosis of root canals [6–8].

Periodontal health also tends to deteriorate with age, with conditions such as gingival recession becoming more prevalent. This recession exposes root surfaces, making them more susceptible to decay, contributing to a higher incidence of root surface caries among the elderly population [6,7,9].

The oral mucosa undergoes notable changes as well, manifesting as thinning, smoothness, dryness, and an increased vulnerability to ulceration [7]. These alterations are often accompanied by modifications in mucosal immunity, which can result in delayed wound healing and tissue regeneration [6]. Additionally, age-related changes in taste perception may occur due to factors such as the loss of filiform papillae on the tongue, mucosal atrophy caused by nutritional deficiencies, and decreased salivary secretion [6,7,10].

Structural changes within the oral cavity are also observed, including mandibular protrusion, alterations in dental occlusion, and changes in facial profile resulting from tooth extractions and alveolar bone atrophy [6,7,10]. These structural changes may be accompanied by progressive resorption and muscular atrophy of the mandible and masticatory muscles, as well as potential arthritic degeneration of the temporomandibular joint [6,7,10].

Understanding the intricate relationship between oral and general health is crucial for providing comprehensive care to geriatric patients. Oral health plays a significant role in various aspects of overall well-being, including functional, psychological, and economic aspects of quality of life. The oral cavity serves as a potential gateway for microbial entry, with oral bacteria implicated in systemic infections such as endocarditis and aspiration pneumonia [7,11–15]. Moreover, periodontal disease has been associated with an increased risk of cardiovascular diseases, attributed to the release of inflammatory cytokines from oral inflammation [7,11–15].

Conversely, systemic conditions may manifest with oral manifestations, serving as early indicators of underlying diseases. Elderly individuals exhibit heightened susceptibility to various oral diseases and conditions, including benign and pigmentary disorders, adverse drug effects, and infectious (fungal, viral, eg: Herpes simplex and Herpes zoster) and autoimmune conditions (eg lichen planus erosive, pemphigus vulgaris, pemphigoid) [6,7,10,17,18]. Recognizing and addressing these complex relationships requires interdisciplinary collaboration and a comprehensive understanding of the unique oral healthcare needs of the elderly population.

Table 1. Therapeutic considerations in relationship with the pathology of the elderly patients

Pathology of the elderly patient	**Therapeutic considerations**
Oral Cancer	Surgery, chemotherapy, radiation therapy Traumatic injuries Oral rinses (lidocaine HCl viscous 2%, diphenhydramine elixir 12.5 mg/5 Ml, diclonine HCl 1%, sucralfate), systemic drugs (penicillin, amoxicillin, erythromycin 500 mg qid)
Candidiasis	Topical agents (clotrimazole troches 10 mg 5 times a day, nystatin oral suspension 500,000 units, nystatin pills 100,000 units), systemic agents (fluconazole 100 mg, itraconazole oral suspension 10 mg/ml, ketoconazole 200-400 mg per day)

Xerostomy (Dry mouth)	Preventive therapy (topical fluorides, maintenance of oral hygiene), salivary substitutes (increased consumption of water, oral rinses and gels, use of artificial saliva), salivary stimulants (chewing gum or sugar-free mints, electrical stimulation, use of drugs such as sodium chloride pilocarpine, bromhexidine and cevimeline)
Oral bullous vesiculo and erosive disease	Pain control measures: viscous lidocaine 2% (swish and spit 5 ml, 4-5 times a day), liquid diphenhydramine (swish and spit 5 ml, 4-5 times a day), combination of viscous lidocaine, diphenhydramine and a coating agent (such as kaopectate or Maalox) in a 1:1:1 ratio, benzidamine diclonine hydrochloride 0.1%, systemic analgesia) Supportive care (hydration, ice chips or popsicles, bland diet , antipyretics such as ibuprofen as needed) Systemic drugs (prednisolone 5 mg dose or maintenance dose, azathioprine 50 mg 1-2 tablets)
Periodontal diseases	Daily brushing and flossing after each meal, electric toothbrushes, dental floss holders, pulsating water jet irrigators, antimicrobial rinses with chlorhexidine 0.12%, systemic antimicrobial therapy (metronidazole, tetracycline, clindamycin), surgical periodontal therapy
Neuropathic pain like burning mouth syndrome	Antidepressants (amitriptyline, trazodone, paroxetine), anticonvulsants (clonazepam, gabapentin), C-fiber nociceptor desensitizer (capsaicin), antioxidant (alpha-lipoic acid), alternative therapies (electroconvulsive therapy, cognitive behavioral therapy, mind-body interactions, changes of diet and lifestyle)
edentulous	Prevention of total tooth loss, fabrication of prostheses with adequate retention, occlusion, esthetics and margin extensions, endosseous dentoalveolar implants, regular evaluations to reduce the risks of dental stomatitis, traumatic ulcers or hyperplastic tissue reactions are recommended

The incidence of oral cancer escalates with advancing age, with typical sites of malignancy in the elderly encompassing the tongue, lips, buccal mucosa, floor of the mouth, and posterior oropharynx. Squamous cell carcinoma accounts for approximately 90% of all oral cancers, while the remaining 10% comprise salivary, bone, or lymphoid cancers [6,19,20].

Patients undergoing long-term bisphosphonate therapy for metabolic bone diseases or osteoporosis may be susceptible to developing osteonecrosis of the jaw, commonly known as bisphosphonate-related osteonecrosis of the jaw [7,10,21,22]. Diabetes mellitus poses a risk for advanced periodontal diseases due to gingival microangiopathy, altered polymorphonuclear leukocyte function, and increased collagen breakdown [1,6,23].

Individuals with chronic gastrointestinal ailments may experience dental erosion [1]. Arthritis affects approximately 49% of individuals aged 65 and older, with osteoarthritis being the most prevalent form and rheumatoid arthritis primarily affecting women. Both conditions can impact the temporomandibular joint, leading to degenerative changes in the condyle [6].

Various medical conditions prevalent among the elderly, including neurological disorders (e.g., Alzheimer's disease, Parkinson's disease, multiple sclerosis), endocrine disorders (e.g., diabetes mellitus), and gastrointestinal disorders (e.g., reflux, ulcers), can affect smell and taste perception [6]. Dysphagia, a common complaint among older adults, may stem from neuromuscular disorders, environmental factors such as smoking, or surgical interventions for head and neck cancer [6]. Epidemiological studies indicate that orofacial pain, predominantly neuropathic in nature, constitutes a significant issue in the elderly population [1,6].

Dentists should be aware of advances in dental materials such as hybrid ionomer/resin and new treatment modalities such as dental implants (in patients with sufficient bone support) for diseases commonly encountered in geriatric patients. [7,10]

One of the primary obstacles in delivering both restorative and preventive dental care to the elderly population is the necessity to foster an understanding of the importance of regular oral healthcare [38]. Across the globe, older individuals often experience poor oral health, manifested by a high prevalence of tooth loss, dental caries, periodontal disease, xerostomia, and precancerous lesions/oral cancer [39]. The foundation of effective prevention

lies in the early detection of oral diseases, a goal that hinges upon establishing regular contact with patients.

