Medicine in Evolution

Printed at: WALDPRESS, Timisoara,
64 Divizia 9 Cavalerie Street,
Phone/Fax: 0040256422247

Edited at: EUROSTAMPA, Timisoara
26, Revolutiei 1989 Street,
Phone: 0040256204816

TRANSLATIONAL AND EXPERIMENTAL CLINICAL RESEARCH CENTER IN ORAL HEALTH (TEXC-OH)
CENTER FOR CONTINUOUS MEDICAL EDUCATION

ISSN 2065-376X medinevolution.umft.ro

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

IULIE 2010 | IANUARIE 2011 | IULIE 2011

IANUARIE 2012 | IULIE 2012 | IANUARIE 2013

blend-a-med | Oral-B | CLINIC LINE GUM PROTECTION SYSTEM

Recomandați Sistemul blend-a-med Oral-B Clinic Line Gum Protection
Este dovedit clinic că reduce si ajută la prevenirea problemelor gingivale în 4 săptămâni pentru a ajuta pacienții să întrerupă ciclul gingivitei. Sistemul combină acțiunea chimică puternică a fluorurii de staniu stabilizate, suplimentată de apă de gură, cu acțiunea mecanică a periuței de dinți Pro-Flex, suplimentată de ață dentară, facând din acesta completarea perfectă a tratamentului din cabinetul dumneavoastră.

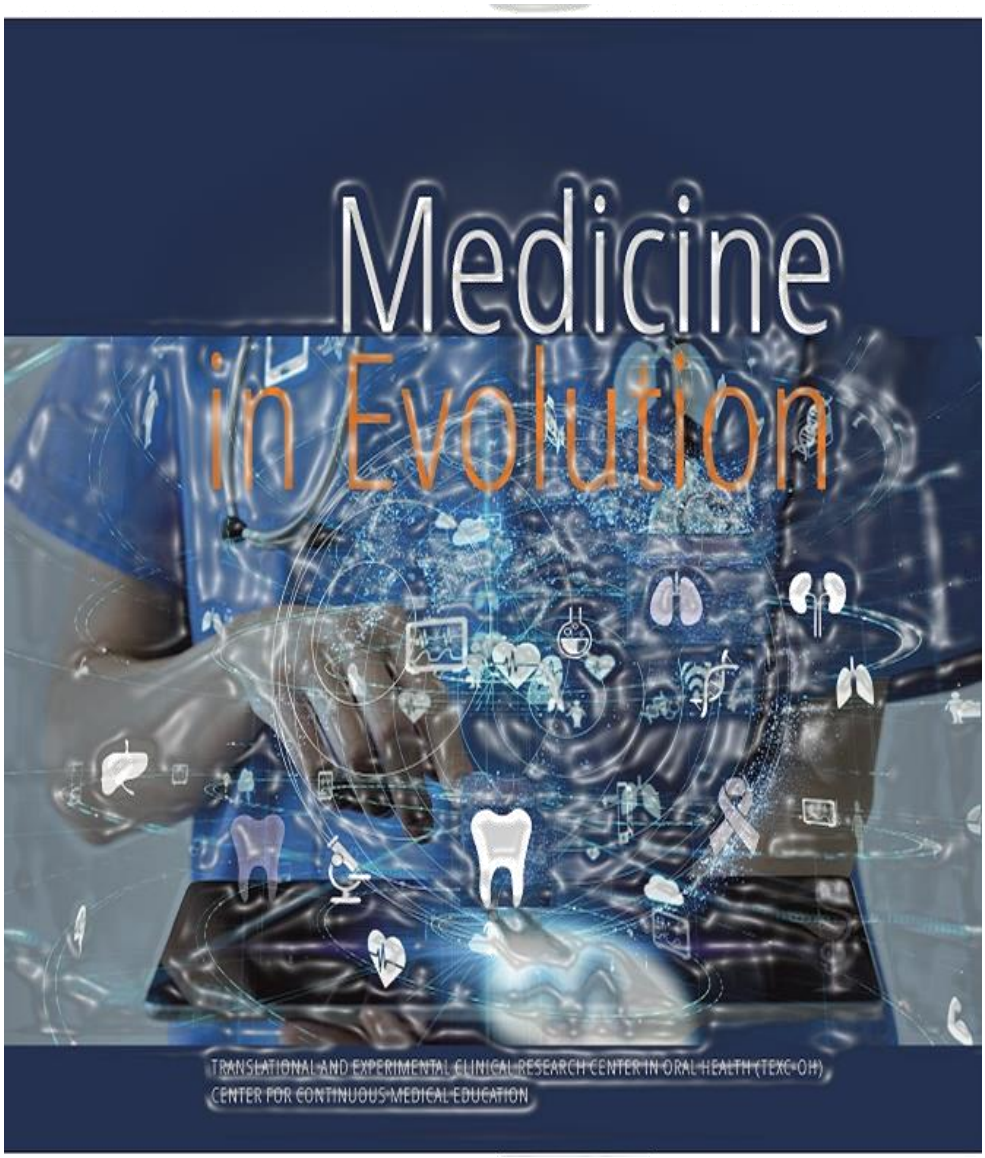
P12125.01

Continuă îngrijirea ce începe în cabinetul dumneavoastră

blend-a-med RESEARCH CENTERS Oral-B

Volume XXVIII, Nr. 3, 2022, Timişoara, Romania
ISSN 2065-376X

MEDICINE IN EVOLUTION



TRANSLATIONAL AND EXPERIMENTAL CLINICAL RESEARCH CENTRE IN ORAL HEALTH
CENTER FOR CONTINUOUS MEDICAL EDUCATION

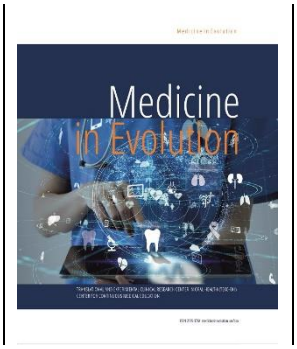
medinevolution.umft.ro

Journal edited with the support of

Printed at: WALDPRESS, Timisoara,
64 Divizia 9 Cavalerie Street,
Phone/Fax: 0040256422247

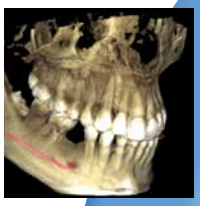
Edited at: EUROSTAMPA, Timisoara
26, Revolutiei 1989 Street,
Phone: 0040256204816

EDITORIAL BOARD



ProMax 3D • PlanScan • ProFace

Unique 3D combination for open CAD/CAM



Digital perfection

Planmeca sets new standards with world's first dental unit integrated intraoral scanner for open connectivity to various CAD/CAM systems.

We would like to invite you to explore the dentistry in new dimensions – see the perfect combination of digital intraoral scan, CBVT and 3D facial photo datasets in one 3D image. This digital perfection enables you to study patient's complete anatomy in detail, plan and utilise open interface with modern CAD/CAM systems according to your needs. Now you can be one of the pioneering specialists, whether you are an implantologist, endodontist, periodontist, orthodontist or maxillofacial surgeon. The new era of dentistry is reality. It's your decision.

Planmeca Oy, Asentajankatu 6, 00880 Helsinki, Finland
tel. +358 20 7795 500, fax +358 20 7795 555, sales@planmeca.com, www.planmeca.com

PLANMECA

1971 - 2011

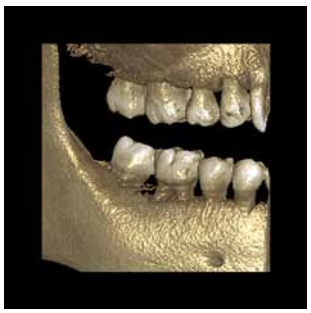
Planmeca ProMax 3D

All volume sizes

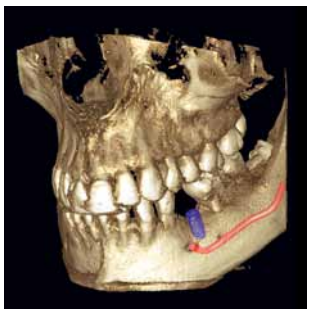
The Planmeca ProMax concept offers a full range of imaging volumes providing detailed information on patient anatomy. The comprehensive Planmeca ProMax platform complies with every need in dental radiology, offering digital panoramic, cephalometric, and 3D imaging as well as 3D face photo together with advanced imaging software.

At the heart of the concept is the robotic SCARA technology: the unique robotic arm enables any movement pattern required by existing or future program, eliminating all imaging restrictions. With the Planmeca ProMax concept superior maxillofacial radiography can be performed with a single platform, today and in the decades to come.

All volume sizes

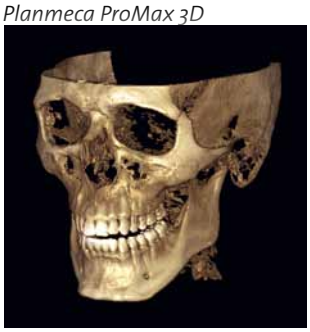


Planmeca ProMax 3D s
Ø42 x 42 mm–90 x 60 x 130 mm



Ø34 x 42 mm–140 x 105 x 130 mm

Planmeca ProMax 3D



Planmeca ProMax 3D Mid
Ø34 x 42 mm–Ø160 x 160 mm

Planmeca ProMax 3D Max
Ø42 x 50 mm–Ø230 x 260 mm

Planmeca Oy, Asentajankatu 6, 00880 Helsinki, Finland
tel. +358 20 7795 500, fax +358 20 7795 555
sales@planmeca.com, www.planmeca.com

PLANMECA

Planmeca Romexis

Software refined

Available on the App Store

Planmeca Romexis is the software of choice for all dental imaging purposes. All patient's digital images – intraoral and extraoral X-ray images, 3D volumes, and photographs – are processed and stored in one easy-to-use system. Planmeca Romexis offers a complete set of tools for image viewing, enhancement, measurement, and implant planning, and fully integrates digital imaging with the patient's other clinical data.

Thanks to its powerful printing features, stunning printouts can be produced. Planmeca Romexis provides direct image capture from Planmeca X-ray units, interfaces with 3rd party devices via TWAIN, and is fully DICOM-compatible. Planmeca Romexis is a JAVA software that runs on Windows, Mac OS, and Linux operating systems, and embraces modern IT standards.

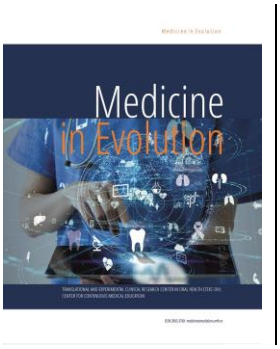
Planmeca Oy, Asentajankatu 6, 00880 Helsinki, Finland
tel. +358 20 7795 500, fax +358 20 7795 555
sales@planmeca.com, www.planmeca.com

PLANMECA

1971 - 2011

CONTENTS

ARTICLES



Marin A., Semenescu A.D., Dinu S., Poenaru M.

Bacteria, biofilm and cholesteatoma - perspectives of innovative therapeutic approaches *218*

Bojoga (Mocuta) D.E., Miron M.I., Grecea R., Luca M.M., Buzatu R.

General anxiety level assessment of dentists in the context of the COVID-19 pandemic *228*

Buzatu R., Luca M.M., Valceanu A.S., Chirila A.V., Miron M.I.

Management and treatment in tooth discoloration *236*

Cărămidă M., Dumitrache M.A., Ioniță A., Oancea R., Sfeatcu R., Tribus L.

Romanian pregnant women' attitude and behaviour related to periodontal health - a pilot study *247*

Ciora E.D., Miron M.I., (Bojoga) Mocuța D.E., Dragoș B., Luca M.M.

Evolution of periodontal disease in patients with type 2 diabetes in the context of initial therapy - systematic review *255*

Cosoroabă R., Todor L., Popovici R.A., Todor S.A., Motoc G.V., Olariu I.

Phytotherapy as an adjuvant in the treatment and prevention of oral cancer *266*

Olariu I., Bran L.R., Damian G., Porumb A., Cosoroaba R.M., Olariu T.

Restoration methods used for aesthetic dental dysfunction correction in Arad *276*

Luca M.M., Popa M., Buzatu R., Penescu B., Miron M.I.

State of current knowledge of the aetiology and incidence of molar-incisor hypomineralization (MIH) - a bibliometric analysis *284*

Miron M.I., Luca M.M., Bojoga (Mocuta) D.E., Odobaşa D., Buzatu R.

Burnout Syndrome, a reality among dentists - systematic review *295*

Mărginean Khattab M.A., Motoc G.V., Vaida L., Olariu I., Motoc O., Milutinovici R.A., Dinu S., Popa M.

An orthodontic approach in the management of Molar-Incisor Hypomineralisation (MIH) *303*

Motoc G.V., M.A. Mărginean K., Vaida L., Olariu I., Cosoroaba R.M., Motoc O., Dinu S., Popa M.

Correlation of salivary ph and tooth decay at the pediatric population *307*

Olariu T., Bran L.R., Olariu I., Lile I.E., Tanase A.D., Damian G.

Oral Health Knowledge among Healthcare Personnel in Arad, Romania *311*

Potra-Cicalău G.I., Ciavoi G., Todor L., Iurcov R.C., Iova G., Ganea M., Scrobotă I.

The benefits of Calendula officinalis extract as therapeutic agent in oral healthcare *316*

Sfeatcu R., Cărămidă M., Bencze M.A., Dragomirescu A.O., Dumitrache M.A.

Inventory of dental students´ needs regarding oral health literacy concept *324*

Talpoş Ş., Nikolajevic-Stoican N., Popa M., Talpoş R., Urechescu H., Hajaj T., Mărăcineanu R., Urtilă F., Pricop M.

Factors influencing the success of replantation in periodontal trauma *329*

Berar A., Buduru S., Breban C., Gherman A., Miţariu L., Tăut M., Buzatu R.

Comparative analysis of zirconia and lithium disilicate all-ceramic crowns manufactured using digital versus digital-conventional technique *337*

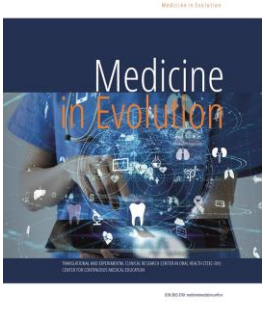
Lolos D., Mihali D.F., Mihali S.G., Oancea R.

Extensive prosthetic rehabilitation in accordance with ceramic masses *346*

Mihali S.G., Lolos D., Bratu D.C.

Registration of intermaxillary relations using anterior Jig compared to the classical method *356*

Bacteria, biofilm and cholesteatoma - perspectives of innovative therapeutic approaches



Marin A.[1], Semenescu A.D.[2,3], Dinu S.[4], Poenaru M.[1]

[1]*Department of ENT, Faculty of Medicine, "Victor Babes" University of Medicine and Pharmacy*
[2]*Department of Toxicology and Drug Industry, Faculty of Pharmacy, "Victor Babes" University of Medicine and Pharmacy*
[3]*Research Centre for Pharmaco-Toxicological Evaluation, "Victor Babes" University of Medicine and Pharmacy*
[4]*Department of Pedodontics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy*

Correspondence to:
Name: Semenescu Alexandra Denisa
Address: Eftimie Murgu Square, No. 2, 300041 Timisoara, Romania
Phone: +40724688140
E-mail address: alexandra.scurtu@umft.ro

Abstract

Nowadays, bacterial infections still represent a problem of global interest due to the emergence of antibiotic resistance. Also, microbial infection are the basis of cholesteatoma being known for the production of chronic inflammation, the collection of cellular debris and the increase in the viscosity of the secretions, the dysfunction of the Eustachian tube, the invasion of the cells of the immune system and epithelial hyperplasia Aim and objectives: To evaluate the antibacterial effect of epigallocatechin gallate (ECGC), in association with an antibiotic (ciprofloxacin) related to the possible synergistic effect. Material and methods: The disk diffusion method was employed to test the sensitivity of *S. aureus* and *P. aeruginosa* in the presence of ECGC and ciprofloxacin, at different concentrations (25–100 µg/mL) as such or in combination. Results: The results demonstrated that ECGC has an antibacterial effect on the selected strains, but the strongest activity was observed following the association of the natural compound with the antibiotic, with a better effect on the *S. aureus* strain. Conclusions: The association of natural compounds with antibiotics can represent an alternative to antibiotic resistance, being a possible effective option in combating infections and even pathologies of the middle ear, such as cholesteatoma.

Keywords: ECGC, antibacterial effect, biofilm, cholesteatoma, synergism

INTRODUCTION

Cholesteatoma is a non-cancerous condition characterized by the abnormal growth of squamous epithelial cells in the middle ear. Two types of cholesteatoma are known, the congenital one, which rarely develops, and the acquired cholesteatoma [1].

The causes of cholesteatoma development are not fully known, but a number of factors are responsible for the formation of this medical condition. Among these factors we find the microbial infection that leads to chronic inflammation, the collection of cellular debris and the increase in the viscosity of the secretions, the dysfunction of the Eustachian tube, the invasion of the cells of the immune system and epithelial hyperplasia [2,3]. This pathology is generally manifested by pain and the presence of a smelly liquid at the level of the infected ear and up to the loss of hearing [4]. From a histological point of view, this non-cancerous lesion contains keratin remnants covered with keratinized squamous epithelium [5].