The main aim of the research is to evaluate the management of elderly patients in dental medical services and to find solutions to improve case management for them.

MATERIAL AND METHODS

To address this issue in my undergraduate thesis, I opted to conduct a cross-sectional observational study focusing on various factors influencing the utilization of dental services among the elderly. These factors, whether directly or indirectly related to dental care utilization, were categorized into four main groups:

1) Factors related to illness and health: Oral health status – oral assessment; Studying discomfort due to dental problems; General state of health - comorbidities; Mobility, functional limitation - assessment of edentence, mastication problems.

2) Socio-demographic factors: Place of residence: urban/rural, lives alone or with family, how many rooms; Education; Profession; Age; Sex

3) Factors related to services: Accessibility; Behavior of the dentist; The attitude of the dentist; The price of the service; Service satisfaction, Shipping.

4) Attitudinal or subjective factors: Personal beliefs related to the need for regular check-ups at the dentist; The need for dental control perceived by the patient; The importance given to oral health by the patient; Fear and anxiety; Resistance to changing prostheses, old work or treatment methods; Perceived financial strain - due to the fact that it is not a free medical service; Doctor-patient satisfaction in relation to dental visits.

The study was carried out between September 1, 2023, and January 15, 2024 and was carried out in two stages. In a first stage, the evaluation of the patients plus an interview was carried out, held between September 1, 2023 and January 15, 2024 in the premises of the individual dental practice, so that in the second stage, the oral health education lesson would be taught, held in the last week of January 2024 in a company meeting room.

Resolution of periodontal disease can be achieved with appropriate interventional therapy and regular oral hygiene. Patients with bleeding disorders, extensive cardiopulmonary problems, and immunosuppression may be poor candidates for periodontal surgery; Local methods (extensive scaling/root planning), topical medications (antimicrobial and anti-inflammatory agents), and occasionally systemic medications (antimicrobial and anti-inflammatory agents) are preferred [Table 2]. [1,16,33,34]

Table 2. Characteristics of subjects

Variable	**Batch distribution**	
Age	Average age = 73,4 years ± 11,5 years Minimum age= 65 yrs Maximum age = 92 yrs	
65 – 74 yrs	46	52,87%
75 – 84 yrs	27	31,04%
above 85 yrs	14	16,09%
Masculine	42	48,28%
Feminine	45	51,72%
Urban	71	81,61%
Rural	16	18,39%

The sample was represented by a group of 87 elderly subjects between the ages of 63 and 88 who presented to an individual dental office. The mean age of the subjects in the target group was 73.4 years ± 11.5 years, with a minimum of 65 years and a maximum of 92 years.

The subjects were divided into risk age groups, respectively 65-74 years representing 53% (N=46), 75-84 years (N=27) and over 85 years (N=14). The predominant gender of the subjects in the target group was female 52% (N=45), although we can state that in terms of gender, the studied sample was a homogeneous one. Most of the patients were from the urban environment, 82% (N=71), because the analyzed practice was also located in the urban environment.

RESULTS

The existence of dental caries. Dental caries was found in 63 patients. Most were found in the 65-74 age group and in female patients (73.2% female versus 71.2% male). A study carried out in England showed that the prevalence of caries was 22%, and among those aged between 75 and 84 years, which is much less than in the subjects of the studied group, so we can say that it is necessary education of the population at all ages.

In all the patients included in the study, we observed the absence of at least 5 teeth, all of them missing the 6-year-old molars, thus we can state that all patients are partially edentulous.

Periodontal disease in the studied sample. Periodontal disease including gingivitis and periodontitis is a disease of the tissues (periodontal attachment and bone) that support the teeth [25]. The existence of periodontal disease was identified in 33.33% of the subjects selected in the studied sample, the highest proportion being found in subjects aged between 75 and 84 years.

Gingivitis refers to the inflammation and bleeding of the gums and, if left untreated, leads to periodontitis [26]. Periodontal disease was characterized as the 11th most prevalent disease in the world by the Global Burden of Disease Study (2016) [27]. Plaque accumulation has been identified as an important cause of periodontal disease because it causes gingivitis and a process of mild to moderate alveolar bone loss [28]. Gingivitis is observed in the majority of patients studied.

Oral cancer is an important cause or disability among adults and older populations in both high- and low-income countries. Oral cancer includes lip cancer, oral cavity cancer, pharyngeal cancer and is the eighth most common type of cancer worldwide [54]. Treatment for oral cancer is surgical, and surgical complications, surgical infections, and mortality may occur postoperatively. As evidenced by literature data, older patients, although they had more comorbidities. the complication rate was 23.2% versus 20.2% in the younger population and 27.7% versus 22.6% of minor complications [55]. The postoperative infection rate, as shown by another study in elderly patients, was 33.7%, of which 23.1% were surgical site infections, and pneumonia was identified in 14.9% of patients [56]. In patients over 70 years of age, survival was not significantly decreased compared to other age groups; however, several patients in this age group were unable to receive or complete adequate adjuvant therapy. Therefore, oral cancer treatment must be individualized, taking into account the patient's performance status and comorbidities [57]. As can be seen from the table below, we encounter malignant or potentially malignant oral lesions in 20% of patients, most being in the over 85 age group.

We present below a synthesis of all these results of the research undertaken.

Table 3. Frequency of oral health programs by age group

Frequency of oral health problems by age group				
Variable		**65 – 74 years**	**75 – 84 years**	**Over 85 years**
The presence of dental caries	Count	45	20	8
	%	97,83%	74,07%	57,14%

The presence of periodontal lesions	Count	17	13	5
	%	36,96%	48,15%	35,71%
The presence of gingivitis	Count	31	18	4
	%	67,39%	66,67%	28,57%
Total population by age groups	Count	2	4	5
	%	4,35%	14,81%	35,71%
The presence of oral lesions	Count	3	3	6
	%	6,52%	11,11%	42,86%

From the figure 1, a higher proportion of edentulous patients accuse a poorer quality of life, compared to non-edentulous ones (this includes patients with good dentures), $p< 0.03$.

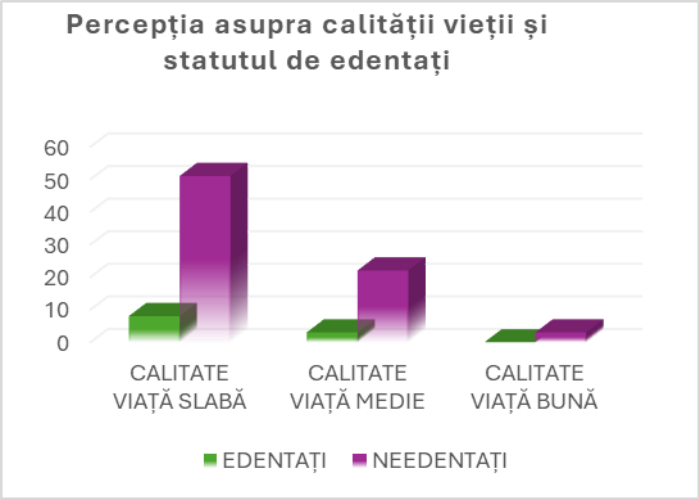

Figure 1. Perception about quality life and edentulous versus non-edentulous

People with untreated dental pathology reported the presence of dental pain, this being reported in 34.78% of people aged between 65 and 74 years with poor health.

Avoidance of certain foods due to dental pathology was reported in 74.07% of the elderly aged 75 to 84 years and in 41.30% of the elderly aged 65 to 74 years. Nutrient deficiency exacerbates chronic pathology in the elderly and they may become prone to sarcopenia and frailty [73]. Anorexia may develop in the elderly due to the combination of acute or chronic illness and poor confinement [74].

Table 4. Frequency of dental pain and avoidance of certain foods by age group

Frequency of dental pain and avoidance of certain foods by age group				
Variable		**65 – 74 years**	**75 – 84 years**	**Over 85 years**
The presence of toothache	Count	16	21	8
	%	34,78%	77,78%	57,14%
Avoiding certain foods due to dental or oral health problems	Count	19	20	12
	%	41,30%	74,07%	85,71%

The analysis of comorbidities in the target group shows the following distribution, the most common being cardio ischemic pathology (CIC), hypertension (HTA), diabetes (DZ) and cancer.

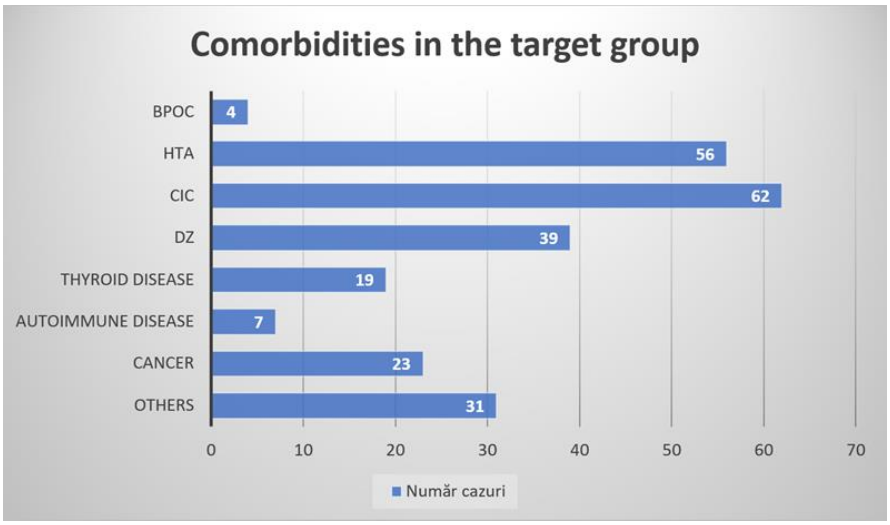

Figure 2. Comorbidities in the target group

DISCUSSIONS

According to the objectives set forth by the World Health Organization (WHO), one of the global aims for oral health is to achieve a 25% reduction in the prevalence of complete edentulism among individuals aged 65 and over. Additionally, the WHO advocates for the retention of at least 20 natural teeth as a benchmark for oral health. Consequently, the role of dentists in geriatric dentistry assumes heightened significance, particularly considering the substantial increase in average life expectancy observed over recent years [1,2,7,10].

The assessment of geriatric patients necessitates a comprehensive, multidimensional diagnostic approach that encompasses medical, psychosocial, and functional aspects. Such assessments are inherently multidisciplinary, designed to gather data on various facets of elderly patients' health and well-being [1,6,11,12]. Effective treatment planning for older adult's hinges upon a thorough understanding of the patient's overall health status and the interplay between systemic conditions and oral health [1,6,11,12].

Patients who have been diagnosed with any type of cancer should have a comprehensive dental examination, clinical and radiographic, completed as early as possible before any surgical and/or chemotherapy treatment. Reconstructive surgery may not be successful in restoring the patient to presurgical form and function. Physical therapy may be necessary to help patients adapt to an oral and maxillofacial environment that functions in a very different way. [17,18]

Oncologists and physicians should be aware that optimal oral health will minimize potential oral complications, such as mucositis, salivary gland dysfunction, osteoradionecrosis, etc., that may develop after surgery, radiation therapy, and chemotherapy. In addition, many patients do not receive routine preventive dental treatment and should be referred to a dentist before initiation of treatment. [6,30–32] It is imperative to extract teeth that cannot be restored or those with periodontal problems that they cannot be rectified.

Dental emergencies can occur at any time during cancer therapy. The patient's oncologist should be consulted before initiating any emergency dental treatment while the patient is receiving chemotherapy or undergoing radiation therapy. Laboratory values for platelets and white blood cells should be determined to assess whether the values are within an appropriate range for haemostasis and whether white blood cells are present in sufficient levels to successfully mount a defence against pathogenic organisms. Tooth extraction after oral radiation therapy can cause osteoradionecrosis. Dentures with any rough surface should

be smoothed. Those that fit poorly with the supporting tissues should be relined or redone. [1,6,31,32]

The dental treatment plan should aim to achieve optimal oral health. Regardless of functional status, elimination of acute dental infection and pain should be achieved for all elderly patients. Cosmetic and aesthetic dental services offer older generations an opportunity to improve their smile, boost their self-esteem and improve their quality of life in their later years. Many older adults have difficulty achieving effective daily plaque control. Various brush designs and handles are available for such patients, either manual or with motorized (electric or sonic) brushes. For patients with difficulty holding a toothbrush due to arthritis or stroke, devices are available to make brushing easier. Wider floss, Teflon-coated floss, floss holders, proximal brushes, and even electric floss are available. [6,7,10] For patients with gingivitis or gingival overgrowth secondary to drug use, chlorhexidine can be used. Older adults at high risk for caries may be placed on a course of chlorhexidine as an adjunct to therapy every 3-6 months. [1,6,7,10]

The presence of fluoride in toothpaste reduces the incidence of tooth decay, and a reduction is observed for every 500 ppm increase in fluoride concentration from 1000 to 2500 ppm.[10] In patients with severe caries, the incorporation of fluoride into glass ionomers used for Atraumatic Restorative Treatment (ART) is a useful secondary preventive measure to reduce recurrent dental caries. [7,10]

"Quality of life" includes many concepts such as health status, function and living conditions. Quality of life refers to the individual's perception of one's own health and this can be influenced by the culture and value system in which we live. The perception of quality of life is different between individuals and can change over time. it has a high impact on the quality of life. Tooth decay affects daily activities and social life. Impairment of oral function causes a decrease in self-esteem and reduces psychosocial well-being. Elderly people with edentulousness avoid social activities because they feel embarrassed to speak in front of others.