Cholesteatoma has a high tendency to erode the ossicles and the temporal bone that supports the neural structures, which can lead to complications such as vertigo, paralysis of the facial nerve and hearing loss [6]. Also, an amplified inflammatory response determines the development of cholesteatoma and bone erosion, as well as the formation of biofilm is associated with the production of cholesteatomas [7]. The importance of biofilms in otolaryngological diseases is more and more known. In recent years, this subject has been intensely debated, involving *in vitro* studies, the vast majority of which are focused on the complications involving medical implants [8]. The formation of biofilms leads to impaired clearance and chronic middle ear infection that triggers the inflammatory process. Thus, inflammatory mediators such as IL-1, TNF-alpha and PAF induce hyperproliferation of keratinocytes and epithelial cells, increased secretion of mucin and bone resorption by stimulating osteoclasts and collagenases [2].

A large number of Gram-negative and Gram-positive bacterial agents as well as fungal agents were isolated from cholesteatoma tissues [1]. *Pseudomonas aeruginosa* and *Staphylococcus aureus* are the most common bacteria observed in cholesteatomatous otitis media [9]. It is considered that the formation of the biofilm keeps the pathogens in the middle ear, thus maintaining the inflammation and developing the cholesteatoma formation. In general, the treatment is based on surgical intervention, possibly including the removal of the inflamed bones; in combination with the administration of antimicrobial medication. However, the partial removal of pathogens or biofilms formed can precipitate the reappearance of the condition [1,6,10].

The ability of pathogens to form biofilms facilitates their survival in unfavourable conditions, allowing them to proliferate and colonize host tissues as well as inert surfaces such as implants, producing negative reactions on human health and resistance to antimicrobial drugs [11]. More controversial is the situation in which biofilms are polymicrobial. A common example of co-infection is that between *Pseudomonas aeruginosa* and *Staphylococcus aureus*, which can aggravate the disease and hinder the choice of antibiotic therapy, the person's recovery being slower [11,12].

Biofilm formation can be considered one of the main causes by which bacteria develop resistance to several drugs. The unreasonable use of antibiotics has led to the development of multi-resistant microorganisms. Natural products derived from plants but also microorganisms and marine species represent an invaluable source of anti-biofilm agents. The compounds isolated from the plants as well as the extracts proved to have important antimicrobial and anti-biofilm effects. The anti-biofilm properties of natural products refer to inhibiting the formation of the polymer matrix, reducing the production of virulence factors,

and suppressing cell adhesion, thus blocking the communication between bacterial cells and the development of biofilm [13].

Biofilm inhibitors as well as quorum sensing (QS) formation inhibitors are being studied as alternatives to current antibiotics due to their small possibility of developing resistance, focusing on products of vegetable origin that have a complex composition [14].

Green tea, an extract from the leaves of *Camellia sinensis* L., is known for its beneficial effects on health due to the wide range of phytochemicals in the composition. It contains numerous constituents, including catechins, caffeine, amino acids, chlorophyll, volatile compounds, minerals. About 30% of its total composition is represented by polyphenols, especially catechins, of which about 65% are represented by epigallocatechin-3-gallate (EGCG) [15,16].

Green tea polyphenols have demonstrated the ability to inhibit acyl homoserine lactone-mediated QS and to inhibit biofilm formation in *Pseudomonas aeruginosa* [15,17].

The inhibitory effect of EGCG against biofilm formation and cholesteatoma development is shown in Figure 1.

Several studies have been carried out to evaluate whether green tea and its main phytocompound, epigallocatechin-3-gallate, have antimicrobial properties. The data obtained showed that both the aqueous and alcoholic extracts and ECGC are effective against *S. aureus* and *P. aeruginosa*. The results were presented using the minimum inhibitory concentration (MIC) and the size of the inhibition zones (IZ). A summary of the studies is shown in Table 1.

Due to the massive acceleration of the development of bacterial resistance at the global level and the lack of new antimicrobial substances, new strategies to eradicate infectious diseases are needed. An alternative would be to combine antibiotics with each other or antibiotics with natural compounds to extract potential synergistic effects, knowing that plants are known for their antimicrobial effects [18].

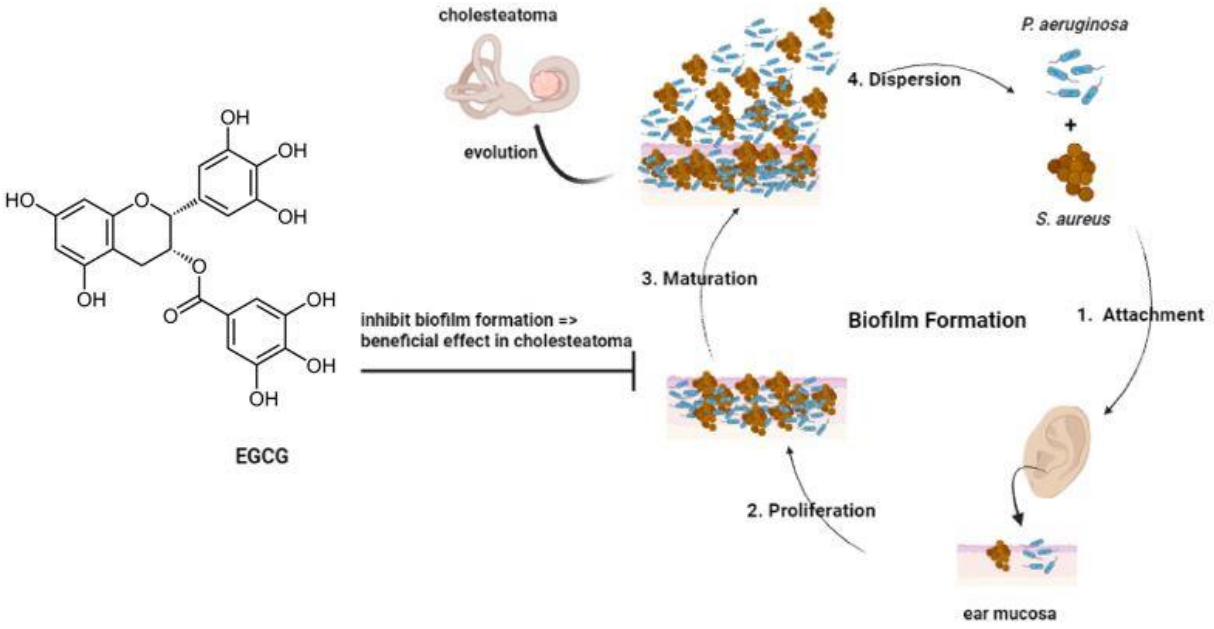


Figure 1. The inhibitory effect of epigallocatechin-3-gallate (EGCG) against biofilm formation and cholesteatoma development

Table 1. Antimicrobial activity of green tea and epigallocatechin-3-gallate (ECGC)

Source -Active compound	Bacterial strain	Zone of inhibition (IZ)	Minimum inhibitory concentration (MIC)	References
Green tea extract (water extract)	***S. aureus***	18.970±0.287 mm	400 µg/mL	[19]
	MRSA	19.130±0.250 mm	400 µg/mL	
	MRSA		0.78 mg/mL	[20]
	S. aureus		0.28 mg/mL	[21]
	MRSA		50–180 µg/mL	[22]
Green tea extract	***S. aureus*** **MDR-*S. aureus***		125 µg/mL	[23]
Green tea extract (alcohol extract)	***S. aureus***		20 µg/mL	[24]
Green tea extract (methanol extract)	***S. aureus***		0.8 mg/mL	[25]
Green tea extract (ethanol extract)	***S. aureus***	12 mm		[26]
EGCG	***S. aureus***		100 mg/mL	[27]
EGCG	**MDR-*S. aureus***		625 µg/mL	[23]
Green tea extract (water extract)	***P. aeruginosa***	17.550±0.393 mm	800 µg/mL	[19]
	MDR-*P. aeruginosa*	17.670±0.398 mm	800 µg/mL	
Green tea extract (ethanol extract)	***P. aeruginosa***	10 mm		[26]
EGCG	***P. aeruginosa***		500 mg/mL	[27]
EGCG	***P. aeruginosa***		200 µg/mL	[28]

Aim and objectives

The objective of this study was to evaluate the antibacterial effect of epigallocatechin-3-gallate (ECGC) on the bacterial strains *S. aureus* and *P. aeruginosa* compared to ciprofloxacin and then to analyze the effect of the association between the natural compound and the antibiotic to assess the synergistic activity obtained; synergism that is necessary to fight infections, even those from the middle ear, and cholesteatoma, a pathology of interest to our research group.

MATERIAL AND METHODS

Epigallocatechin-3-gallate (E4143) and ciprofloxacin (17850) were purchased from Sigma Aldrich (Germany). The antibacterial effect of EGCG, Cip and their association was evaluated against *Staphylococcus aureus* (ATCC 25923™) and *Pseudomonas aeruginosa* (ATCC 27853™), strains acquired from ATCC (American Type Culture Collection, Microbiologics, France). The Disk diffusion method for susceptibility testing, in accordance with the SRAST

(Standard Rules for Antimicrobial Susceptibility Testing) using impregnated disks was employed. The experimental protocol was conducted as presented in literature [23,27,28]. Ciprofloxacin and EGCG solutions were obtained in a wide range of 25–100 µg/mL, samples that were used as such or in combination against *P. aeruginosa* and *S. aureus*. The plates were incubated in standard conditions (at 37°C) and evaluated after 24 h. Data are presented as inhibition zone expressed in mm. All the tests were realized in triplicate.

RESULTS

Regarding the antibacterial activity, in the figures 2 and 3 are exposed the data obtained after the evaluation of ciprofloxacin, epigallocatechin-3-gallate and their association on two bacterial strains, namely *S. aureus* and *P. aeruginosa*. The results showed that Cip, used at low concentrations (25-75 µg/mL) exerted a slight antimicrobial effect compared with the highest concentration (100 µg/mL) tested on *S. aureus* while EGCG at the same concentration (100 µg/mL) presented a weaker effect. EGCG_Cip association showed a higher antimicrobial activity on *S. aureus* bacterial strain compared to the individually tested substances (figure 2).

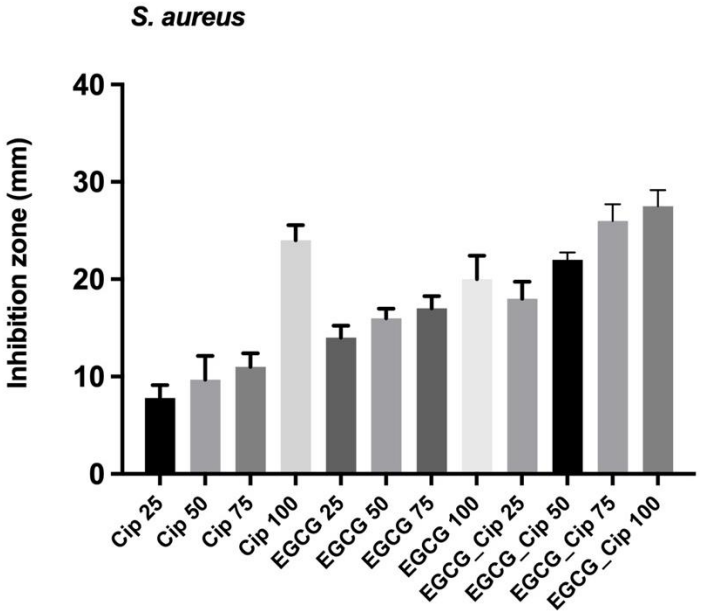


Figure 2. The effect of ciprofloxacin (Cip), epigallocatechin-3-gallate (EGCG) and their association at different concentrations (25, 50, 75, and 100 µg/mL) on *S. aureus* bacterial strain

Regarding the activity on *P. aeruginosa* bacterial strain, EGCG tested at the highest concentration showed a stronger effect compared to ciprofloxacin tested at the highest concentration (figure 3). The association between EGCG and antibiotic leads to a better effect but not as pronounced as in the case of *S. aureus*.

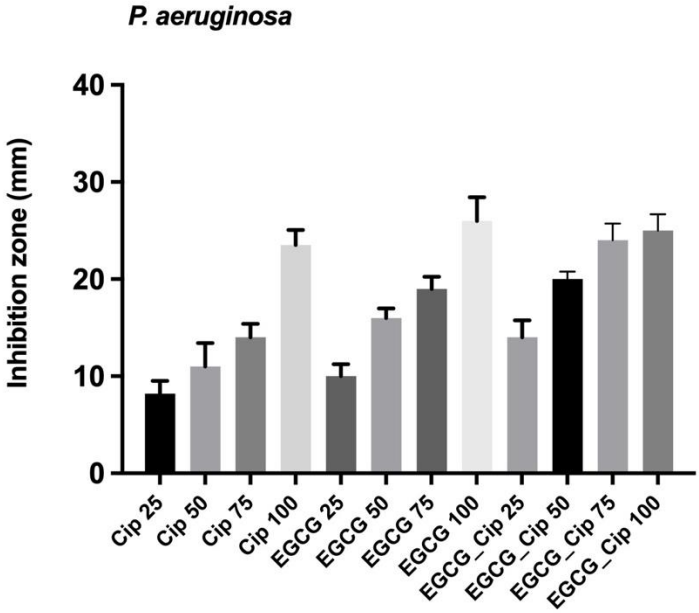


Figure 3. The effect of ciprofloxacin (Cip), epigallocatechin-3-gallate (EGCG) and their association at different concentrations (25, 50, 75, and 100 µg/mL) on *P. aeruginosa* bacterial strain

DISCUSSIONS

The pathogenesis of acquired cholesteatoma has become an intensively studied subject. A first step was the study carried out by Chole and Faddis in which the presence of biofilms was reported in 16 of the 24 clinical cases of cholesteatoma (66%) [29]. Another group led by Lampikoski identified biofilm formation in 3 out of 5 cases of cholesteatoma (60%) [30]. Also, Kaya et al. obtained results like those existing in the specialized literature, more precisely in 8 out of 13 cases the formation of biofilm was observed at the level of the middle ear mucosa (61.5%) [8]. Considering the data presented, it was found that bacteria can infect the keratin matrix and form biofilms that further lead to chronic infections. After an *in vitro* study, it was concluded that biofilm formation was responsible for the containment of more than 50% of the pathogens isolated from cholesteatoma tissues at the level of the ossicles [31].

The formation of biofilms has been shown to represent a main role in the evolution of cholesteatoma. Normally, the middle ear cavity is colonized by bacterial flora, this aspect can make it difficult to differentiate between harmless and pathogenic microbial agents. Therefore, the inflammatory process generated by the wide variety of pathogenic agents has a greater relevance in the production of infection, in the development of cholesteatoma, than the responsible bacterial species itself [1].

The creation of biofilms led to the emergence of resistance to antibiotics and in general to antimicrobial medication, putting great obstacles in the effective treatment of infections among the population. Thus, in recent years, the intensive study of natural products has been started in terms of their efficiency as antimicrobial and antibiofilm agents; there are promising data in this regard.

Most products of natural origin work by inhibiting bacterial growth or by reducing their pathogenicity, acting on specific genes that manage the decisive factors of virulence. In addition, besides these mechanisms, certain compounds including EGCG have been investigated for their action as QS inhibitors [32,33]. The study conducted by Yin et al. pointed out that the polyphenols extracted from the leaves of *Camellia sinensis* L. inhibit the QS system of *Chromobacterium violaceum* not through the production or degradation of acyl homoserine lactones and most likely interfere with acyl homoserine lactone receptors. In

addition, polyphenols extracted from green tea can inhibit the production of elastase, total protease, biofilm formation and motility of *Pseudomonas aeruginosa*, but without slowing its growth. The tea extract showed that it may be able to significantly decrease the biofilm formation of *Pseudomonas aeruginosa* at concentrations between 49 µg/mL-159 µg/mL through QS modulation [15]. The main polyphenolic compound in tea, EGCG at the concentration of 40 µg/mL, demonstrated that it can inhibit biofilm formation by 30% and can decrease the swarming ability of *Burkholderia cepacia* [34].

According to Yang's results, it was shown that epigallocatechin-3-gallate has a high binding affinity to the enoyl-acyl carrier protein reductase of *Pseudomonas aeruginosa*, being an effective quorum-quenching candidate [35].

Further studies on the isolation of bioactive compounds, as well as their activities, are necessary to know the complexity of the beneficial effects of green tea extract.

Monotherapy is often ineffective, the combination of several antibacterial agents is optimal for eradicating infections, such as those with *P. aeruginosa* and *S. aureus*. The main advantages of the combined therapy are the inhibition of the emergence of bacterial resistance and the broadening of the spectrum of antibacterial action compared to the use of monotherapy [36].

Our study highlighted the antibacterial effect of epigallocatechin-3-gallate at concentrations between 25-100 µg/mL compared to a fluoroquinolone, ciprofloxacin, against the bacterial strains *S. aureus* and *P. aeruginosa*. The association of ECGC with ciprofloxacin led to a stronger effect, especially against *S. aureus*, which pointed out the synergistic effect of the two molecules. In the specialized literature, the antibacterial effect of ECGC in association with other antibiotics was also studied, and the synergy was also observed. The study by Shanmugapriya et al. showed that an antibiotic from the class of cephalosporins, such as cefepime, associated with epicatechin 3-gallate of natural origin, induced a synergistic eradication effect against the resistant isolate of *P. aeruginosa*. Thus, combining the antibiotic with ECGC allowed the use of lower concentrations of ECGC and cefepime than when each substance would be administered alone. The minimum inhibitory concentration for the natural compound was reduced to 4, 2, 1 and 0.5 µg/mL in the presence of the antibiotic at a concentration of 0.5, 1, 2 and 4 µg/mL [37].