Edentation is the final stage of untreated caries or periodontal disease [58]. Edentacy is widespread throughout the world; it has been reported that in the elderly over 74 years, edentulousness can be found in 21.9% of individuals in the United States of America, in Sweden the prevalence of edentulousness among the elderly was 7% in 2000 [59,60]. The peak incidence of edentulousness is around 65 years of age, as demonstrated by most studies in developed and developing countries [61].

The prevalence of edentulousness in the general population is much lower than in the elderly, with a United States study of 432,519 adults showing a prevalence of 4.9% [61]. Pelter assessed the prevalence of edentulousness in the elderly (50 years) in India, Russia, China, Ghana, Mexico and South Africa. The prevalence of edentulousness was 16.3% in India, 9% in China, 21.7% in Russia and 8.5% in South Africa [62].

In Europe, numerous studies have evaluated the prevalence of edentulousness, in Sweden the prevalence of this disease decreased significantly from 19% in 1975 to 3% in 1997 [63]. The causes of tooth decay are complex. The main causes are the conditions produced by the harmful microbial role on oral health, there is also interaction with the genetic profile of the individuals, also edentation can occur as a consequence of iatrogenic, traumatic or therapeutic causes [64]. As we have shown in these paragraphs, tooth decay is common all over the globe, especially in the elderly, as our study also demonstrated, which revealed that 35.71% of people over 85 years old are toothless and need dentures, 14 .81% of subjects aged 75 to 84 and 4.35% of those aged 65 to 74.

CONCLUSIONS

Oral health plays a crucial role in the overall well-being and quality of life of older people. As people age, they may face unique oral health challenges and risks. Therefore, it is essential to prioritize oral health care for the elderly population to maintain their oral function, prevent discomfort and improve their overall health.

One of the main concerns for oral health in the elderly population is tooth decay. With age, the risk of tooth decay increases due to factors such as dry mouth, root exposure and dietary habits. Implementing preventive measures such as regular dental checkups, fluoride treatments, and dental sealants can help reduce the incidence of tooth decay and preserve natural teeth.

Another common oral health problem among the elderly is periodontal disease. Gingivitis and periodontitis can lead to gum inflammation, gum recession and even tooth loss if left untreated. Encouraging regular oral hygiene practices, such as proper brushing and flossing, along with professional dental cleanings can help prevent and manage periodontal disease in the elderly population.

Sialorrhea or xerostomia is common among older people and can have a significant impact on oral health. Medications, chronic conditions, and reduced saliva production all contribute to dry mouth. Adequate hydration, avoiding alcohol and tobacco, and using saliva substitutes can help alleviate dry mouth symptoms and protect oral tissues from infection and decay.

Proper denture care is essential for seniors who wear dentures. Dentures should be cleaned daily, removed at night and examined regularly for proper fit. Ensuring resources are available for denture repair and maintenance can help seniors maintain optimal oral health and prevent denture-related complications.

Oral cancer is a significant concern for the aging population, and early detection is crucial for successful treatment. Raising awareness of oral cancer risks, promoting regular oral cancer screenings, and educating people about self-examination techniques can help with early detection and prompt treatment of oral cancer.

Collaboration between health care providers, caregivers, and family members is vital to meeting the oral health needs of the elderly. Integrated care and regular communication can ensure comprehensive oral health management and enable timely intervention when needed.

In conclusion, prioritizing oral health care for the aging population is essential to maintaining their overall health and well-being. By addressing common oral health issues such as tooth decay, periodontal disease, dry mouth, denture care and oral cancer, we can help seniors enjoy healthy and comfortable oral function, improving their quality of life into the their golden age.

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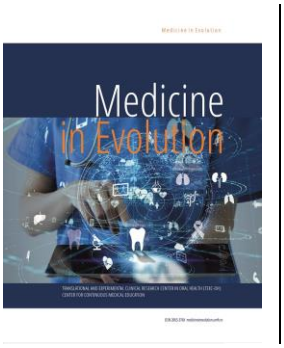
Carvacrol, a Promising Anti-inflammatory, Anti-bacterial and Antioxidant Agent, in Periodontal Disease Therapy



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Abstract

Aim and objectives: This research aims to provide a summary of the therapeutic benefits of carvacrol in cases of periodontitis. We focused on the anti-inflammatory, antibacterial, and antioxidant properties of this natural extract, which may help in the treatment of periodontal disease.

Material and methods: Plant extracts are getting increasingly popular due to their anti-inflammatory, anti-bacterial and antioxidant properties, as well as their ability to alter inflammatory response.

Results and discussions: An intriguing possibility for treatment of periodontal disease is the effectiveness of carvacrol against gram-negative microorganisms.

Conclusions: Carvacrol is a promising anti-inflammatory, antibacterial, and antioxidant agent in the treatment of periodontal disease, based on the provided data.

Keywords: Carvacrol, periodontitis, anti-inflammatory, antioxidant, antimicrobial

INTRODUCTION

Herbal extracts have been used for medicinal purposes since antiquity. Researchers are currently interested in a growing number of natural chemicals, essential oils and vegetable extracts due to their characteristics and benefits for human health [1]. One of these compounds, carvacrol, has been found in high amounts in essential oils and has been shown to have a variety of bioactivities in cells and animals [2].

Carvacrol is a phenolic monoterpenoid produced by a variety of plants, the most well-known of which is *Origanum vulgare* (Greek oregano), *Thymus vulgaris* (thyme), *Origanum majorana* (marjoram), *Satureja hortensis* (summer thyme) and *Satureja montana* (winter thyme) are among the plants that produce it [3]. Carvacrol has long been known to be a component of oregano essential oil and it is one of the most studied [4]. Anti-inflammatory, anti-bacterial and antioxidant activities are acquired by carvacrol 5, 6]. Carvacrol also contains analgesic [7], antifungal, anti-diabetic, cardioprotective [8], anti-hepatotoxic [9], anticancer [10], antimutagenic [11] and antiparasitic [12] pharmacological activities. The chemical structure and characteristics of carvacrol are illustrated in Figure 1.

Periodontal disease is a collection of chronic, inflammatory and microbial-induced diseases that typically present as gingivitis and chronic periodontitis. Both kinds of periodontal disease are caused by bacteria, gram-negative anaerobes being the most common periodontal pathogens [13, 14]. This infection, commonly known as periodontitis, is an oral infection characterized by irreversible deterioration of the tooth-supporting structures. Periodontal disease is a public health issue since it is a pathology that connects other illnesses [15]. Periodontitis, particularly its mild and moderate forms, is extremely common in adult-aged populations all over the world, with prevalence rates of approximately 50% [16], while its severe form becomes more common in the third and fourth decades of life, with global prevalence rates of around 10% [17].