This synergistic activity between antibiotics and ECGC was also observed in the study conducted by Zhao. Epicatechin 3-gallate in low concentrations demonstrated a synergistic effect with β-lactam antibiotics such as penicillin and oxacillin against methicillin-resistant *S. aureus* (MRSA). ECGC dose-dependently inhibited the growth of both methicillin-susceptible and methicillin-resistant *Staphylococcus aureus* (MSSA and MRSA) and reduced tolerance of bacteria to high ionic strength and low osmotic pressure in their external atmosphere [38]. Hu's research also reported the superior effect of EGCG against MRSA when combined with ampicillin [39].

All these results confirm the synergism between antibiotics and phytocompounds, more precisely the effect of their association is greater than the effect of the compounds administered individually or the sum of the effects of the individual compounds; synergism that produced an impressive antibacterial effect.

CONCLUSIONS

Following this study and the review of specialized literature, we concluded that plants and natural compounds extracted from plants have a significant antibacterial role and represent an alternative to antibiotic resistance. In addition, it can be concluded that the association of natural compounds, in this case ECGC, with antibiotics potentiates the antibacterial effect due to the resulting synergy. Thus, this combination can be an effective

option for fighting infections and even ear infections and cholesteatoma, a pathology that can seriously affect the population.

REFERENCES

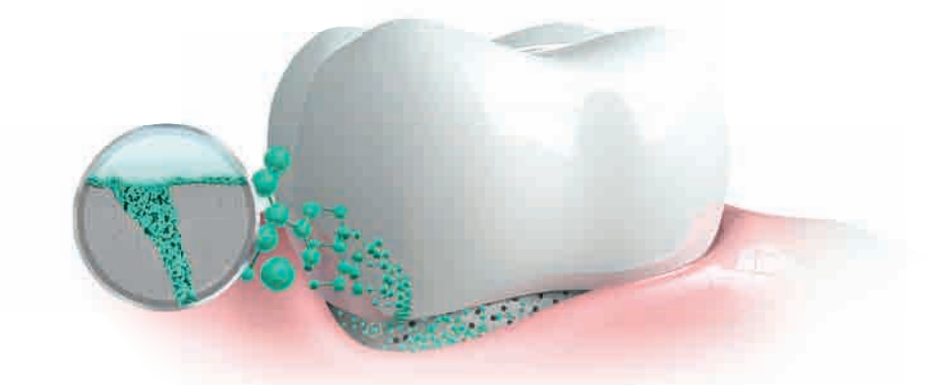
1. Masanta WO, Hinz R, Zautner AE. Infectious causes of cholesteatoma and treatment of infected ossicles prior to reimplantation by hydrostatic high-pressure inactivation. Biomed Res Int. 2015;2015:761259.
2. Frickmann H, Zautner AE. Cholesteatoma—a potential consequence of chronic middle ear inflammation. Otolaryngology. 2012; S5.
3. Zautner AE. Adenotonsillar disease. Recent Pat Inflamm Allergy Drug Discov. 2012 May;6(2):121-9.
4. Nevoux J, Lenoir M, Roger G, Denoyelle F, Ducou Le Pointe H, Garabédian EN. Childhood cholesteatoma. Eur Ann Otorhinolaryngol Head Neck Dis. 2010 Sep;127(4):143-50.
5. Lim DJ, Saunders WH. Acquired cholesteatoma: light and electron microscopic observations. Ann Otol Rhinol Laryngol. 1972 Feb;81(1):1-11.
6. Frank DN, Magno JPM, Velasco KJS, Bootpetch TC, Salud JED, David KJV, Miller AL, Yee EC, Dulnuan HP, Pyles RB, Lacuata JAC, Arbizo JL, Kofonow JM, Guce B, Mendoza KMD, Robertson CE, Ilustre GMS, Chiong ANE, Lu S-L, Tongol EA, Sacayan ND, Yarza TKL, Chiong CM and Santos-Cortez RLP. Microbiota Associated With Cholesteatoma Tissue in Chronic Suppurative Otitis Media. Front. Cell. Infect. Microbiol. 2022, 12:746428.
7. Kuo CL, Shiao AS, Yung M, Sakagami M, Sudhoff H, Wang CH, Hsu CH, Lien CF. Updates and knowledge gaps in cholesteatoma research. Biomed Res Int. 2015;2015:854024.
8. Kaya E, Dag I, Incesulu A, Gurbuz MK, Acar M, Birdane L. Investigation of the presence of biofilms in chronic suppurative otitis media, nonsuppurative otitis media, and chronic otitis media with cholesteatoma by scanning electron microscopy. ScientificWorldJournal. 2013 Oct 27;2013:638715.
9. Ricciardiello F, Cavaliere M, Mesolella M, Iengo M. Notes on the microbiology of cholesteatoma: clinical findings and treatment. Acta Otorhinolaryngol Ital. 2009 Aug;29(4):197-202.
10. Stark T, Gurr A, Sudhoff H. Prinzipien der sanierenden Cholesteatomchirurgie [Principles of cholesteatoma surgery]. HNO. 2011 Apr;59(4):393-9.
11. Stacy A, McNally L, Darch SE, Brown SP, Whiteley M. The biogeography of polymicrobial infection. Nat Rev Microbiol. 2016 Feb;14(2):93-105.
12. Guzzo F, Scognamiglio M, Fiorentino A, Buommino E, D'Abrosca B. Plant Derived Natural Products against Pseudomonas aeruginosa and Staphylococcus aureus: Antibiofilm Activity and Molecular Mechanisms. Molecules. 2020 Oct 29;25(21):5024.
13. Lu L, Hu W, Tian Z, Yuan D, Yi G, Zhou Y, Cheng Q, Zhu J, Li M. Developing natural products as potential anti-biofilm agents. Chin Med. 2019 Mar 20;14:11.
14. Guzman JPMD, De Las Alas TPL, Lucban MC, Sevilla CEC. Green tea (Camellia sinensis) extract inhibits biofilm formation in acyl homoserine lactone-producing, antibiotic-resistant Morganella morganii isolated from Pasig River, Philippines. Heliyon. 2020 Oct 23;6(10):e05284.
15. Yin H, Deng Y, Wang H, Liu W, Zhuang X, Chu W. Tea polyphenols as an antivirulence compound Disrupt Quorum-Sensing Regulated Pathogenicity of Pseudomonas aeruginosa. Sci Rep. 2015 Nov 9;5:16158. Erratum in: Sci Rep. 2016;6:17987. Yin, Honging [corrected to Yin, Hongping].

16. Singh BN, Shankar S, Srivastava RK. Green tea catechin, epigallocatechin-3-gallate (EGCG): mechanisms, perspectives and clinical applications. Biochem Pharmacol. 2011 Dec 15;82(12):1807-21.
17. Mihalik K, Chung DW, Crixell SH, JC McLean R, Vattem DA. Quorum sensing modulators of Pseudomonas aeruginosa characterized in Camellia sinensis. Asian J Tradit Med. 2008; 3:12–23.
18. Buchmann D, Schultze N, Borchardt J, Böttcher I, Schaufler K, Guenther S. Synergistic antimicrobial activities of epigallocatechin gallate, myricetin, daidzein, gallic acid, epicatechin, 3-hydroxy-6-methoxyflavone and genistein combined with antibiotics against ESKAPE pathogens. J Appl Microbiol. 2022 Feb;132(2):949-963.
19. Radji M, Agustama RA, Elya B, Tjampakasari CR. Antimicrobial activity of green tea extract against isolates of methicillin-resistant Staphylococcus aureus and multi-drug resistant Pseudomonas aeruginosa. Asian Pac J Trop Biomed. 2013 Aug;3(8):663-7; discussion 666.
20. Aboulmagd E, Al-Mohammed HI, Al-Badry S. Synergism and postantibiotic effect of green tea extract and imipenem against methicillin-resistant Staphylococcus aureus. Microbiol. J. 2011;1:89–96.
21. Yam TS, Shah S, Hamilton-Miller JM. Microbiological activity of whole and fractionated crude extracts of tea (Camellia sinensis), and of tea components. FEMS Microbiol Lett. 1997 Jul 1;152(1):169-74.
22. Cho YS, Schiller NL, Oh KH. Antibacterial effects of green tea polyphenols on clinical isolates of methicillin-resistant Staphylococcus aureus. Curr Microbiol. 2008 Dec;57(6):542-6.
23. Parvez MAK, Saha K, Rahman J, Munmun RA, Rahman MA, Dey SK, Rahman MS, Islam S, Shariare MH. Antibacterial activities of green tea crude extracts and synergistic effects of epigallocatechingallate (EGCG) with gentamicin against MDR pathogens. Heliyon. 2019 Jul 22;5(7):e02126.
24. Bandyopadhyay D, Chatterjee TK, Dasgupta A, Lourduraja J, Dastidar SG. In vitro and in vivo antimicrobial action of tea: the commonest beverage of Asia. Biol Pharm Bull. 2005 Nov;28(11):2125-7.
25. Archana S, Abraham J. Comparative analysis of antimicrobial activity of leaf extracts from fresh green tea, commercial green tea and black tea on pathogens. J. Appl. Pharm. Sci. 2011; 1:149–52.
26. Kumar A, Kumar A, Thakur P, Patil S, Payal C, Kumar A, Sharma P. Antibacterial activity of green tea (Camellia sinensis) extracts against various bacteria isolated from environmental sources. Recent Res. Sci. Technol. 2012;4:19–23.
27. Cui Y, Oh YJ, Lim J, Youn M, Lee I, Pak HK, Park W, Jo W, Park S. AFM study of the differential inhibitory effects of the green tea polyphenol (-)-epigallocatechin-3-gallate (EGCG) against Gram-positive and Gram-negative bacteria. Food Microbiol. 2012 Feb;29(1):80-7.
28. Jeon J, Kim JH, Lee CK, Oh CH, Song HJ. The Antimicrobial Activity of (-)-Epigallocatehin-3-Gallate and Green Tea Extracts against Pseudomonas aeruginosa and Escherichia coli Isolated from Skin Wounds. Ann Dermatol. 2014 Oct;26(5):564-9.
29. Chole RA, Faddis BT. Evidence for microbial biofilms in cholesteatomas. Arch Otolaryngol Head Neck Surg. 2002 Oct;128(10):1129-33.
30. Lampikoski H, Aarnisalo AA, Jero J, Kinnari TJ. Mastoid biofilm in chronic otitis media. Otol Neurotol. 2012 Jul;33(5):785-8.
31. Dommerich S, Frickmann H, Ostwald J, Lindner T, Zautner AE, Arndt K, Pau HW, Podbielski A. Effects of high hydrostatic pressure on bacterial growth on human ossicles explanted from cholesteatoma patients. PLoS One. 2012;7(1):e30150.
32. Shaw E, Wuest WM. Virulence attenuating combination therapy: A potential multi-target synergy approach to treat Pseudomonas aeruginosa infections in cystic fibrosis patients. RSC Med. Chem. 2020;11:358–69.

33. Asfour HZ. Anti-Quorum Sensing Natural Compounds. J Microsc Ultrastruct. 2018 Jan-Mar;6(1):1-10.
34. Huber B, Eberl L, Feucht W, Polster J. Influence of polyphenols on bacterial biofilm formation and quorum-sensing. Z Naturforsch C J Biosci. 2003 Nov-Dec;58(11-12):879-84.
35. Yang L, Liu Y, Sternberg C, Molin S. Evaluation of enoyl-acyl carrier protein reductase inhibitors as Pseudomonas aeruginosa quorum-quenching reagents. Molecules. 2010 Feb 3;15(2):780-92.
36. Belley A, Neesham-Grenon E, Arhin FF, McKay GA, Parr TR Jr, Moeck G. Assessment by time-kill methodology of the synergistic effects of oritavancin in combination with other antimicrobial agents against Staphylococcus aureus. Antimicrob Agents Chemother. 2008 Oct;52(10):3820-2.
37. Shanmugapriya P, Roziahanim M, Nornisah M. Combination of Epicatechin 3-Gallate from Euphorbia hirta and Cefepime Promotes Potential Synergistic Eradication Action against Resistant Clinical Isolate of Pseudomonas aeruginosa. Evidence-Based Complementary and Alternative Medicine, vol. 2018, Article ID 5713703, 7 pages, 2018.
38. Zhao WH, Hu ZQ, Okubo S, Hara Y, Shimamura T. Mechanism of synergy between epigallocatechin gallate and beta-lactams against methicillin-resistant Staphylococcus aureus. Antimicrob Agents Chemother. 2001 Jun;45(6):1737-42.
39. Hu ZQ, Zhao WH, Hara Y, Shimamura T. Epigallocatechin gallate synergy with ampicillin/sulbactam against 28 clinical isolates of methicillin-resistant Staphylococcus aureus. Journal of Antimicrobial Chemotherapy, 2001; 48(3): 361–4

Noul elmex®SENSITIVE PROFESSIONAL cu tehnologia PRO-ARGIN

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

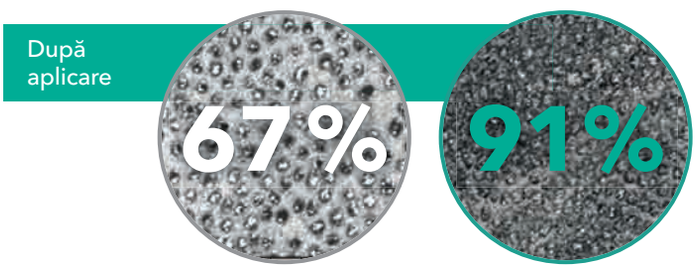
Referințe: 1. Nathoo S, et al. J Clin Dent. 2009;20(Spec Iss):123 –130; 2. Docimo R, et al. J Clin Dent. 2009;20(Spec Iss): 17– 22.; 3. Report Deon Hines-0003, 2016; 4. Studiu Ipsos cu privire la utilizarea produsului elmex® SENSITIVE PROFESSIONAL Repair & Prevent, efectuat în Polonia, rezultate după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

elmex® SENSITIVE PROFESSIONAL realizează obturarea superioară a tubulilor dentinari în comparație cu tehnologiile concurente[1,2,*]

Studiul 1[1,*]

Tehnologia cu fluorură de staniu/ fluorură de sodiu

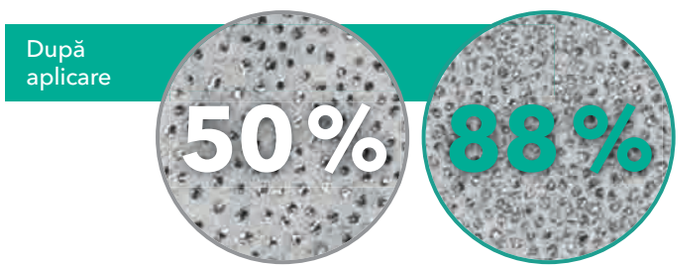
Tehnologia PRO-ARGIN



Studiul 2[2,*]

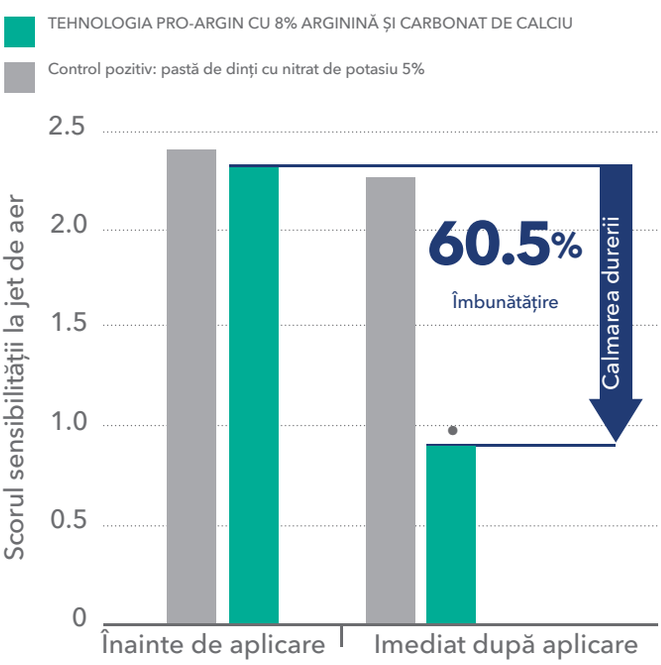
Tehnologia Novamin/ fluorură de sodiu

Tehnologia PRO-ARGIN



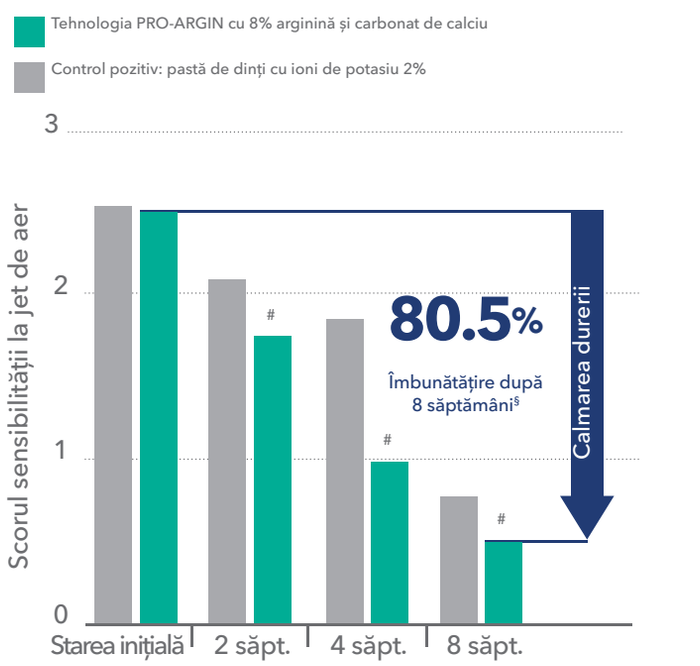
elmex® SENSITIVE PROFESSIONAL oferă calmare semnificativă imediată** și de durată a durerii din sensibilitatea dentară[3,4]

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.