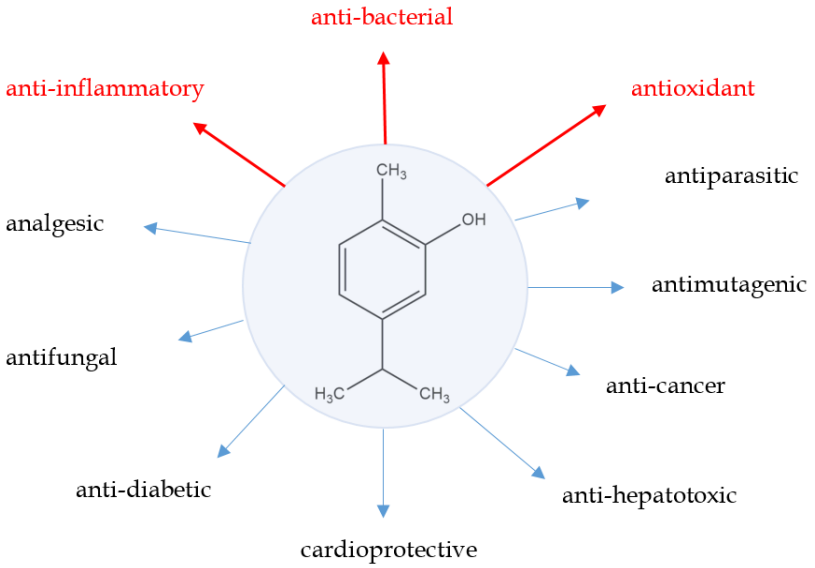

Figure 1. Chemical structure of carvacrol and pharmacological activities [5-12, 18]

Aim and objectives

The purpose of this paper is to present an overview of therapeutic effects of carvacrol in periodontitis. We will focus on the anti-inflammatory, anti-bacterial and antioxidant qualities of this essential oil, which could support periodontal disease treatment.

MATERIAL AND METHODS

In order to conduct this review, we searched the PubMed and Google Scholar databases using the following keywords: periodontal disease, carvacrol, anti-inflammatory, anti-bacterial and antioxidant. Articles that addressed periodontal disease *in vitro* or *in vivo* using carvacrol and for which we had access to the complete text met the inclusion criteria. The exclusion criteria were represented by articles to which we had access only to the abstract. Following the removal of inappropriate and duplicate articles, our analysis contained 64 bibliographic references.

RESULTS AND DISCUSSIONS

Periodontal therapy's main goal is to lessen the infectious and inflammatory threat while also halting tissue deterioration. Removal of pathogenic biofilms and reduction of inflammation can stop periodontal tissue degradation. Nevertheless, depending on the kind of tissue defects, systemic health state and age, only a limited regrowth of lost tissues occurs [19]. To eliminate the microbial load on the periodontium, one of the most prevalent approaches is mechanical treatment and periodontal surgery. However, because periodontal disease is immunogenetically regulated and hence necessitates adjuvant therapy, this method is not always optimal [20]. Researchers are motivated to identify new treatment plans for the prevention and treatment of marginal periodontitis due to an increase in the frequency of the disease, growing resistance of gram-negative bacteria to ordinary antibiotics and even their side effects [21].

As a result, the creation of new herbal medicine formulas containing bioactive molecules would be advantageous not only for less invasive, uncomplicated and predictable therapy, but also for the prevention of marginal periodontitis. Natural remedies are made out of plant extracts that are thought to have therapeutic effects. Due to the complex action of the extracts, little side effects and inexpensive cost compared to manufactured medications, phytotherapy is gaining popularity. At the same time, because contemporary drugs might cause antibiotic resistance, herbal remedies are a viable alternative in the treatment of a variety of body and oral disorders [22].

Because of their anti-inflammatory and anti-bacterial characteristics, as well as their role in modifying the inflammatory response, plant extracts are becoming increasingly popular [23]. More and more plant extracts have been studied in terms of their effect on the bacterial flora of periodontal disease in recent years [24-27]. One of this natural extracts that has been demonstrated to reduce the symptoms of periodontal disease is carvacrol.

Carvacrol, which is efficient against bacteria linked to caries, has been shown to be a possible therapeutic agent in periodontal disease in a fascinating study [28]. Carvacrol improves experimentally generated periodontitis in rats, according to an *in vivo* research that used radiographic examinations to study the effect of intragastric administration of carvacrol on alveolar bone resorption. In small doses, carvacrol is safe and effective in the treatment of periodontal disease. According to the findings, carvacrol preserves gingival tissue in rats with periodontal disease, which are mediated through carvacrol's inhibitory action on inflammation and periodontal tissue deterioration. Carvacrol also suppresses the inflammatory response and matrix metalloproteinase-9 (MMP-9) expression [29]. Integrated into herbal periodontal gels, essential oil with carvacrol was utilized in other research to treat experimentally generated periodontitis in rats and it was found that local application of carvacrol reduced alveolar bone resorption [30, 31]. These findings in the literature urge us to investigate the possible advantages of carvacrol in periodontal disease in greater depth.

a. Anti-inflammatory properties of carvacrol on periodontitis

Inflammatory cytokine levels, inducible nitric oxide synthase (iNOS) expression and cyclooxygenase-2 (COX-2) expression have all been demonstrated to be inhibited by carvacrol [32]. Carvacrol suppresses neutrophil elastase production as well as the synthesis of prostaglandins E2 (PGE2), prostaglandins F1 and prostaglandins F2, according to other studies [32-34].

Xiao et al. (2018) found that carvacrol not only inhibited the production of nitric oxide (NO) and PGE2 generated by interleukin-1 (IL-1), but it also suppressed the expression of iNOS, COX-2 and matrix metalloproteinases (MMPs) in chondrocytes through decreasing the nuclear factor-kappa B (NF-κB) signaling pathway [35]. In an *in vivo* animal investigation, da Silva Lima et al. (2013) found that administering carvacrol in doses of 50-100 mg/kg has anti-inflammatory effects, reduces inflammatory edema in rats paws and lowers IL-1 and PGE2. At the same time, they showed that a dose of 100 mg/kg lowers COX-2 and IL-1 messenger ribonucleic acid expression in mice. Carvacrol boosted the levels of interleukin-10 (IL-10) and anti-inflammatory cytokines, indicating that this natural extract has a protective impact [33]. Tabibzadeh Dezfuli et al. (2017) also found that once-daily oral administration of carvacrol lowers the levels of IL-1, interleukin-6 (IL-6) and tumor necrosis factor alpha (TNF-α) in mice with streptozotocin-induced diabetes [36]. On the other hand, contrary results were obtained, stating that carvacrol has a favorable effect in lowering IL-1, interleukin-4 (IL-4) and interleukin-8 (IL-8), but not IL-6 and TNF-α, most likely due to the approach utilized in the research by Carvalho et al. (2012, 2020) [37, 38].

Carvacrol anti-inflammatory activity could be attributed to inhibition of one or both cyclooxygenase (COX) enzymes, as evidenced by other studies which demonstrate that carvacrol inhibits both cyclooxygenase-1 (COX-1) and COX-2 [7, 32]. Another study found that carvacrol inhibits inflammatory edema and leukocyte migration, indicating that it has anti-inflammatory properties [37]. Carvacrol in thyme oil inhibits LPS-induced production of COX-2 mRNA and protein, possibly suppressing inflammation [34, 39]. Tsai et. al (2011) found that *Thymus vulgaris* essential oil contains 2.03% cavracrol and has significant anti-inflammatory action [39].