Referințe: 1. Hines D, et al. Poster acceptat, July 2018 IADR. Colgate- Palmolive Company 2018.; 2. Hines D, et al. Poster #0742, March 2018 AADR. Colgate-Palmolive Company 2018.; 3. Nathoo S, et al. J Clin Dent. 2009;20(Spec Iss):123 –130; 4. Docimo R, et al. J Clin Dent. 2009; 20(Spec Iss): 17– 22.

elmex®
SENSITIVE PROFESSIONAL

General anxiety level assessment of dentists in the context of the COVID-19 pandemic

Bojoga (Mocuta) D.E.[1], Miron M.I.[1], Grecea R.[2], Luca M.M.[3], Buzatu R.[4]

[1]Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania and Interdisciplinary Research Center for Dental Medical Research, Lasers and Innovative Technologies, Timisoara, 9 Revolutiei 1989 Ave., 300070 Timisoara, Romania
[2]DMD, Timişoara, Romania
[3]Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[4]Department of of Dental Aesthetics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Miron Mariana
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40 722644842
E-mail address: miron.mariana@umft.ro

Abstract

Since 2020, since the beginning of the pandemic, in Romania, dentistry has been one of the most affected fields of activity, dentists being one of the risk categories, when we refer to general anxiety, in the context of the COVID-19 pandemic. The aim of this study is represented by the evaluation of the anxiety level of dentists, in the context of the COVID-19 pandemic, using a questionnaire. In this study were used 88 dentists who carry out their professional activity with a frequency of at least 5 days/week, in Timiş County and are between 24 and 65 years old. The study found that female dentists (25%) have a higher level of general anxiety than men (20%) in the context of the COVID-19 pandemic. Consequently, the level of general anxiety is high in 2 out of 5 female dentists, while only 1 in 5 male dentists has a high level of general anxiety in the context of the COVID-19 pandemic.

Keywords: anxiety, fear, COVID-19, dentistry

INTRODUCTION

The difference between fear and anxiety is a matter of gradation and especially of cognition. Both can appear in the psychological picture of the adolescent, having a role in his daily functioning and marking him as a future anxious adult, or calm and balanced. We call fear, that state whose object is rather known to the subject, that is, a state that has an emotional and representative content of its object. In contrast to these situations, the word anxiety is often reserved for cases where the object is poorly differentiated cognitively, but it can also be applied to intense fears or those that are repetitive, chronic or pathological [1,2].

In addition to this anxious expectation that anticipates the possibility of unfortunate events, anxiety may be accompanied by muscle tension, motor inhibition and neurovegetative manifestations. Among these, the most common are: palpitations or tachycardia, dizziness or dizziness, hot flashes or colds, redness and paleness, dry mouth, nausea and sore throat [3].

In situations where anxiety acquires a generalized character, in which the elements listed above are exacerbated and may have a more lasting character, we speak of pathological anxiety. Such cases can lead to the inhibition of the subject's action, to the underestimation of the real personal capacities [4].

At the end of 2019, pneumonia with an uncertain aetiology appeared in the Wuhan region from China [5]. There was a lot of information about a pathogen that was contacted from a fish market or a live animal. Initially, the transmission of the pathogen was from animal to human, later starting a rapid transmission from human to human. The pathogen was named "New Corona Virus 2019 (219-nCoV)", and the disease caused by it, "Corona Virus 2019 Disease (COVID-19)" [6].

The COVID-19 pandemic has had and is having a significant impact on the mental health of the population, therefore, monitoring the mental health of the population during pandemic crises is an immediate priority [7,8].

In the case of pandemics such as Severe Acute Respiratory Syndrome (SARS) there have been a number of stressful situations that threaten the physical health and psychological well-being of the individual and his perception that the transmission of the virus is relative and uncontrollable even if taken measures to prevent contamination (for example, wearing a protective mask and avoiding congestion) [9].

Because dentists perform procedures that create aerosols and make direct contact with saliva and blood, the risk of exposure is high among them. As a result, both the dentist and the entire team are extremely vulnerable, with a high possibility of direct exposure to the virus, which also implies a major negative psychological impact [10].

The COVID-19 pandemic continues to have a negative impact on the work of dentists. Routine dental procedures were suspended for a period of two months due to the risk of cross-infection during treatment. Moreover, the oral mucosa has been recognized as a route of virus entry, limiting dental activity only to treating emergencies, to minimize the generation of drops and aerosols. In addition, both companies operating in the field of dentistry and dental practices have decided to suspend their collaboration with some staff [11].

Aim and objectives

The aim is represented by the evaluation of the anxiety level of the dentists, in the context of the COVID-19 pandemic, using a questionnaire.

MATERIAL AND METHODS

With the onset of the pandemic, one of the most important components of the medical health system, dentistry, faced a total restriction on the practice of routine dental treatments for a period of two months. An acute shortage of rules of application of Government Ordinances, developed in order to prevent and combat the transmission of SARS-CoV-2 virus had a negative influence on the level of general anxiety of dentists.

In this study were included 88 dentists who carry out their professional activity with a frequency of at least 5 days/week, in Timiș County and are between 24 and 65 years old. People retired from professional activity, people with chronic or neuro-mental disorders were excluded from the study.

Of the total number of participants, 45 were male and 43 were female. All participants were informed about the purpose and manner of conducting the study and gave their consent to participate.

To conduct this study, a questionnaire was designed using the Google Forms platform (Table I).

Psychometric test used in the study

Sex:.....

Age:.....

GENERAL ANXIETY LEVEL MEASUREMENT SCALE IN THE CONTEXT OF THE COVID-19 PANDEMIC

Below are a number of statements. In the last 2 weeks (14 days), how often have you been bothered by the following issues:

Table 1. The scale for measuring the level of general anxiety in the context of the COVID-19 pandemic. (Lee S., 2020) [9]

	Never	Rarely	Sometimes	Often	Almost alwasy
I had trouble falling asleep or sleeping because I was thinking about COVID-19.	**0**	**1**	**2**	**3**	**4**
I lost my appetite when I thought about it or when I was exposed to information about COVID-19.	**0**	**1**	**2**	**3**	**4**
I felt paralyzed or frozen when I thought about it or when I was exposed to information about COVID-19.	**0**	**1**	**2**	**3**	**4**
I felt dizzy, confused or weakened when I read or heard news about COVID-19.	**0**	**1**	**2**	**3**	**4**
I am an active person who carries out the plans established for me.	**0**	**1**	**2**	**3**	**4**

The questionnaire sent consisted of the socio-demographic information part and the measurement scale part.

The questionnaires were sent to the subjects of the sample using the social media platform, Facebook.

Data collection was performed only once / subject, in January 2022.

The following variables were recorded in this study:

- age;
- sex;
- dizziness;
- sleep disorders;
- tonic immobility;
- decreased appetite;
- abdominal discomfort.

Subjects were asked to rate each item on the scale based on how often they faced the condition in the last 14 days (Tab. 1). The scale consisted of a number of five items, each item corresponding to a state. The assessment of each condition was made by the subjects included in the sample by the following assessment:

1. Never
2. Rarely - at least in a day or two
3. Sometimes - in a few days
4. Often - in more than 7 days
5. Almost always – daily

Each answer corresponds to a score, in order to interpret the results, as follows:

1. Never = 0;
2. Rarely = 1;
3. Sometimes = 2;
4. Often = 3;
5. Almost always = 4.

A score ≥ 9 represents a high level of anxiety.

RESULTS

Of the 88 subjects included in the study sample, 51% (45 subjects) were male and 49% (43 subjects) were female, aged between 24 and 65 years.

For greater accuracy and easier data processing, the age of the subjects was divided into five intervals, as follows:

- age less than or equal to 25 years;
- age between 26 and 35 years;
- age between 36 and 45 years;
- age between 46 and 55 years.

Of the total percentage of subjects included in the study, 36% are between 26 and 35 years old, 25% are between 36 and 45 years old, 14% are between 46 and 55 years old and 14% are under 25 years old.

The analysis of the results based on the study criterion was done using the anxiety assessment scale in the context of the COVID-19 pandemic.

Of the total percentage of male subjects, included in the sample, to the statement "I had trouble falling asleep or sleeping because I was thinking about COVID-19", only 23% said they had not once had problems with sleep due to the COVID-19 pandemic, while 77% of them say they had (Fig. 1).

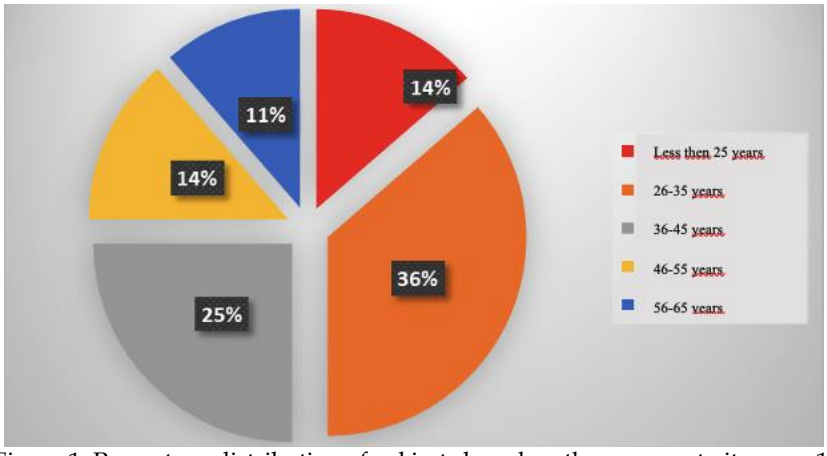


Figure 1. Percentage distribution of subjects based on the answers to item no. 1.

Of the total percentage of subjects included in the sample, in the statement "I lost my appetite when I thought about it or when I was exposed to information about COVID-19", only 26% stated that they had no problems with appetite, while 74% of them say they had (Fig. 2).

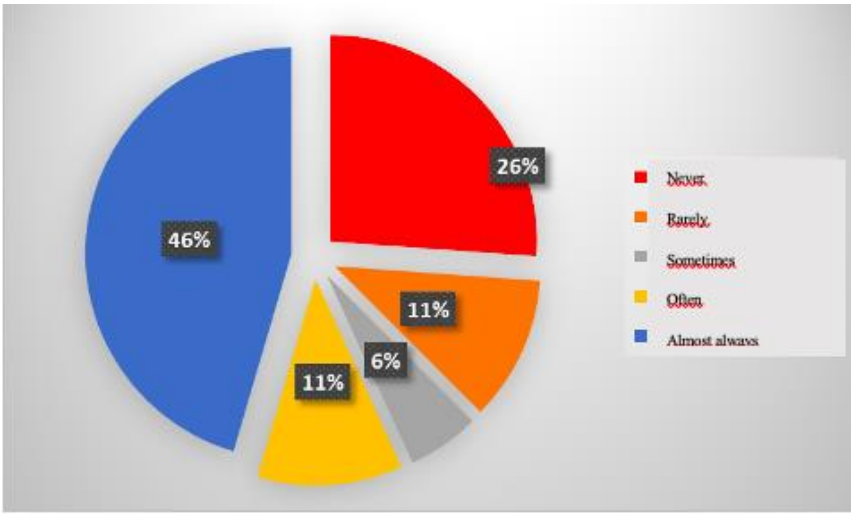


Figure 2. Percentage distribution of subjects based on the answers to item no. 2.

Of the total percentage of subjects included in the sample, in the statement "I felt paralyzed or frozen when I thought or when I was exposed to information about COVID-19", 77% stated that they were they almost always felt paralyzed or frozen when they thought or were exposed to information about the COVID-19 pandemic, 6% often, 11% sometimes, and 6% rarely (Fig. 3).

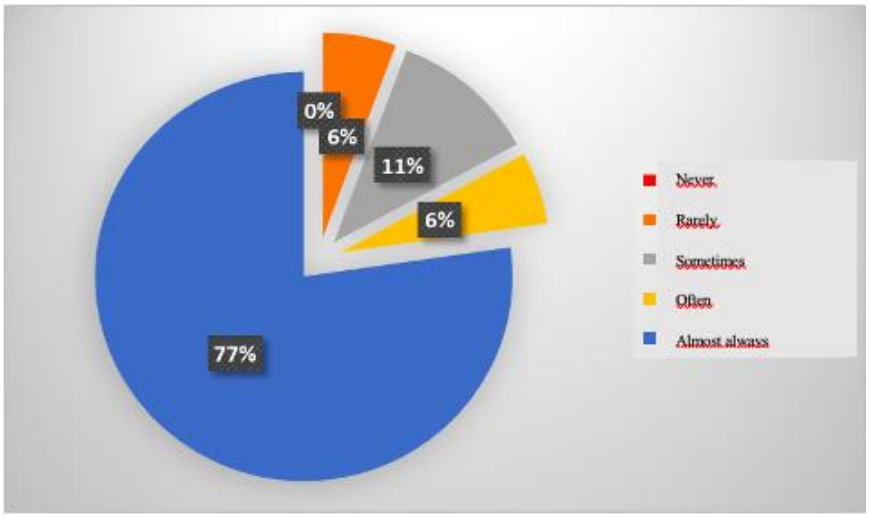


Figure 3. Percentage distribution of subjects based on the answers to item no. 3.

Of the total percentage of subjects included in the sample, for the statement "I felt dizzy, confused or weak when I read or heard news about COVID-19", 77% said they felt almost always dizzy, confused or weak when I read or heard news about the COVID-19 pandemic, 6% often, 11% sometimes, and 6% rarely (Fig. 4).

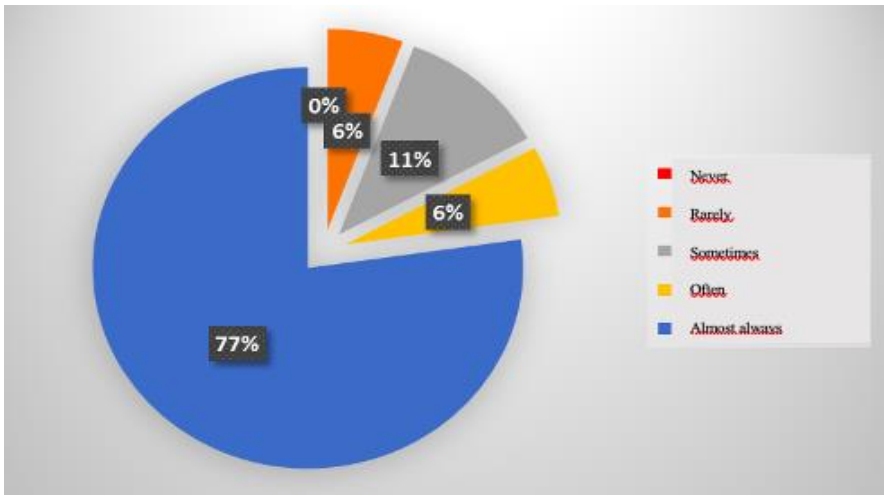


Figure 4. Percentage distribution of subjects based on the answers to item no. 4.

Of the total percentage of subjects included in the sample, the statement "I was nauseous or had a stomach ache when I thought about it or when I was exposed to information about COVID-19", all remarked at least once the installation of a physical reaction at the time of a mention of the COVID-19 pandemic (Fig. 5).

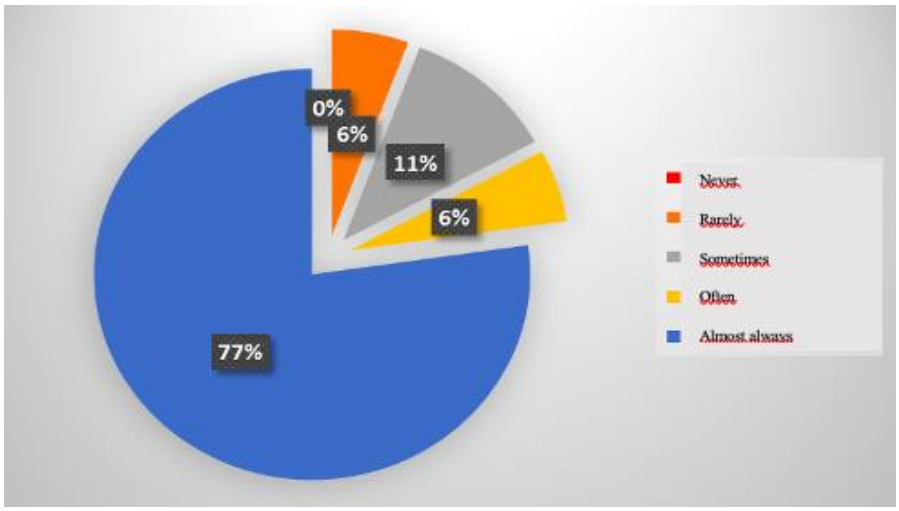


Figure 5. Percentage distribution of subjects based on the answers to item no. 5.

DISCUSSIONS

The results of this study showed that 25% of female subjects (11 subjects) included in the study had a score greater than or equal to 9, while only 20% of male subjects (9 subjects) included in the study had a score greater than or equal to 9.