Using carvacrol, which has the characteristics of particular anti-anaerobic bacteria, anti-inflammation, and immunomodulation, Hu et al. (2023) created the first near-infrared (NIR) light-responsive nanodrug delivery system. By remodeling the classic inflammatory immunity pathways, such as the MAPK, interleukin-17 (IL-17) and tumor necrosis factor (TNF) signaling pathways, the plant-based monomer in conjunction with the in situ light-sensitive nano-drug delivery system developed by these authors, restores immunity and speeds up periodontal restoration. This combination potentially offers a non-invasive treatment option for periodontal disease [40].

b. Anti-bacterial activity of carvacrol on periodontitis

Carvacrol works on microbial cells and damages bacterial membranes structurally and functionally [12]. Carvacrol is one of the few components of essential oils that may breakdown the outer membrane of gram-negative bacteria, allowing lipopolysaccharides (LPS) to be released [41, 42]. Monoterpenes with anti-bacterial qualities, like carvacrol and thymol, are found in the essential oils and other extracts made from different sections of the aromatic *Verbenaceae* shrub *Lippia sidoides* [43-45].

Maquera–Huacho et al. (2018) investigated the anti-bacterial capabilities of carvacrol and terpinen-4-ol against *Porphyromonas gingivalis* and *Fusobacterium nucleatum*, as well as the cytotoxic effect on fibroblasts. For *Porphyromonas gingivalis* the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of carvacrol were 0.007%, respectively 0.002% for *Fusobacterium nucleatum*. Carvacrol had anti-biofilm activity and its cytotoxicity was comparable to that of chlorhexidine [46].

Gandova et al. (2023) evaluated the anti-bacterial efficacy of carvacrol against seven pathogenic and conditionally damaging microorganisms. Gram-positive or gram-negative microorganisms such as *Salmonella enterica* subsp. *Enterica serovar Abony*, *Bacillus subtilis*, *Staphylococcus aureus*, *Listeria monocytogenes* and *Escherichia coli* had inhibitory zone diameters measured between 3.9 and 4.9 mm [47]. Additionally, it has been discovered that carvacrol possesses anti-bacterial properties against *Salmonella spp.*, *Enterococcus sp.*, *Shigella*, *Pseudomonas aeruginosa*, *Salmonella spp.* and *Escherichia coli* [48].

Wang et al. (2016) investigated the anti-bacterial properties of the phenolic components of oregano essential oil against oral pathogens. Hinokitiol, carvacrol, thymol and menthol were the components studied. The MIC and MBC of these components were determined, resulting in carvacrol having MIC 200-400 g/mL and MBC 200-600 g/mL against *Aggregatibacter actinomycetemcomitans, Streptococcus Mutans*, *Methicillin-resistant Staphylococcus aureus* and *Escherichia Coli* [49].

Miladi et al. (2017) investigated the anti-bacterial and antibiofilm properties of five essential oils: eugenol, carvacrol, thymol, p-cymene, and γ-terpinene. The oils were studied either alone or in combination with tetracycline, and the results showed that the essential oils had a selective antimicrobial activity when used alone, and that they had a synergistic effect when used in combination with tetracycline, reducing oral bacteria at a rate of two to eight times when used in that manner. Notably, essential oils provided either alone or in conjunction with tetracycline shown significant antibiofilm activity. This adds carvacrol to the group of natural compounds capable of altering bacterial resistance and eliminating bacterial biofilm [50].

When compared to synthetic medicines, the anti-bacterial activity values for *Thymus zygis* and *Origanum compactum* essential oils demonstrated a potent antimicrobial action [51]. Carvacrol and thymol are two herbal substances contained in this essential oils with significant broad-spectrum anti-bacterial activity. It has been demonstrated that nanoparticles encapsulated in carvacrol and thymol are more soluble and have stronger anti-bacterial properties [52].

As a result, the researchers discovered that carvacrol exhibits anti-bacterial action against periodontal biofilm [46]. Drug resistance can be decreased and therapeutic efficacy increased when carvacrol and antibiotics are used together. Carvacrol is safe and has little cytotoxicity even at high concentrations [53]. Despite the lack of information regarding carvacrol's metabolism in humans, the molecule is thought to be safe [54].

c. Antioxidant effects of carvacrol on periodontitis

Essential oils have strong biological and pharmacological properties, which makes them very interesting. Chroho et al. (2024) studied essential oils isolated from *Thymus zygis* and *Origanum compactum*. These essential oils contain carvacrol and thymol, which exhibited a significant antioxidant activity, according to the tests [51]. The essential oil of *Thymus vulgaris* has antioxidant action because it contains high levels of carvacrol and thymol, natural chemicals with increased antioxidant activity [39, 55]. Using the oxygen radical absorbance capacity (ORAC) method as reported in a study, the antioxidant effect of carvacrol was found to be 1687.0 ± 102.90 μmol TE/mL [47].

Pathologies produced by reactive oxygen species (ROS) imposed by free radicals are referred to as oxidative stress. The imbalance between oxidants and antioxidants in favor of oxidants, with damaging and pathogenetic potential, is termed as oxidative stress. Oxidative stress can occur intracellularly or extracellularly, depending on its severity. Intracellular oxidative stress can result in cell necrosis or more or less pronounced cell disorganization, with catastrophic consequences in the case of a cell that is unable to replicate. Extracellular oxidative stress can also be harmful to cells. Free radicals are molecules formed from incompletely oxidized chemicals that have experienced partial combustion and include

oxygen groups in their structure that can initiate aggressive oxidation events on the surface of cell membranes or even inside cells [56].

Rapid metabolism attracts more free radicals, resulting in an imbalance between ROS formation and antioxidant defenses. These free radical species cause oxidative damage to lipids, proteins and nucleic acids in diverse tissues [57]. Superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) are the first line of defense antioxidants [58].

Carvacrol has significant antioxidant effects and can prevent and suppress a variety of diseases [59]. Chronic stress can cause cytotoxicity and oxidative stress is a significant factor that may be involved [57]. Carvacrol inhibits lipid peroxidation by increasing the activity of SOD, GPx, glutathione reductase (GR) and CAT. Free radicals such as peroxyl radicals, superoxide radicals, hydrogen peroxide and NO are effectively eliminated by carvacrol [60, 61].

Treatment with carvacrol raises glutathione (GSH) levels considerably. Carvacrol ability to maintain GSH levels is mostly owing to its radical elimination actions, which remove ROS. In cell cultures and animals, carvacrol has been found to boost antioxidant capacity [62]. Oregano extract has been shown to have a preventive effect against free radical activity, preventing tissue damage caused by prolonged stress [1].