Subjects with a score greater than or equal to 9 may experience certain conditions: dizziness, sleep disturbance, tonic immobility, loss of appetite, or nausea [4,12].

Dizziness, which is the fourth item on the scale, is a major symptom of panic attacks and an associated feature of generalized anxiety disorder (American Psychiatric Association, 2013) [13,14,15].

Sleep disorder, which is the second item on the scale, is a common symptom of both generalized anxiety disorder and post-traumatic stress disorder (American Psychiatric Association, 2013) [6,7].

Tonic immobility, which is the third item on the scale, is not a major symptom of any psychiatric condition [7,10].

Loss of appetite, which is the fourth item on the scale, is a common symptom of major depressive disorder, a condition that often occurs in conjunction with panic disorder (American Psychiatric Association, 2013). Loss of appetite is also a visible sign of fear, as it reflects the biological process of blood leaving the digestive tract in areas of the body that mobilize the person to deal with an imminent threat [4,12].

Abdominal nausea or distress, which is the last item on the scale, also captures the digestive changes associated with a fear response. Similar to dizziness, nausea and abdominal distress are also major symptoms of panic attacks and are features associated with generalized anxiety disorder (American Psychiatric Association, 2013) [6,12].

Although the scale items focus on reactions related to anxiety and trauma, the fact that they are focused exclusively on stressful bodily symptoms makes them extremely relevant for somatic symptoms and associated disorders (American Psychiatric Association, 2013).

For the age group up to 25 years, no scores higher than 9 were recorded.

For the age category 26 - 35 years, no scores higher than 9 were registered.

For the age category 36 - 45 years, 5 scores higher than 9 were registered, 3 being attributed to the male sex, and 2 to the female sex,

For the age category 45 - 55 years, 6 scores higher than 9 were registered, 4 being attributed to the female sex, and 2 to the male sex.

For the age category 56 - 65 years, 9 scores higher than 9 were registered, 5 being attributed to the female sex, and 4 to the male sex.

The limitations of the study were represented by the small number of subjects included in the study.

CONCLUSIONS

Anxiety is a complex phenomenon, a phenomenon that has both a psycho-social and a physical component. In addition to the problems facing humanity, in 2019 the pandemic COVID-19 began, which has become a risk factor for anxiety.

Following the study, it was found that the level of general anxiety of dentists, in the context of the pandemic with COVID-19 virus, participants in the study, is high, and the quality of sleep, social relationships and psycho-emotional and physical health being all altered due to this pandemic.

The study found that female dentists (25%) have a higher level of general anxiety than men (20%) in the context of the COVID-19 pandemic.

Consequently, the level of general anxiety is high in 2 out of 5 female dentists, while only 1 in 5 male dentists have a high level of general anxiety in the context of the COVID-19 pandemic.

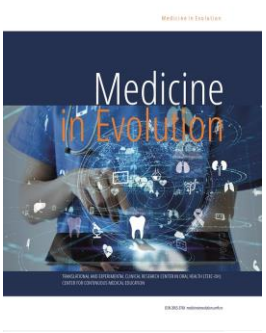
Sinces the beginning of the pandemic, in 2020, in Romania, dentistry has been one of the most affected fields of activity, dentists being one of the risk categories, when we refer to general anxiety, in the context of the COVID-19 pandemic.

REFERENCES

1. Abel M, Sewell J. Stress and Burnout in Rural and Urban Secondary School Teachers. The Journal of Educational Research. 2016;92(5):287-293.

2. Alharthy N, Alrajeh O, Almutairi M, Alhajri A. Assessment of anxiety level of emergency health-care workers by generalized anxiety disorder-7 tool. International Journal of Applied and Basic Medical Research. 2017;7(3):150.
3. Aniţei M. Fundamentele psihologiei. Bucureşti: Editura Universitară; 2010.
4. Association A. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). Washington, D.C.: American Psychiatric Publishing; 2013.
5. Baghizadeh Fini M. What dentists need to know about COVID-19. Oral Oncology. 2020; 105:104741.
6. Bäuerle A, Teufel M, Musche V, Weismüller B, Kohler H, Hetkamp M et al. Increased generalized anxiety, depression and distress during the COVID-19 pandemic: a cross-sectional study in Germany. Journal of Public Health. 2020;42(4):672-678.
7. Giacobbe P, Flint A. Diagnosis and Management of Anxiety Disorders. CONTINUUM: Lifelong Learning in Neurology. 2018; 24:893-919.
8. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiatry Research. 2020; 288:112954.
9. Lee S. Coronavirus Anxiety Scale: A brief mental health screener for COVID-19 related anxiety. Death Studies. 2020;44(7):393-401.
10. Salari N, Hosseinian-Far A, Jalali R, Vaisi-Raygani A, Rasoulpoor S, Mohammadi M et al. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. Globalization and Health. 2020;16(1).
11. Salari N, Khazaie H, Hosseinian-Far A, Khaledi-Paveh B, Kazeminia M, Mohammadi M et al. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. Human Resources for Health. 2020;18(1).
12. Schröder J, Blank R. Managementul stresului. Bucureşti: All; 2011.
13. Shah S, Mohammad D, Qureshi M, Abbas M, Aleem S. Prevalence, Psychological Responses and Associated Correlates of Depression, Anxiety and Stress in a Global Population, During the Coronavirus Disease (COVID-19) Pandemic. Community Mental Health Journal. 2020;57(1):101-110.
14. SU T, LIEN T, YANG C, SU Y, WANG J, TSAI S et al. Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: A prospective and periodic assessment study in Taiwan. Journal of Psychiatric Research. 2007;41(1-2):119-130.
15. Walton M, Murray E, Christian M. Mental health care for medical staff and affiliated healthcare workers during the COVID-19 pandemic. European Heart Journal: Acute Cardiovascular Care. 2020;9(3):241-247.

Management and treatment in tooth discoloration



Buzatu R.[1], Luca M.M.[2], Valceanu A.S.[1], Chirila A.V.[3], Miron M.I.[4]

[1]*Department of Dental Aesthetics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*
[2]*Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania*
[3]*Young dentist, Privat Ofifice*
[4]*Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*

Correspondence to:
Name: Magda Luca
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40 725724706
E-mail address: luca.magda@umft.ro

Abstract

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.

The aims of this study is evaluation of color change and sensitivity that occur in all the teeth. By

Mean, a comparison between 2 main categories of treatment to cure tooth discoloration. In – office bleaching treatment and home bleaching treatments. This article is a systemic review study research.

Bleaching techniques and other methods used for removing discolorations and stains suffered various improvements over the years such as aesthetic outcome and the reduction of secondary reactions. Development of Home Bleaching products is an outcome of improvements made in this domain, though they are not realised by a professionist and do not qualify as quality equal. Therefore, professional bleaching represents an efficient, safe and sustainable method for this kind of therapy, but home bleaching techniques do give relative good results at a considerable lower cost of treatment.

Keywords: Bleaching, Tooth whitening, Home Bleaching, Discolorations, professional techniques

INTRODUCTION

In recent years, cosmetic dentistry has been receiving increasing attention due to the growing interest of patients in the aesthetic appearance of their smile. It is undeniable that today's society is looking for white teeth and attractive smiles. A bright smile is a sociological asset, with a strong psychological impact on the subject himself, but also on the people around him. The natural and aesthetic appearance of a tooth is determined not only by its morphology and its position in relation to the other teeth, but also and above all by its color. Even though the bleaching technique has been known for long time, it was by a handful of practitioners in the past. Like pioneers, they gradually developed and adjusted various techniques. In the 19th century, the use of oxalic acid (Chapple, in 1877) and (Taff and Athenon, in 1879) was proposed for bleaching vital teeth, before hydrogen peroxide was introduced by Harlan for the first time in 1891. However there were also other method has been used in the past such as electric current in 1895 and the application of ultraviolet by Rossental in 1911. In 1918, Abbot used hydrogen peroxide activated by light or heat. This technique was updated by Torres in 1983, and by Goldstein in 1987. Finally, in 1989, the ambulatory techniques by Haywood and Heymann, as opposed to the classic chair side techniques. In the present time, there are 2 techniques that have been outlined, first is Ambulatory or at home bleaching which need to have intraoral device or tray that patient can apply peroxide gel. Second technique is in office by professional technique, dental practitioner will be using photo -activation. This allows the modification in the color of the enamel from the first treatment. [1]

However, many products are commercially available, as are treatments supervised by a dentist, offered to the patient in order to solve a wide variety of dental dyschromias without restorative intervention. Choosing the correct treatment methods, it is important for dental practitioner to understand the etiology and severity of dental dyschromias for the best results and no harm to the dental health of the patient. [2]

Teeth whitening, also called teeth bleaching, is an aesthetic procedure to meet the needs of patients who want to have white teeth. Home-based whitening products with bleaching properties have become popular and accessible to more people because bleaching with bleaching agents can be done at home with prescribed of dentist or purchased over-the-counter. There are many products available on the market today such as hydrogen peroxide, carbamide peroxide, sodium percarbonate, sodium hexametaphosphate, sodium tripolyphosphate, and calcium peroxide. All These agents have a wide range concentrations and characteristics acting as gel in tray, strips, paint-on gel, chewing gum, and mouthwash which have varying application times and duration of treatment. [3]

However, techniques of home bleaching use a low concentration of 10-20% of bleaching agents that’s why patients have to do multiple bleaching sessions to achieve satisfactory results. While professional technique in the office, teeth whitening will use about 35% high concentration whitening solution and various technologies. To stimulate the effectiveness of the teeth whitening solution to work better, such as cool light, LED light, or laser light to whiten patient’s teeth several shades in one session. [4]

Home bleaching with custom trays (Dentist-supervised home bleaching)

Supervised dental bleaching using dental trays is one of the most commonly used approaches to whiten patient teeth. The technique of tray whitening was first described in dental research in 1989. In 1990s this method became more widespread and it was accepted by dental community as a whole. The advantages of this method are easy to use, less time consuming, cause less sensitivity and gingival irritation when compared to the professional technique of teeth whitening. 10% carbamide peroxide has been the most used for this kind of

procedure. However, increasing the concentration of the bleaching agents have been used or new bleaching agents containing 3% to 10% hydrogen peroxide have been released. Home bleaching with hydrogen peroxide with custom trays was introduced to reduce bleaching time but maintaining the effectiveness. A carbamide peroxide gel containing desensitizing agents that could be applied in a shorter time has also been proposed to reduce the intensity of tooth sensitivity. [5]

Home Bleaching with trays can be done at home following dentist's advice. Before starting process of whitening patient teeth, professional dental hygiene and treatment of any other dental problems like decay or periodontal disease are essential. Next step is making patient's tray. [6]

Even though, at home bleaching with custom trays method is convenience, short time consuming and cheaper than professional (in office) technique. There are still side effects that can be sometimes encountered by the patient. Tooth sensitivity and gingival irritation were the most common side effect that has been reported after bleaching procedure. [7]

Bleaching tray

There are 2 types of bleaching tray that available on the market. Some are thin and hard, it is suitable for treating individual teeth and give a better seal as oxygen release by the active agent is diluted by saliva. There are also standard trays with most bleaching systems which are thicker and softer but it can be used only full arch coverage due to their non-retentive properties. They are less irritating and easier to use for both dentist and patient. [8]

Over-the-Counter Teeth Whitening

In the present time, there are various types of home bleaching products available in the market all around the world. Most of the manufacturers claim that these products It has the ability to make teeth whiter. [9]

Chewing gum

Chewing gum containing sodium hexametaphosphate (4.0 - 7.5%) was added on the market. This product claims to prevent the formation of colored spots on the tooth and whiten teeth. But this kind of product usually doesn't give dramatic results. Whitening chewing gums contain abrasives which scrub the surface of teeth and remove stains. Titanium dioxide and baking soda are also found in whitening gums, it has properties of polishing the surface of the teeth and whitening. Some whitening gums have an ingredient called Calpox or calcium peroxide. It helps oxidize stains, making them easier to remove from the teeth. [10]

Mouthwash

Mouthwashes, or rinsing solutions have recently appeared on the market, and manufacturers say they can remove stains and decrease plaque formation. Usually, mouthwash has a low concentration of hydrogen peroxide and sodium hexametaphosphate can also be included in the formulation. [11]

Dental floss

Whitening dental floss has been created by manufacturers to promote reduction of colorations in interproximal areas. The shrinkage properties of stains are associated, by the presence of silica in the composition, with properties abrasive at the superficial level when applied in the interdental region. [12]

Toothbrush

In addition to being used as part of normal oral hygiene, the toothbrushes manual and electric teeth can also be used to maintain a brightening effect or to prevent extrinsic staining after bleaching treatmen. [13]

Toothpaste

Toothpastes claiming whitening properties represent more than 50% of products available over the counter and rarely contain sodium peroxide carbamide or hydrogen, or any other kind of bleaching agent. Their ability to removing stains is linked to the large amount of

abrasive elements contained in their formulation, which eliminates extrinsic superficial colorings. The active components of "whitening" toothpastes include enzymes that break the organic molecules of the biofilm. In addition, abrasives such as alumina, dehydrated dicalcium phosphate, and silica are also included in the formulation to help eliminate discoloration. However, the abrasiveness of these toothpastes must be moderate in order to prevent excess wear of the underlying enamel and dentin. [14]

Varnish (paint-on-gel)

Whitening varnishes are lightening products available in the market that have carbamide or hydrogen peroxide in suspension. The varnish is affixed to the surface of the teeth with an applicator, usually comparable to brush, and will adhere to the surface of the enamel. [15]

Universal trays with commercial gel

We can now find in shops or on the internet imitating the ambulatory technique proposed by dental surgeons. These are universal thermoformable trays that the user adapts himself to his teeth after having immersed them for a few seconds in the water. Heat making them soft and pliable. Then immediately places them in mouth, compresses them with his fingers so that they take the shape of the teeth; and wait a few minutes for them to harden. [16]

Once the trays are molded, they can receive a bleaching gel, most often containing carbamide peroxide, but the concentrations of which are rarely indicated. Manufacturers claim results comparable to professional outpatient treatment. [17]

Whitening strips

These products were created to avoid the use of trays. Those are adhesive strips with bleaching agents contained in a very viscous in a thin layer on the adhesive side of the strip. They are bonded to the buccal surface of the maxillary anterior teeth and mandibular, usually up to the first premolar, and have a small flap folding over the lingual surface. The active agent, applied evenly to the surface teeth, is hydrogen peroxide in concentrations ranging from 5 to 14%, and is released over relatively short periods of time, ranging from 5 to 60 minutes. [18]

Professional techniques (In-office)

In office bleaching technique was introduced in the last two decades, It is a technique that can be offered in certain severe cases or in patients in a hurry wishing to limit the treatment in the time.

This technique has a faster result, the control of the contact of agents with soft tissues and that of the possible ingestion of product. [19]

Many techniques have been developed since the 1970s. However, they all consist of the application of a product highly concentrated in hydrogen or carbamide peroxide directly on the pulped teeth after protection of gum tissue. The concentrations are generally 35% for carbamide peroxide, and can range for 15 up to 35% hydrogen peroxide. [20]

Today we have them often found in the form of ready-to-use gels, packaged in a single or two tanks. The new generations offer a higher viscosity. The principle active agent can be combined with a copolymer, with sodium and calcium fluoride, as well as for some, to titanium dioxide. [21]

Some of these adjuvants give the gel a putty consistency and a color, which allows to visualize and control the excess at gum level. There are also products in powder and liquid form to mix, considered to be more stable, and used in particular in the Baratieri technique: the mixture has the property of changing color; turquoise green at the start of activation, it turns white when no longer active, indicating that it needs to be renewed. [22]

These various techniques are distinguished by the specific products used, but are also

characterized by specific activation systems and protocols precise operating procedures. So today we find many modes of activation of peroxides of hydrogen, which accelerate and potentiate the lightening effect. AT the origin we used the classic halogen lamps intended for the photopolymerization composites; then appeared high-energy lamps: halogen, plasma, laser, xenon, UV; which allow both arcades to be illuminated simultaneously. Currently we even find methods using chemical or ultrasonic activators.

In all cases, the important thing is to have a good match between the chosen gel, its

concentration, and its mode of activation, which must be adapted in terms of power and wavelength. [23]

Aim and objectives

The aims of this study is evaluation of color change and sensitivity that occur in all the teeth. By mean a comparison between 2 main categories of treatment to cure tooth discoloration. In – office bleaching treatment and home bleaching treatments.

MATERIAL AND METHODS

This article is a systemic review study research. This literature review was carried out in two stages.

The first search was in January to February 2021 on the professional bleaching techniques and its efficient, including adverse effect. A comprehensive search was perform on vary of textbook and from sites such as Pubmed, Web of science, Scopus, Cocharane, reserchgate and Springer link.

The studies was searched in 2 languages: English, French. The following keywords:

Whitening, bleaching, tooth whitening, home bleaching, professional technique, discoloration, commercial whitening product.

All the researches were from 2011 to 2020. The studies that was included in this thesis were Meta-analyzes and systematic reviews, Critical reviews, longitudinal studies and case reports. When there was limited literature to find on a topic, case reports were used. We have also used relevant books to complement some topics.

Then, from March to May 2021, the same research on the home bleaching techniques. Which performed in the same databases and concerning the same types of articles with the search equation.

Exclusion and Inclusion criteria

Inclusion criteria

1. The studies from the year 2011 to 2020
2. Articles evaluating the efficiency of different bleaching product
3. The studies that has the result or descried the efficient of one of bleaching technique
4. The studies that contain the adverse effect of bleaching technique

Exclusion criteria

1. Studies that are too old. Or the studies that contributed for more than 10 years
2. Articles like product advertising
3. The articles that are in other languages

Data collection

A first selection was made using the titles of the articles. Subsequently, the abstracts were analyzed to keep Meta-analyzes and systematic reviews, Critical reviews, longitudinal studies and case reports. Comparing between profession bleaching technique and home bleaching technique. Finally a search manual was carried out using the sources contained in the selected journals and not detected by the search equation.

RESULTS

Effectiveness of professional techniques

As part of clinical research (BIZHANG, CHUN and DAMERAU, 2011), two professional whitening systems were compared: one is a treatment outpatient (Illumine Home, a 10% carbamide peroxide gel worn at night in a splint for two weeks), the other a chairside treatment (Illumine Office,15% hydrogen peroxide gel in a tray for 45 minutes, three times every three weeks). It emerged that the two treatments allow to evenly to brighten teeth and maintain results beyond three months.

Similarly, a recent study (DAN, et al., 2012) comparing a treatment outpatient (10% carbamide peroxide gel worn at night in a gutter) and chairside treatment (25% hydrogen peroxide gel for one hour) shown that 5 days of outpatient treatment at home produces the same clarification than a one-hour chair treatment session. However, the patients in the trial said they preferred outpatient treatment, especially for convenience.

In 2011, Kim (Kim, et al., 2011) demonstrated that wearing during the night of a splint with 15% carbamide peroxide produced lightening significantly more than 10% carbamide peroxide gel.

However, a similar comparison (MATE, et al., 2015) showed that the difference obtained by the use of these two agents became insignificant if the study was continued for a further 4 weeks.

Gerlach (GERLACH, GIBB and SAGEL, 2011) compared three concentrations different

carbamide peroxide applied for two hours a day and not noted no difference in results between 10% and 15% carbamide peroxide, but a statistically significant color difference between 10% and 20%, and between 15% and 20%.

Effectiveness of over-the-Counter teeth whitening

By Evaluation of different commercial products

- **Chewing gum**

A study (GRAND and PAIGE, 2015) showed that chewing gum whitening containing sodium hexametaphosphate reduces the formation of stains by 33% compared to a treatment without chewing gum.

However, another study (MASON, HANA and SAMANTHA, 2012) comparing the ability to eliminate coloring of two chewing gum containing nicotine with a chewing gum whitening has shown that the former were more effective in the removal of extrinsic stains as lightening chewing gum.

- **Toothpaste**

In addition, an in vitro study, published in Brazilian Oral Research (LIME,

SILVA and AGUIAR, 2018), sought to determine the whitening potential of three toothpastes compared to a placebo. Twenty bovine incisor blocks, including enamel and dentin, were randomly divided into four groups: G1 distilled water, G2 Colgate Regular toothpaste, G3 Crest Extra Whitening toothpaste, G4 Rapid toothpaste White. The teeth were stained by immersion in black tea, then brushed by a electric toothbrush with the corresponding toothpaste. After analyzing the photo reflectance, only Rapid White toothpaste was found to be effective in removing extrinsic stains, while there were no notable differences between the control group and Colgate Regular or Crest Extra Whitening.

In another study examining the effectiveness of stannous fluoride toothpaste and sodium hexametaphosphate (HE, BAKER and BARTIZEK, 2019), the tests demonstrate a significant effectiveness of this type of toothpaste in removing stains extrinsic colors.

- **Varnish**

Concerning varnishes, some authors (HAMAYASHI and YAKIBANI, 2019) estimate that the application of a 6% hydrogen peroxide gel by a paint-on-gel system shows significant

clinical results, whether applied by a practitioner in the office or by patients themselves at home.

The trial of a new varnish (ZIRRY, et al., 2016) containing peroxide 8% carbamide has been shown to be effective, with an improvement of two shades on the Chromascope shade guide.

Another study (KISHA, et al., 2016) compared four varnish. Of the four, only two, the Crest Night Effects and the Colgate Simply White, managed to brighten teeth significantly, unlike Beautifully Bright and Sparkling White, without effects after two weeks of treatment.

• **Strips**

In 2012, 30 students from a university in Mexico City participated in an essay on Crest White strips Professional 6.5% Hydrogen Peroxide Strips. He was demonstrated a very significant improvement in the color of the teeth after three weeks of use (GURRABIRO, et al., 2012).

Another study, conducted in 132 children and adolescents, also showed that the strips were an effective means of tooth whitening (DONLY and GERLACH, 2012).

In a study followed over a somewhat longer term, Gerlach reported that six months after treatment using Crest Whitestrips, most teeth had retained their color improvement, significant compared to the initial situation or the placebo group. On the other hand, it turned out that younger subjects showed initially a greater decrease in yellows compared to older subjects, but after 6 months there was no longer any color difference between young and old subjects.

Comparison of professional and over - counter methods

Aushill's study (AUSCHILL, HELLWIG and SCHMIDALE, 2015) aimed to assess the ability of three different lightening techniques to clarify the teeth of 39 patients in 6 shades on the Vita Shade Guide shade guide. Group A (n = 13) has used commercial whitening strips (Hydrogen peroxide whitestrips at 5.3%, twice 30 minutes per day), group B (n = 13) outpatient system Opalescence PF, a 10% carbamide peroxide gel wore overnight for eight hours in a custom-made gutter in the laboratory after alginate impression mouth of the patient, and group C (n = 13) was treated in the chair with the Ultra system Opalescence boost with 38% hydrogen peroxide applied to the surface vestibular teeth for 15 minutes, the gum protected by a dam. All treatments cleared the teeth to six shades, but at different speeds. It therefore took an average of 31 strips of use cycles to achieve this result, about 7 for outpatient treatment, and only three chairside treatment sessions. So the speed of action seems directly linked at the concentration of lightening agent.

In another study (FERRARI, M., CAGIDIACO, 2017), the Opalescence outpatient treatment system (a gel containing 10% carbamide in a suitable gutter) was confronted with Crest Whitestrips (6% hydrogen peroxide strip). Using these 30 minute treatments per day for two weeks in both cases cleared the teeth, but with significantly better results with strips. However, it should be noted that in this study the strips benefited from a larger quantity of agent brightening, since the 10% carbamide peroxide of the Opalescence system corresponds in terms of peroxide ions released to 3% hydrogen peroxide (compared to 6% for the strips tested here). Likewise, Crest 6.5% Hydrogen Peroxide Whitestrips have been compared to the Nite White Excel system, a 10% carbamide peroxide gel in a suitable gutter. Once again, the strips have shown effective superior in terms of clarification, but again they were more concentrated in agent lightening than the gel of the gutter (KARPINIA, MAGNUSSON and SAGEL, 2012) (GERLACH, ZHOU, 2012).

Thus, another study (GERLACH, GIBB and SAGEL, 2012) undertook to compare Whitestrips Crest (with 5.3% hydrogen peroxide) with the Opalescence system but with different levels of carbamide peroxide concentration: 10, 15 and 20%. If the concentrations at 10 and 15% did not reveal any significant differences with the strips, the 20% Opalescence gel

on the other hand provides a significant lightening greater than that resulting from the use of Whitestrips.

Similarly, two professional techniques tested by Bizhang (outpatient treatment with 10% carbamide peroxide gel worn at night in a splint for two weeks; and chairside treatment with peroxide gel 15% hydrogen in a gutter for 45 minutes, three times every three weeks) after 3 months show better results than Crest Whitestrips, 6% hydrogen peroxide lightening strips, available over the counter (BIZHANG, MIN and HAMAYACHI, 2011).

Likewise, the study of Woo (WOO, 2013) found a significant difference between the use of Day White gel with 16% carbamide peroxide and that of strips with 6.5% hydrogen peroxide, in favor of gel in the gutter, even though it delivers a lower amount of peroxide ions. It is therefore interesting to carry out the meta-analysis of these comparisons between whitening strips (hydrogen peroxide concentrations 5.3 to 6.5%) and gel in a trays with three levels of carbamide peroxide concentration: 10, 15/16 and 20%. Strips are thus significantly more effective than trays with gel when this contains 10% carbamide peroxide, but the gel becomes significantly more effective when the carbamide peroxide reaches 20%.

In view of all these studies, we can conclude that the whitening strips represent the most effective solution among the techniques available in commerce, which in some cases can even compete in efficiency with professional techniques. However, it is all a question of the concentrations of bleaching agent, and at high levels, especially in the case of colorings supported, professional techniques remain the first choice solutions; the ambulatory technique is also the preferred one, because it is better supported, by patients.

DISCUSSIONS

In the present time, manufacturers have been able to develop a complete range of bleaching products, available in supermarkets or on the internet, within the reach of all patients. Easy to use, the most efective use the same active ingredient, hydrogen peroxide as professional products. [24]

Logically, by using identical molecules, these products in some cases provide results similar to those of the Professional treatments. Everything is a question of the choice of system (Tray, strips, direct application on the teeth), application time, treatment duration, but above all concentration. The dosage between concentration of the bleaching product and processing time is especially important. In any case, some systems available in the trade, in particular lightening strips, can provide, from a certain concentration of active principle, results deemed satisfactory in terms of for clarification. [25]

The undeniable advantage of these commercial techniques lies in the cost of significantly lower treatment for the patient. Indeed, the price of the systems of whitening available over the counter is in a range of 10 to 60 euros, a session in a "smile bar" costs on average 79 euros, while the price of whitening treatment in a dental office generally varies between 400 and 800 euros. We can thus understand the enthusiasm of patients for these treatments do-it-yourself alternatives. [26]

In term of quality of treatment and great result, Professional treatments will always have a primary advantage: the knowledge and experience of a dentist. As has already been demonstrated, this knowledge often plays an essential role in the success of a whitening treatment. They are in particular a guarantee of quality. Only the dentist is able to make the etiological diagnosis and to identify the various interacting factors in a whitening treatment, such as the presence of restorations, crowns, pulped teeth etc. Once all these elements are in hand, he will be able to propose the most suitable treatment. Indeed, each case of clarification is specific, and it is nonsense to sell universal solutions as is done in shops. [27]

Expertise and medical knowledge for a precise treatment, in addition to this qualitative aspect, it must also be admitted that only recourse to the dentist guarantees all the safety conditions necessary for the smooth running of the treatment.

However, this duality in terms of quality in the treatment offer the pernicious thing about this clarification is that it creates a two-tier system of care. Patients who cannot afford the treatments provided by a dental surgeon, or not having understood the interest, expose themselves to significant risks related to the insufficiently controlled use of highly active products. They are not able to avoid the various pitfalls inherent in this type of treatment. Many the authors warn against certain abuses, which may in particular lead to overdoses, patients sometimes combining treatments (for example sessions in smile bar accompanied by a treatment with strips at home). [28]

CONCLUSIONS

The many improvements made to bleaching dental techniques have led to the development of a wide range of products, putting a consumer increasingly demanding in terms of aesthetics in front of a complex choice when he decides to lighten his smile. He can thus call on a dental surgeon and in this way trust the expertise of a professional enlightenment professional, or rely on a more economical solution by choosing one of the many systems today delivered in the trade.

The treatments offered by dental surgeons are techniques proven to be effective for some time. They also benefit from the practitioner control, guaranteeing real safety. We can note a preference for outpatient treatment, less aggressive while treating the tooth more depth, and offering the advantage of being carried out in the patient's home. Faced with these professional means, there is a large number of techniques in over-the-counter, with a wide variety of effectiveness levels. If some products have unsatisfactory results, such as mouthwashes or chewing gum, others with contrary allow a real clarification. These include gutters universal combined with a peroxide gel, inspired by outpatient treatments professionals, and lightening strips or "strips". Along with these DIY techniques a new type of business has developed, bars smile, copying the methods of dental surgeons, without however benefiting from the knowledge necessary for their perfect mastery.

Indications for the appropriate use of methods and products teeth whitening are dependent on a correct diagnosis of dyschromia. The treatments should therefore imperatively be supervised by a practitioner, able to confirm the indication, prepare teeth for treatment, monitor the effects secondary, choose the appropriate method and products, and prepare, if necessary, perfectly adapted gutters; in order to maximize benefits while decreasing the harmful effects.

On the other hand, if, according to the literature, the risks associated with these techniques appear to be limit to dentinal hypersensitivities and transient mucosal irritations, it However, it should be noted that many of these studies show significant biases, because sponsored by pharmaceutical producer groups, and what is more on very short observation periods. Many authors warn against drifts and excesses linked to the trivialization of the use of these very corrosive substances by inexperienced people.

These treatments can therefore only be considered as a comprehensive therapy including a specific examination and full patient care, bringing together all the medical aspects of dental treatment. This aspect has led various countries to strengthen their regulations. So the UK health department has already banned preparations containing more of 0.1% hydrogen peroxide, while in the United States, the birthplace of development of over-the-counter dental whitening, American Dental Association has published recommendations that must meet the products for clarification. Finally, in response to concerns surrounding the

use unfortunate lightening substances, the decision taken by the European Union to reserve to dental surgeons only the delivery of products containing more than 0.1% hydrogen peroxide constitutes, if necessary, a recognition of the practitioner's authority in dental whitening.

Different treatment modalities are available to the patient designing a whiter smile. Tooth sensitivity and gingival or mucosal irritation are the most common side effects of vital tooth-bleaching. However, ADA recognized products tend to include agents to minimize or

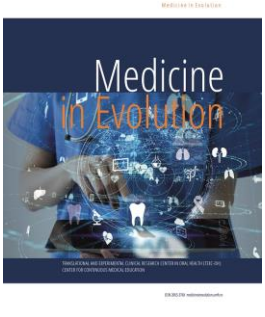
prevent these side effects. Dentists should educate themselves to be able to inform their patients about the benefits and risks of different whitening methods based on the current scientific evidence and to suggest the best treatment option based on a correct diagnosis.

REFERENCES

1. Lajnert V, Pavičić DK, Gržić R, Kovač Z, Pahor D, Kuis D, et al. Influences of age and maxillary anterior teeth status on patient's satisfaction with dental appearance and tooth colour. Gerodontology. 2012;29(2):e674-679.
2. Al-Zarea BK. Satisfaction with appearance and the desired treatment to improve aesthetics. Int J Dent. 2013;2013:7.
3. Tin-Oo MM, Saddki N, Hassan N. Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics. BMC Oral Health. 2011;11:6.
4. Berteretche M-V. Esthétique en odontologie. Editions CdP; 2014. 240 p.
5. He L-B, Shao M-Y, Tan K, Xu X, Li J-Y. The effects of light on bleaching and tooth sensitivity during in-office vital bleaching: a systematic review and meta-analysis. J Dent. 2012;40(8):644-53.
6. Alqahtani MQ. Tooth-bleaching procedures and their controversial effects: A literature review. Saudi Dent J. 2014;26(2):33-46.
7. Buzek J, Ask B. SANTÉ ET CONSOMMATEURS: RÈGLEMENT (CE) No 1223/2009 DU PARLEMENT EUROPÉEN ET DU CONSEIL du 30 novembre 2009 relatif aux produits cosmétiques. Rev Droit Union Eur. 2013;(4):827.
8. de Araújo LSN, dos Santos PH, Anchieta RB, Catelan A, Briso ALF, Zaze ACSF, et al. Mineral loss and color change of enamel after bleaching and staining solutions combination. J Biomed Opt. 2013;18(10):108004–108004.
9. Monteiro D, Moreira A, Cornacchia T, Magalhães C. Evaluation of the effect of different enamel surface treatments and waiting times on the staining prevention after bleaching. J Clin Exp Dent. 2017;9(5):e677-81.
10. Côrtes G, Pini NP, Lima DANL, Liporoni PCS, Munin E, Ambrosano GMB, et al. Influence of coffee and red wine on tooth color during and after bleaching. Acta Odontol Scand. 2013;71(6):1475-80.
11. GERLACH, R.W., BARKER, M.L. Clinical response of three direct-toconsumer whitening products: strips, paint-on gel, and dentifrice. Compend.. contin. educ. dent. 2011; 24 (6): 458, 461-464, 466.
12. GERLACH, R.W., BARKER, M.L. Clinical response of three direct-toconsumer whitening products: strips, paint-on gel, and dentifrice. Compend.. contin. educ. dent. 2003; 24 (6): 458, 461-464, 466.
13. Feiz A, Khoroushi M, Gheisarifar M. Bond Strength of Composite Resin to Bleached Dentin: Effect of Using Antioxidant Versus Buffering Agent. J Dent Tehran Iran. 2011;8(2):60.
14. Anil M, Ponnappa KC, Nitin M, Ramesh S, Sharanappa K, Nishant A. Effect of 10% Sodium Ascorbate on Shear Bond Strength of Bleached Teeth - An in-vitro Study. J Clin Diagn Res JCDR. 2015;9(7):ZC31-33.
15. Miranda TAM, Moura SK, Amorim VH de O, Terada RSS, Pascotto RC. Influence of exposure time to saliva and antioxidant treatment on bond strength to enamel after tooth bleaching: an in situ study. J Appl Oral Sci Rev FOB. 2013;21(6):567-74.