Carvacrol has antioxidant properties *in vitro* and *in vivo*, which are attributable to the existence of the hydroxyl group (–OH) which is linked to the aromatic ring [63, 64]. Another study, conducted by Samarghandian et al. (2016) found that carvacrol reduces oxidative damage to the brain, liver and kidneys, making it a promising novel pharmacological agent for treating oxidative stress [1]. In a study by Tabibzadeh Dezfuli et al. (2017) it was discovered that giving diabetic rats 15 mg/kg body carvacrol per day reduced malondialdehyde (MDA) levels and increased CAT, SOD and GPx activity compared to rats who did not receive the extract, implying that carvacrol has antioxidant properties [36]. Per se, treatment with carvacrol has been shown to reduce the negative effects of chronic stress.

CONCLUSIONS

Based on the above-mentioned, carvacrol is a promising anti-inflammatory, anti-bacterial and antioxidant agent in periodontal disease therapy.

We can conclude that carvacrol is a viable perspective in the treatment of periodontal disease and due to its qualities it could be an excellent excipient in various topical preparations or per os treatments, in order to lessen the impact of periodontitis on the mouth and the rest of the body. However, more clinical trials are needed before a definite treatment plan can be implemented in the dentist office.

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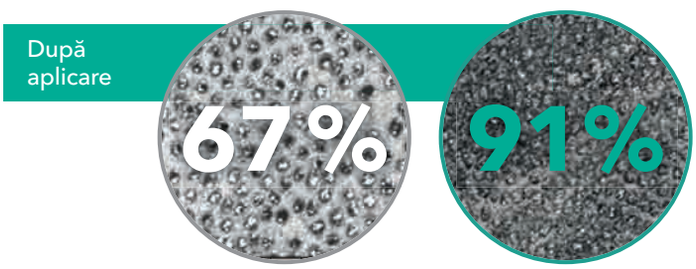
Studiul 1[1,*]

Tehnologia cu fluorură de staniu/ fluorură de sodiu

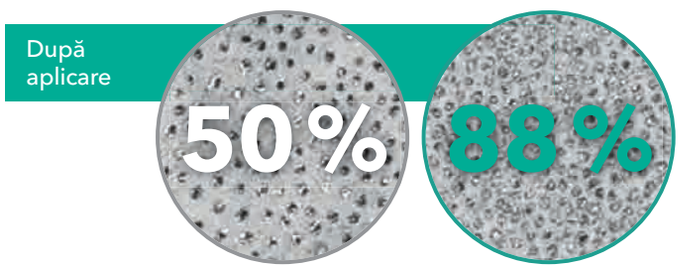
Tehnologia PRO-ARGIN



Studiul 2[2,*]

Tehnologia Novamin/ fluorură de sodiu

Tehnologia PRO-ARGIN



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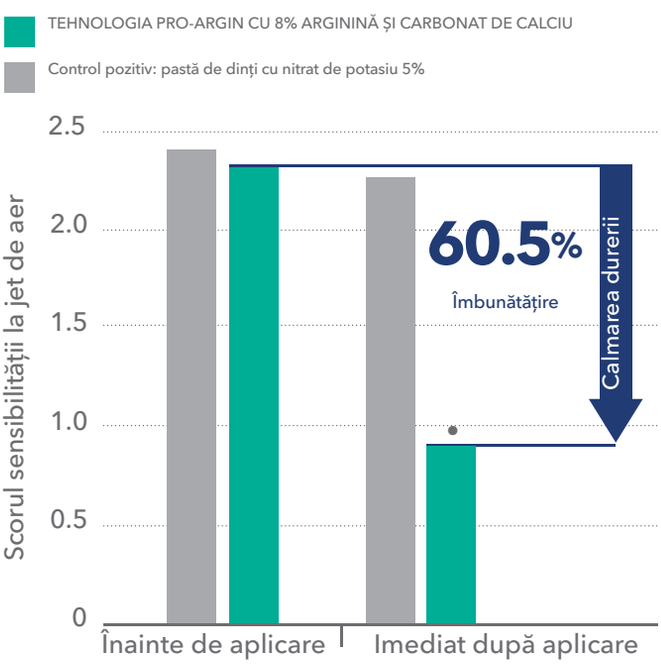
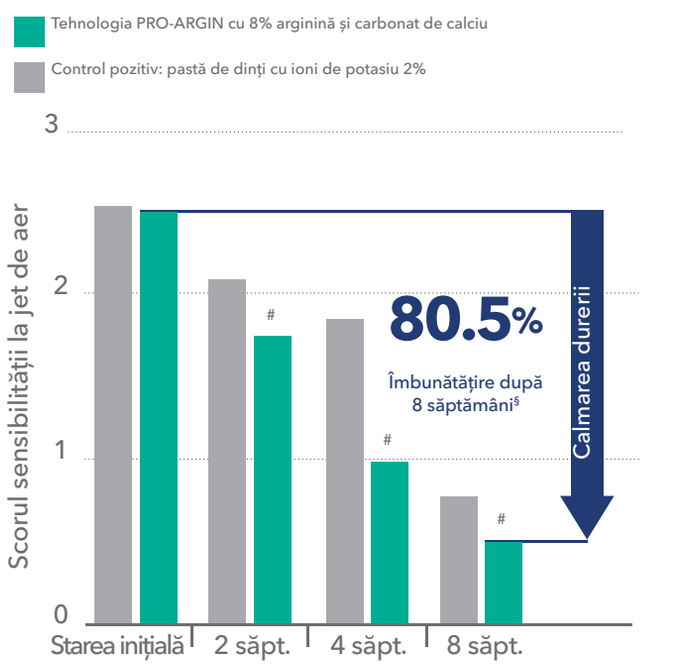
Calmarea semnificativă a durerii din sensibilitatea dentară instant[3,‡,**]



‡ În comparație cu starea inițială (sunt prezentate doar datele relevante)
• Semnificativ statistic (p<0,001)

Calmarea semnificativă de lungă durată a durerii din sensibilitatea dentară după 2, 4, și 8 săptămâni de utilizare[4,§,&]



§ În comparație cu starea inițială
& În comparație cu o pastă de dinți comercială desensibilizantă, ce conține 2% ioni de potasiu și 1450 ppm de fluor (NaF)
# Semnificativ statistic (p<0,05)

*Studiu in vitro, imagini reale de microscopie confocală după 5 aplicări (p<0,05%);
**Pentru calmarea imediată aplicați direct pe suprafața sensibilă și masați ușor cu vârful degetului timp de 1 minut.

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- photographer – for unpublished photographs;
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- initial publisher – for a table, picture or text which have previously been published elsewhere.

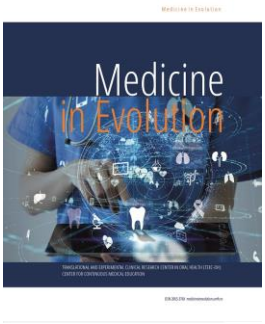
5. ETHICAL ASPECTS

Do not use name of patients, initials or hospital observation charts numbers. If a photograph of a body part which could allow direct or deductive recognition of the patient needs publishing, then the paper must be accompanied by the written consent of the patient and clinician, as well.