16. Niat AB, Yazdi FM, Koohestanian N. Effects of drying agents on bond strength of etch- and-rinse adhesive systems to enamel immediately after bleaching. J Adhes Dent. 2012;14(6):511-6.
17. Bahari M, Alizadeh Oskoee P, Savadi Oskoee S, Pouralibaba F, Morsali Ahari A. Mercury release of amalgams with various silver contents after exposure to bleaching agent. J Dent Res Dent Clin Dent Prospects. 2016;10(2):118-23.
18. Bacaksiz A, Tulunoglu O, Tulunoglu I. Efficacy and Stability of Two in-Office Bleaching Agents in Adolescents: 12 Months Follow-Up. J Clin Pediatr Dent. 2016;40(4):269-73.
19. Carey CM. Tooth Whitening: What We Now Know. The journal of evidence-based dental practice. 2014; 14(Suppl): 70-76.
20. Conseil de l'Europe. Directive du Conseil 2011/84/UE du 20 septembre 2011 modifiant la directive 76/768/CEE relative aux produits cosmétiques en vue d'adapter son annexe III au progrès techniqueTexte présentant de l'intérêt pour l'EEE en ligne. 2011 (consulté le 16 août 2015). Publication no.: 32011L0084. Disponible sur: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:283:0036:0038:FR: PDF
21. France. Décision du 9 juillet 2013 portant suspension de la mise sur le marché, de la distribution, de l'exportation, de l'importation, de la fabrication, de la détention en vue de la vente ou de la distribution à titre gratuit et de l'utilisation de produits mis sur le marché sous le statut de dispositifs médicaux destinés à être utilisés sur la face externe des dents en vue de les blanchir ou de les éclaircir, interdiction de ces mêmes activités pour d'autres de ces produits et retrait de ces derniers en ligne. 2013 (consulté le 16 août 2016). Publication no.: AFSM1300149S. Disponible sur http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000026380863&dateTexte=&categorieLien=id.
22. Madhu KS, Hegde S, Mathew S, Lata DA, & Bhandi SH. Comparison of Radicular Peroxide Leakage from four Commonly used Bleaching agents following Intracoronal Bleaching in Endodontically treated teeth - An In Vitro Study. Journal of International Oral Health: JIOH. 2013; 5(4): 49-55.
23. Ministère des affaires sociales, de la santé et des droits des femmes. Quelles sont les techniques et produits utilisésen ligne. 2011 (consulté le 1 septembre 2015). Disponible sur: http://www.sante.gouv.fr/quelles-sont-les-techniques-etproduits-utilises.html.
24. Scientific Committees. Formule structurelle du peroxyde de carbamideen ligne. (consulté le 19 août 2015). Disponible sur: http://www.google.fr/imgres?imgurl=http%3A%2F%2Fec.europa.eu%2Fhealth%2Fopinions%2Ffr%2Fblanchiment
25. Cocquet M, Delhommais P.-A. Au bon vieux temps. Éditions de l'Observatoire.2018. 26. Debussy T. Les Botot et l'eau eponyme. Actes. Société française d'histoire de l'art dentaire, 2014, 19.100-106.
26. Fournier J.-P. Une histoire industrielle: "les dentifrices du docteur Pierre". Actes. Société française d'histoire de l'art dentaire, 2011, 16.53-56.
27. Briso A, Rahal V, Sundfeld R, Santos P dos, Alexandre R. Effect of Sodium Ascorbate on Dentin Bonding After Two Bleaching Techniques. Oper Dent. 2013;39(2):195-203.

Romanian pregnant women' attitude and behaviour related to periodontal health - a pilot study



Cărămidă M.[1], Dumitrache M.A.[1], Ioniță A.[2], Oancea R.[3], Sfeatcu R.[1], Tribus L.[4]

[1]*Oral Health and Community Dentistry Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania*
[2]*Endodontics Resident, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania*
[3]*Preventive, Community Dentistry and Oral Health Department, "Victor Babeş" University of Medicine and Pharmacy, Timisoara, Romania*
[4]*Internal Medicine Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania*

Correspondence to:
Name: Ruxandra Sfeatcu
Address: Eforie Street no. 4-6, district 5, Bucharest, Romania
Phone: +40 722 576 219
E-mail address: ruxandra.sfeatcu@umfcd.ro

Abstract

There is a well-studied bidirectional association between adverse pregnancy outcomes and periodontal inflammation and pregnant women should be aware of the oral health-related preventive behaviours. Aim: assessment of Romanian pregnant women' awareness, knowledge and behaviour regarding the periodontal health during pregnancy. Material and method: a cross-sectional pilot study was conducted in 2020-2021 on a sample of 80 pregnant women with a mean age of 28.42±6.91 years, using an on-line self-assessment questionnaire. Results: 62.75% reported frequent gingival bleeding; 25%brush their teeth only in the morning; 63.75% use interdental cleaning products; only 18.75% visited the dentist during the pregnancy. 45% never had a professional dental cleaning; only 23.75% declared being acknowledged about the effects of pregnancy on periodontal health and only 11.75% were informed about the impact of untreated periodontal inflammation on pregnancy evolution. Conclusion: Most of the pregnant women were unaware of the association between periodontal condition and adverse pregnancy outcomes, oral hygiene was unsatisfactory and dental visits were neglected.

Keywords: pregnancy, periodontal health, periodontal inflammation, gingivitis

INTRODUCTION

Pregnancy is a physiological temporary state during which a woman's body goes through different changes and some of them involves the periodontium [1]. There is a well-documented bidirectional association between periodontal health and pregnancy evolution [1,2].

On one hand, due to the changes in level of progesterone and estrogen, structural changes are induced but also a susceptibility to inflammation [1-3]. Thus, previously periodontal healthy women might experience gingival bleeding due to vascular fragility [2,4]. In case of previously untreated gingivitis or periodontitis, there is an increased risk for rapid evolution of inflammation [3,4]. In some cases, pregnancy gingivitis occurs, which is a temporary generalized gingivitis during the pregnancy in which the level of gingival bleeding is not correlated to the level of dental plaque accumulation [5]. In other cases'pregnancy tumor' is developed, which is a localized gingival proliferative lesion, usually developed from the papilla and sometimes with a such a gingival enlargement that impedes mastication because of the extension even on the occlusal surfaces [6].

Periodontal inflammation, untreated before pregnancy or poorly controlled during pregnancy can induce complication for both pregnant woman and fetus, complications known as adverse pregnancy outcomes [1-3]. There is a well-documented risk for low birth weight, premature birth or mother's pre-eclampsia [1,2]. These complications develop because of the characteristics common to all chronical inflammation which is a condition that describes also periodontitis [7]. Persistent subgingival biofilm, and subsequent microbial dysbiosis, induces inflammatory response, with an increased systemic level of cytokines like Il-1, IL-6, TNF-alpha, PGE2 that reach the fetal-placental unit in such a way that the risk for growth restrictions or premature birth is increased [1,7].

The most recent global epidemiology of inflammatory forms of periodontal conditions show that around 80% of adults have a form of periodontal inflammation, with a prevalence of gingivitis periodontitis of 50% and moreover with the severe form, periodontitis stage 3 or 4 affecting 11% of adults [8]. Pregnancy gingivitis has a prevalence varying between 38% and 93.75%, according to recent epidemiological data [9,10]. Taking into consideration the high frequency of this chronical inflammatory condition and its potential risks induced to pregnancy outcome, specific preventive actions, both personal and professional are of outmost importance to avoid complication.

In the recent years, based on evidence derived from research in this specific field, European Federation of Periodontology and the American Academy of Periodontology published a set of specific recommendation for not only women patients and dental professionals but also medical professionals to get involved into preventive actions in order to avoid adverse pregnancy outcome induces by periodontal inflammation [7]. Thus, women are encouraged to check their periodontal health and, in need, to get the proper periodontal treatments before pregnancy as well as to perform a proper oral hygiene before and during the pregnancy. Dental professionals are recommended to check periodontal health during the pregnancy more often and perform non-surgical treatment during the pregnancy, for pregnant woman who are diagnosed during the pregnancy with a form of gingivitis and periodontitis in order to reduce the inflammatory state [1-4]. Any surgical periodontal treatments are recommended to be postponed after the birth [2,3]. Medical professionals and specific Obstetrical-Gynecologist specialists should advice future pregnant woman to get a periodontal check-up and to support during the pregnancy to see a periodontist for professional cleaning and specific periodontal treatment in case of periodontal inflammation [2-4].

Aim and objectives

The aim of the present study was the assessment of the attitude and behaviour toward the periodontal health among a group of Romanian pregnant women.

MATERIAL AND METHODS

The present cross-sectional pilot study was conducted in November 2020 - April 2021 and initiated by the Department of Oral Health and Community Dentistry from the Faculty of Dental Medicine, "Carol Davila" Medicine and Pharmacy University (Bucharest, Romania). The sample included 80 Romanian pregnant women. The inclusion criteria was adults (age>18 years) and a pregnancy at the moment of participation at the study. The exclusion criteria were dental professionals or dental students. The participants in the study were assessed using a self-administered online questionnaire with 26 items related to socio-demographic data, information regarding the pregnancy, perceived oral health state and periodontal health-related attitude and behaviour. The estimated filling-in time was 5 minutes. Prior to completion of the questionnaire, the invited subjects were informed about the survey in respect to the Declaration of Helsinki and the current European privacy law, by including a section in the questionnaire describing the aim of the study and their rights as participants. All the invited participants agreed to participate to the study and after giving their consent, they proceeded to completion of the survey. It was an anonymous web-survey and no personal data were collected.

RESULTS

Within our sample, the participating women had a mean age of 28.42 ± 6.91 years (ranging between 18 and 43 years), 21.25% (17 subjects) living in Bucharest, the capital city of Romania, while the rest living either in rural area (42.50%, 34 subjects) or urban area (36.25%, 29 subjects) other than Bucharest.

When it comes to the pregnancy, only 6.25% (5 subjects) declared that the present pregnancy was obtained through in vitro fertilization while the rest were from natural conception. Regarding the phase of the pregnancy at the time of participation to the study, 10% (8 subjects) stated they were in the first trimester, 23.75% (19 subjects) in the second trimester and 66.25% (53) in the third trimester.

Results related to perceived symptoms of gingival inflammation during the pregnancy, showed that 82.5% of women reported gingival bleeding with a frequency varying from seldom to spontaneous with one fifth of women noticing this either every time they performed toothbrushing (17.50%) of spontaneously (2.50%) (Table I). Moreover, 32.50% noticed exacerbated gingival bleedings compared to the time before pregnancy. Among other gingival inflammation symptoms, painful gums were most frequently mentioned (17.50%) (Table I).

Table I. Self-reported symptoms of gingival inflammation during the pregnancy

Assessed parameter	Answers	% (N)
Gingival bleeding		
	Yes, spontaneous	2.50% (2)
	Yes, during every toothbrushing	17.50% (14)
	Yes, sometimes during toothbrushing	38.75% (31)

Assessed parameter	Answers	% (N)
	Yes, only during flossing	3.75% (3)
	Seldom	20% (16)
	Not at all	17.50% (14)
Perceived increase in gingival bleeding compared to before pregnancy		
	Yes	32.50% (26)
	No	67.50% (54)
Other gingival symptoms during the pregnancy		
	Painful gingiva	17.50% (14)
	Increased in volume of the gingiva	2.50% (2)
	Changes in colour of the gingiva	3.75% (3)
	Not at all	78.75% (63)
History of gingival/periodontal inflammation		
	Gingivitis	6.25% (5)
	Periodontitis	3.75% (3)
	No	46.25% (37)
	Don't know	43.75% (35)
Perceived overall oral health status		
	Excellent	7.50% (6)
	Very good	22.50% (18)
	Good	51.25% (41)
	Satisfactory	12.50% (10)
	Poor	5% (4)
	Very poor	1.25% (1)

Assessment of the oral hygiene-related behaviour, as part of the mandatory routine for the maintenance of a good periodontal health, revealed that 25% of the pregnant women declared they performed toothbrushing only in the morning. Manual toothbrush was preferred by 80% of the participants. Regarding the additional oral hygiene products, mouthwash was the most frequently mentioned (by 58.75% of subjects) while interdental cleaning products were used by only 63.75% of the participants and interdental brushes being the most frequently used (by 30% of subjects) (Table II).

Table II. Oral self-care habits of subjects

Assessed parameter	Answers	% (N)
Frequency of toothbrushing		
	> Twice daily	8.75% (7)

Assessed parameter	Answers	% (N)
	Twice a day	65% (52)
	Once a day, in the morning	25% (20)
	< Daily	1.25% (1)
Type of used toothbrush		
	Manual	80% (64)
	Powered	16.25% (13)
	Both manual and powered	3.75% (3)
Additional oral hygiene products used		
	Dental floss	22.50% (18)
	Interdental toothbrushes	30% (24)
	Oral irrigator	3.75% (3)
	Mouthwash	58.75% (47)
	Wooden toothpicks	16.25% (13)

Evaluation of the behaviour related to dental services utilization showed that, within the studied group, only 18.75% of the pregnant women went to the dental office for a check-up during the pregnancy and that only 31.25% received a professional dental cleaning in the last year while 45% declared they had never had this in-office preventive dental procedure (Table III).

Table III. Dental services utilization among subjects

Assessed parameter	Answers	% (N)
Dental check-up during the pregnancy		
	Yes	18.75% (15)
	No	81.25% (65)
The last professional cleaning		
	< 6 months	11.25% (9)
	6-12 months	20% (16)
	> 12 months	23.75% (19)
	Never	45% (36)
Frequency of dental visits, in general		
	< 6 months	30% (24)
	6-12 months	35% (28)
	Once every few years	10% (8)
	Seldom, only in need	16.25% (13)
	Never	8.75% (7)

Assessed parameter	Answers	% (N)
Recommendation from the obstetrics-gynecology specialist to visit the dental office		
	Yes	11.25% (9)
	No	88.75% (71)

When it comes to the information received by the pregnant woman about the association between periodontal health and pregnancy evolution, results showed that only 23.75% of subjects declared they were informed about the effects of pregnancy on periodontal status. Only 13.75% declared they had certain knowledge about the adverse pregnancy outcomes in the presence of untreated gingival or periodontal inflammation (Table IV). Regarding the source of this type of information, the dentist was the most frequently mentioned (Table IV).

Table IV. Declared knowledge regarding the association between periodontal health and pregnancy evolution

Assessed parameter	Answers	% (N)
Informed about impact of pregnancy on periodontal health		
	Yes	23.75% (19)
	No	76.25% (61)
Source of information regarding the impact of the pregnancy on periodontal health		
	Dentist	13.75% (11)
	Obstetrics-gynecology specialist	2.50% (2)
	Internet	8.75% (7)
Informed about the impact of untreated gingival/periodontal inflammation on pregnancy evolution		
	Yes	13.75% (11)
	No	86.25% (71)
Source of information regarding the impact of untreated gingival/periodontal inflammation on pregnancy evolution		
	Dentist	11.25% (9)
	Obstetrics-gynecology specialist	2.50% (2)
	Internet	1.25% (1)

DISCUSSIONS

In the present study, most pregnant women showed, despite the perceived gingival bleeding frequently met during the pregnancy, the tendency to get involved more in the self-oral healthcare but less in the professional preventive procedures in order to avoid any adverse pregnancy outcome or periodontal complication.

Gingival bleeding were observed frequently by two thirds of the participants in our study, a higher frequency than that reported in a similar recent study on Saudi Arabia expecting women where only one third mentioned bleedings and another third swollen gums

[11], but in similar proportion observed in a study on Polish population that reported the development of gingivitis or periodontitis during the pregnancy in 70% of studied pregnant women [12]. The second most frequently mentioned symptom of gingival inflammation during the pregnancy was painful gums similar to the results reported by a recently published research on Dutch women population [13].

Three quarters of the subjects in our study declared a tooth brushing frequency of twice daily or more often, which is in line with other surveys in other countries [13-16].

According to the European Federation of Periodontology and American Academy of Periodontology, dental check-up before and during pregnancy play a major role in prevention, early diagnosis and specific and individualized therapeutic procedures during the pregnancy according to the periodontal condition and the gestational age [3,7]. In our study, dental service utilization was highly neglected not only during pregnancy but also before the conception, in general.

The main source of information was the dentist in the present study, in line with the result reported at Polish pregnant women population [12], which emphasis the major role that the dentists play in the oral health promotion. However, the proportion of pregnant women population who declared having certain information regarding the association between periodontal condition and pregnancy evolution is far from satisfactory. On the other hand, the proportion of women who stated they had information about the changes in gingival health during the pregnancy was greater than that of women who acknowledged the negative effects of untreated periodontal inflammation on both women and fetus health state.

Therefore, oral health promotion programs targeting present or future pregnant women should emphasize these less known aspects but of outmost importance.

CONCLUSIONS

In the current study, pregnant women were unaware of the association between potential periodontal inflammatory conditions and adverse pregnancy outcomes. Despite the perceived gingival bleedings reported by most of the participants in the study, the dental check-up and the preventive professional dental cleaning are largely neglected. Moreover, oral hygiene routine is unsatisfactory due to the sub-optimal toothbrushing frequency and the underuse of the additional oral hygiene products.

REFERENCES

1. Ide M, Papapanou PN. Epidemiology of association between maternal periodontal disease and adverse pregnancy outcomes--systematic review. J Clin Periodontol. 2013 Apr;40 Suppl 14:S181-94.
2. Madianos PN, Bobetsis YA, Offenbacher S. Adverse pregnancy outcomes (APOs) and periodontal disease: pathogenic mechanisms. J Clin Periodontol. 2013 Apr;40 Suppl 14:S170-80.
3. Michalowicz BS, Gustafsson A, Thumbigere-Math V, Buhlin K. The effects of periodontal treatment on pregnancy outcomes. J Clin Periodontol. 2013 Apr;40 Suppl 14:S195-208.
4. Miyazaki H, Yamashita Y, Shirahama R, Goto-Kimura K, Shimada N, Sogame A, Takehara T. Periodontal condition of pregnant women assessed by CPITN. J Clin Periodontol. 1991 Nov;18(10):751-4.
5. Mariotti A. Sex steroid hormones and cell dynamics in the periodontium. Crit Rev Oral Biol Med. 1994;5(1):27-53.
6. Reddy NR, Kumar PM, Selvi T, Nalini HE. Management of Recurrent Post-partum Pregnancy Tumor with Localized Chronic Periodontitis. Int J Prev Med. 2014 May;5(5):643-7.