6. PRESENTING THE MANUSCRIPT

6.1. CONTENT OF THE PAPER - INDICATIONS FOR ORIGINAL ARTICLES

Paper title [Book Antiqua 20, bold, left alignment]



Surname N.[1], Surname N.[2] [Book Antiqua, 14, bold]

[1] *Author Affiliation (DEPARTMENT, FACULTY, UNIVERSITY, CITY/COMPANY) [10, italic]*
[2] *Author Affiliation (DEPARTMENT, FACULTY, UNIVERSITY, CITY/COMPANY) [10, italic]*

Correspondence to:
Surname Name: [10, italic]
Address: [10, italic]
Phone: +40 [10, italic]
E-mail address: [10, italic]

Abstract [Book Antiqua, 12, bold, justify alignment]

Recommendations for original studies

Original studies must include a structured abstarct of maximum 150 words, containing the following titles and informations: Aim and objectives; Material and methods; Results; Conclusions; Key words: give 3-5 key words; The abstract will be translated into an international circulation language.

Keywords: Innovation, technology, research projects, etc. [Book Antiqua 9].

INTRODUCTION [Book Antiqua, 11, bold, left alignment]

Introduction presentation of general aspects, in the context of the approached theme.

Introduction include **Aim and objectives –** Define the aim of the article. Briefly expose the rationale of the presented study or observation. Make strictly pertinent referals and do not exhaustively review the subject. Do not include data or conclusions from the paper.

There is a limitation of 4/6 pages. All pages size should be A4 (21 x 29,7cm). The top margins should be 2 cm, the bottom, right, margins should be 2cm and left margins should be 2,85 cm. All the text must be in one column and Book Antiqua font, including figures and tables, with single-spaced 10-point interline spacing.

Aim and objectives [Book Antiqua 11, bold italic, left alignment]

The text included in the sections or subsections must begin one line after the section or subsection title. Do not use hard tabs and limit the use of hard returns to one return at the end of a paragraph. Please, do not number manually the sections and subsections; the template will do it automatically.

[Book Antiqua, 11 point, normal, justified alignment].

MATERIAL AND METHODS [Book Antiqua, 11, bold, left alignment]

Describe the selection of observations or subjects for the experiment (including controls). Identify methods, equipments (with the name and address of the manufacturer in brackets) and give sufficient details on procedures. Give references for the selected methods, including statistical methods; offer details and brief descriptions for previously published methods which are not well known; describe new or substantially modified methods, justify their use and assess their limitations. Precisely identify all used drugs and chemicals, including generic names, dosage and administration ways. Describe statistical methods with sufficient details for reported results to be verified. Whenever possible, quantify discovered aspects and present them with appropriate measurement indicators for the uncertainty or error of measurement (such as confidence intervals). [Book Antiqua, 11 point, normal, justified alignment].

RESULTS [Book Antiqua, 11, bold, left alignment]

Present results in a logical succession as text, tables and illustrations. Emphasize or briefly describe only important observations. [Book Antiqua, 11 point, normal, justified alignment].

DISCUSSIONS [Book Antiqua, 11, bold, left alignment]

Underline new, important aspects of the study. Do not repeat in detail data which have been presented in previous sections. Include implications of revealed aspects and their limitations, including implications for future studies. Connect your observations to other relevant studies. Relate the results to the aim proposed for the study. [Book Antiqua, 11 point, normal, justified alignment].

CONCLUSIONS [Book Antiqua, 11, bold, left alignment]

Organize conclusions which emerge from the study. In the end state: a) contributions to be acknowledged but which do not justify paternity right; b) thanks for technical support;

c) thanks for financial or material support. [Book Antiqua, 11 point, normal, justified alignment].

REFERENCES [Book Antiqua, 11, bold, left alignment]

A numbered list of references must be provided at the end of the paper. The list should be arranged in the order of citation in the text of the publication, assignment or essay, not in alphabetical order(according to the Vancouver rules). List only one reference per reference number. It is very important that you use the correct punctuation and that the order of details in the references is also correct.

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Internet Documents - Standard format - #. Author A, Author B. Document title. Webpage name [format]. Source/production information; Date of internet publication [cited year month day]. Available from: URL. [Book Antiqua, 10 point, normal, justified alignment].

[1] _____
[2] _____
[3] _____

6.2. CONTENT OF THE PAPER - INDICATIONS FOR CASE REPORTS

Content of the paper for case report will respect indications for original articles.

Themes may be selected from all medical fields. Manuscripts which offer a special gain for daily activity will have priority. The title must be clearly, precisely stated. It may be completed by a subtitle. It is advisable to include in the key words of the title the main message, the special element which may be observed from the case evolution. The content of a case report must be divided into three parts:

Introduction – It must include a maximum of 15 typed rows (half page). Here, the main medical problem is summarized in order to place the case in a specific domain.

Case report – It contains essential specific information on the case. In order to make a logical, chronological and didactical case report the following 5 chapters are needed:

I. Anamnesis;
II. Clinical examination data;
III. Laboratory data;
IV. Additional paraclinical investigations;
V. Treatment and evolution.

Discussions – The reason for the case report must be stated. The report must be patient-centered. Occasional deviations from typical (characteristic) evolutions, nosologically important facts must be presented in such a manner to expose the clinical picture as completely as possible. The case report must not appear as an appendix of a general review. Dimensions of a case report: maximum 6-8 typed pages, 30 rows of 60 characters/page.

6.3. MEASUREMENT UNITS, SYMBOLS, ABREVIATIONS

All measurements must be expressed in International System (IS) units. Abreviations must be fully explained when first used.

6.4. TABLES

Tables are noted with Roman figures and they will have a brief and concise title, concordant with their content.

6.5. ILLUSTRATIONS

Number all illustrations in Arabic figures in a single succession. Apply a label on the back side of every illustration, containing its number and an arrow indicating the upper side. Coloured illustrations may be accepted but it is the choice of the editors, according to particular technical abilities of each journal issue, or it may involve a fee in special cases.

6.6. EXPLANATIONS FOR DRAWINGS AND GRAPHS

Explanation for drawings and graphs must be clear and in readable dimensions, considering the necessary publishing shrinkage.

6.7. PHOTOGRAPHS

Offer glossy, good quality photographs. Any annotation, inscription, etc. must contrast with the ground. Microphotographs must include a scale marker.

6.8. ILLUSTRATION LEGENDS

Include explanations for each used symbol, etc. Identify the printing method for microphotographs.

7. COPIES FOR PUBLISHING

In order to accelerate publishing, the main author will send a set of printed sheets presenting the final version of the paper, as it will appear in the journal. It is really helpful that texts to be also sent on electronic support, diacritic characters mandatory.

8. REJECTION OF PAPERS

If a paper does not meet publishing conditions, whatever these may be, the editors will notify the first author on this fact, without the obligation of returning the material. Original photographs or the whole material will be returned only if the author comes to the editor and takes them.

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