7. Sanz M, Kornman K; working group 3 of the joint EFP/AAP workshop. Periodontitis and adverse pregnancy outcomes: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. J Periodontol. 2013 Apr;84(4 Suppl):S164-9.
8. Tonetti MS, Chapple IL, Jepsen S, Sanz M. Primary and secondary prevention of periodontal and peri-implant diseases: Introduction to, and objectives of the 11th European Workshop on Periodontology consensus conference. J Clin Periodontol. 2015 Apr;42 Suppl 16:S1-4.
9. Tellapragada C, Eshwara VK, Acharya S, Bhat P, Kamath A, Vishwanath S, Mukhopadhyay C. Prevalence of Clinical Periodontitis and Putative Periodontal Pathogens among South Indian Pregnant Women. Int J Microbiol. 2014;2014:420149.
10. Cornejo C, Rossi G, Rama A, Gomez-Gutierrez N, Alvaredo G, Squassi A, Klemonskis G. Oral health status and oral health-related quality of life in pregnant women from socially deprived populations. Acta Odontol Latinoam. 2013;26(2):68-74.
11. Togoo RA, Al-Almai B, Al-Hamdi F, Huaylah SH, Althobati M, Alqarni S. Knowledge of Pregnant Women about Pregnancy Gingivitis and Children Oral Health. Eur J Dent. 2019 May;13(2):261-270.
12. Gaszyńska E, Klepacz-Szewczyk J, Trafalska E, Garus-Pakowska A, Szatko F. Dental awareness and oral health of pregnant women in Poland. Int J Occup Med Environ Health. 2015;28(3):603-11.
13. Stelmakh V, Slot DE, van der Weijden GA. Self-reported periodontal conditions among Dutch women during pregnancy. Int J Dent Hyg. 2017 Nov;15(4):e9-e15.
14. Penmetsa GS, Meghana K, Bhavana P, Venkatalakshmi M, Bypalli V, Lakshmi B. Awareness, Attitude and Knowledge Regarding Oral Health among Pregnant Women: A Comparative Study. Niger Med J. 2018 Nov-Dec;59(6):70-73.
15. Petit C, Benezech J, Davideau JL, Hamann V, Tuzin N, Huck O. Consideration of Oral Health and Periodontal Diseases During Pregnancy: Knowledge and Behaviour Among French Pregnant Women. Oral Health Prev Dent. 2021;19(1):33-42.
16. Hullah E, Turok Y, Nauta M, Yoong W. Self-reported oral hygiene habits, dental attendance and attitudes to dentistry during pregnancy in a sample of immigrant women in North London. Arch Gynecol Obstet. 2008 May;277(5):405-459.

Evolution of periodontal disease in patients with type 2 diabetes in the context of initial therapy - systematic review

Ciora E.D.[1], Miron M.I.[1], (Bojoga) Mocuţa D.E.[1], Dragoş B.[2], Luca M.M.[3]

[1]Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania
[2]Research Center in Dental Medicine Using Conventional and Alternative Technologies, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[3]Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania

Correspondence to:
Name: Miron Mariana Ioana
Address: P-ta Eftimie Murgu 2, 300041 Timisoara, Romania
Phone: +40 722 644 842
E-mail address: miron.mariana@umft.ro

Abstract

Periodontal disease and diabetes are two conditions with an increased prevalence in most populations around the world. Diabetic patients present particular manifestations in the oral cavity, mainly determined by the frequent presence of infectious processes, which may be due to: alteration of oral microbial flora, alteration of neutrophil function and/or microangiopathies.

The protocol of this review was developed following the principles of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) and was structured to cumulate the results of clinical trials based on the effects of non-surgical therapy on periodontal status of patients with type 2 diabetes.

Keywords: periodontal disease, hyperglycemia, type 2 diabetes, initial therapy

INTRODUCTION

The frequency of type 2 diabetes mellitus (DM), a chronic metabolic condition, has been continuously rising worldwide. Diabetes is a metabolic disorder characterized by chronic hyperglycemia and altered metabolism of carbohydrates, lipids and proteins. The cause of this condition can be either a defect in insulin secretion or inadequate action of insulin on target cells in the body or a combination of both.

Regarding the clinical forms, they are represented by: type I diabetes (insulin-dependent diabetes), specific to children and young adults and represent approximately 10% of all patients with diabetes; type II diabetes (non-insulin-dependent diabetes) generally affects subjects over 40 years and type III diabetes, a very rare form that occurs secondary to pancreatic diseases, genetic syndromes, hormonal or drug manifestations (gestational diabetes, iatrogenic, senile, malignant diseases).

Chronic hyperglycemia is generally associated with long-term damage, dysfunction and even insufficiency of various organs such as eyes, kidneys, nervous system, heart and blood vessels [1]. Additionally, diabetic individuals exhibit unique oral symptoms that are mostly brought on by the frequent occurrence of infectious processes that may result from changes in the oral microbial ecology, altered neutrophil function, or microangiopathies. The first clinical signs in the oral cavity may be: frequent candidiasis, persistent gingivitis, periodontitis, polychaete, dry mouth, delayed tissue scarring, acetone-smelling breath, tongue hypotonicity, salivary hyperviscosity and increased tartar formation. The severity of these symptoms differs depending on the type of diabetes and its duration and the evolution can be unpredictable.

Periodontal disease and diabetes are 2 conditions with an increased prevalence in most populations around the world. The association between these two conditions has been recognized and discussed over the years by many dental professionals. About 30-50% of diabetics suffer from a form of periodontal disease, mild or moderate-severe form while the prevalence of severe periodontitis in diabetic adults is 9-11% of cases [2]. Epidemiological studies have identified that diabetes is a major risk for periodontal disease, increasing the risk of it occurring three times compared to non-diabetic individuals, especially if it is associated with inadequate glycemic control [3].

Some patients, especially those with type 2 diabetes, are asymptomatic in the first years after the onset of the disease. Other diabetic patients, especially children with absolute insulin deficiency, may have marked hyperglycemia, polyuria, polydipsia, polyphagia, weight loss, and blurred vision. Untreated, diabetes can even lead to death due to installed ketoacidosis or, in rare cases, due to non-ketotic hyperosmolar syndrome [4].

Aim and objectives

The purpose of this systematic review is to follow the evolution of the periodontal disease in patients with diabetes in the context of initial therapy such as non-surgical treatment, in articles with randomized clinical trials.

MATERIAL AND METHODS

The protocol of this review was developed following the principles of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) and was structured to cumulate the results of clinical trials based on the effects of non-surgical therapy on the periodontal status of patients with type 2 diabetes.

Search strategy

The search and analysis of the literature were performed in the following databases: PubMed, Cochrane and Clinical Trials.

The literature was researched using a combination of the terms:

- periodontal disease / periodontitis and Diabetes mellitus
- periodontal disease / periodontitis and Type 2 diabetes
- periodontal disease / periodontitis and non-surgical treatment on diabetes mellitus
- periodontal disease / periodontitis and initial therapy on diabetes mellitus

These keywords were used to analyze the literature from the most important databases, with scientific articles in English. Additional search filters were also used to optimize results such as: articles published in the last 10 years and randomized clinical trials.

Inclusion criteria were defined according to the PICOS model:

- Population (P) - adult subjects with type 2 diabetes
- Intervention (I) - non-surgical therapy of periodontal disease
- comparison (C) - periodontal status before and after non-surgical periodontal treatment (initial therapy)
- result (O) - periodontal status assessment
- type of study (S) - randomized controlled clinical trials

Thus, the question based on which the research of clinical studies was conducted was formulated: "What are the effects of non-surgical treatment on periodontal status in patients with type 2 diabetes?"

The criteria for including the articles in the analysis were: only those that reported randomized clinical trials; sample of subjects with type 2 diabetes; definite diagnosis of diabetes patients; evaluation of periodontal indices at the beginning and end of the study; at least 2 treatment groups in each study; at least 10 participants in each group and the adult population.

Exclusion criteria in choosing studies for types of diabetes other than type II; lack of details regarding the evaluation of periodontal status; articles older than 10 years; studies without clear results; languages of international circulation other than English.

Following the research of the specialized literature, a number of 52 scientific papers were identified in 3 databases (PubMed, Clinical Trials, Cochrane) of which 31 were evaluated in detail, after excluding duplicates, from which were excluded review and studies in other languages of international circulation. After evaluating them in terms of inclusion-exclusion criteria, a number of 6 studies were eligible for inclusion in this review. Figure 1 shows the selection diagram of the articles.

The search protocol was performed to include in the analysis, randomized clinical trials with at least two groups of subjects, with at least one study group to which non-surgical treatment was applied.

For the evaluation of the periodontal status, it was aimed that the clinical studies include the evaluation of periodontal indices such as: plaque index (PI), loss of attachment (PA), bleeding index (IS) and periodontal pocket depth (APP).

Data extraction

The data were extracted in an Excel table to obtain a count of the most important information. Data such as:

- name of the main author
- year of study
- country of study and type
- data on participants (number, age, sex)

- the periodontal status necessary for the eligibility to participate in the study
- measurements made to examine periodontal status
- the treatment administered and any medicinal substances where appropriate
- data on diabetes mellitus (Type and laboratory tests performed)
- main results

No information was included on the exclusion criteria for periodontal eligibility for each individual study and no information was included on drug treatment for diabetes or diabetes-related eligibility criteria (blood glucose, glycosylated hemoglobin, etc). Also, no information was presented regarding patients such as the presence of risk factors such as smoking, diet, etc.

RESULTS

Data presentation

The main data were presented in tables 1 and 2 which briefly present the main aspects of the 6 evaluated studies.

Table 1. Brief presentation of the 6 clinical trials analyzed

No.	Reference	Type of study	Country	Characteristics of the participants			Periodontal status	Periodontal status measurements
				No.	Age	Gender		
1	Raman 2014	randomized clinical trial	Malaysia	40	30-70	M-F	At least 12 teeth present, 5 or more periodontal pockets of at least 5 mm and loss of attachment of at least 4 mm in at least 2 different quadrants that bleed on probing	• bacterial plaque index • gingival bleeding index • depth of periodontal pockets • loss of attachment
2	Lopez 2013	randomized controlled trial	Chile	52 (26 with diabetes and 26 without diabetes)	45-70	M-F	Minimum 15 teeth, periodontal pocket depth of at least 4 mm and attachment level larger than 3 mm	
3	Auyeung 2012	randomized controlled trial	Taiwan	100	50-65	61M-39F	A loss of attachment of at least 1.5 mm was considered a case of periodontal disease	
4	Kaur 2015	randomized controlled trial	India	100 (52 with poor glycemic control, 48 with good glycemic control)	45-60	M-F	Minimum 12 teeth present, attachment loss of at least 4 mm, periodontal pocket depth of at least 5 mm	
5	Lin 2012	randomized controlled trial	Taiwan	28 (14 with standard treatment and 14 with standard treatment + Minocycline)	40-80	M-F	Minimum 20 teeth, 5 or more teeth with periodontal pocket greater than or equal to 5 mm	
6	Chen 2012	randomized clinical trial	China	134	38-81	68M-66F	Minimum 16 teeth, attachment loss larger than 1 mm	

Table 2. Brief presentation of the 6 analyzed studies (continued)

No.	Reference	Type of study	Therapeutic approach	1. Diabetes	2. Evaluation	Pharmaceutical treatment	Duration	Results
1	Raman 2014	randomized clinical trial	all patients - dental education. non-surgical therapy group - scaling and root-planing treatment with chlorhexidine 0.12%	Type 2	HbA1c, CRP	Chlorhexidine 0,12 %	May 2010 - April 2011	Reduced plaque index in patients with non-surgical therapy. Both groups showed a decrease in HbA1c, CRP
2	Lopez 2013	randomized controlled trial	emergency extractions and restoration of carious lesions where necessary. Both groups benefited from dental education, subgingival scaling and crown polishing.	Type 2	HbA1c	Absent	9 months	Professional dental prophylaxis significantly improves periodontal status in patients with diabetes. No patients with a progression of periodontal disease were detected.
3	Auyeung 2012	randomized controlled trial	instructions on dental hygiene both groups, gingival and subgingival scaling, plaque removal performed at 3,6,9,12 months - treatment group.	Type 2	HbA1c	Absent	1 year	Significant improvements in the population with moderate to severe cases of periodontal disease. Patients with mild cases did not show significant improvements.
4	Kaur 2015	randomized controlled trial	The patients in the treatment group received dental education at the beginning of the study and 4 sessions of scaling and root-planing for a maximum period of 2 weeks.	Type 2	HbA1c	Absent	6 months	Significant improvements in periodontal parameters in groups that received non-surgical treatment.
5	Lin 2012	randomized controlled trial	Scaling and root-planing, dental hygiene instructions for both groups.	Type 2	HbA1c	14 patients minocycline gel 2%	6 months	Both groups showed a significant decrease in periodontal pockets and bleeding at probing.
6	Chen 2012	randomized clinical trial	group 1 - descaling and root-planing at the beginning and subgingival descaling at 3 months, group 2 - descaling and root-	Type 2	HbA1c, CRP, triglycerides, FPG, total cholesterol	Absent	6 months	In the groups that received treatment, the plaque index and bleeding at probing decreased significantly. The depth of the periodontal pockets decreased.

No.	Reference	Type of study	Therapeutic approach	1. Diabetes	2. Evaluation	Pharmaceutical treatment	Duration	Results
			planing + subgingival prophylaxis at 3 months. control group - no treatment.					

Data analysis

Of the 6 studies analyzed for this review, Auyeung et al [5] and Lin et al [620] conducted studies on the Taiwanese population, both of which were randomized controlled trials. The Auyeung et al study [5] was performed on a larger sample of patients (100) while Lin et al was performed on a smaller sample (28).

In Auyeung et al [5], patients with periodontal disease were evaluated at 3, 6, 9 and 12 months both in terms of periodontal indices and metabolic parameters (glycosylated hemoglobin) and inflammatory parameters (interleukin-1β and C-reactive protein). Patients were divided into 2 groups, those with a mild stage of periodontal disease and those with a moderate-severe stage. Patients received indications for oral hygiene and supra and subgingival descaling using ultrasonic and manual instruments. Subgingival descaling was performed under local anesthesia [5].

At 3, 6, 9 and 12 months after the initial post-therapy, the patients benefited from scaling and root planing as well as retraining on the rules of dental hygiene. The evaluation of glycosylated hemoglobin was also performed to evaluate the influence of periodontal treatment on diabetes. At the end of the study, a significant decrease in periodontal indices was obtained, such as plaque index, gingival bleeding index and periodontal sac depth in the group with moderate-severe disease [5].

Also, Lin et al [6] studied the evaluation of periodontal parameters in patients with periodontal disease and type 2 diabetes in the context of non-surgical treatment. They used the same initial treatment methods as Auyeng et al [5] but unlike Auyeung et al [5], they also used drug treatment in their study. They divided the patients into 2 groups of 14 patients, one of whom received treatment in the form of scaling and root-planing and the second group in addition to this treatment also received subgingival administration of antibiotic-minocycline. Minocycline was administered as a 2% gel administered at the subgingival level. The administration of minocycline was performed both at the beginning of treatment and in the next 3 weeks, once a week. Also, all patients received dental education [5].

Periodontal parameters such as the depth of the periodontal pocket, the gingival bleeding at the sites, the plaque index, the loss of attachment were analyzed. In addition, they were followed by interleukin 6 (IL-6) - for the evaluation of inflammation, glycosylated hemoglobin and C-reactive protein - for the evaluation of diabetes both at the beginning of the study and after 3 and 6 months of treatment as a secondary objective of study [6].

Both groups of patients showed a significant reduction in the depth of the periodontal pockets, which ranged from 1.7 to 2.02 mm at 3 and 6 months. There were no significant differences between these 2 groups between these parameters. Gingival bleeding was also reduced in both groups. In addition, both groups showed a decrease in the degree of attachment loss. However, the values for the 2 groups were similar, not noticing otherwise a difference between the 2 types of treatment [6].

The Raman et al study [7] evaluates the effects of initial therapy in contrast to the effects of health education in patients with periodontal disease and type 2 diabetes. Of the 40 patients, 20 were divided into the control group and 20 into the experimental group. Both groups received dental education and a toothbrush, interdental brushes and dental floss. The

group that received the non-surgical treatment benefited from scaling and root planing using Gracey curettes and ultrasonic descaling device.

In addition, patients in the non-surgical treatment group also received 0.12% chlorhexidine mouthwash, which they used 3 times / day for a period of 13 days. The control group did not receive any dental treatment except for dental education and motivation from the evaluators [7].

The results obtained showed that the plaque index showed differences between the two groups at the 2-month control but by the end the difference was no longer significant. Also, there were no significant differences between the 2 groups in the gingival bleeding index. The reduction in plaque index is evident in the group that received non-surgical treatment both at 2 months and at the end, which is why we can emphasize the improvement of the periodontal status of these patients. The reduction in plaque index was also present in patients in the control group. All patients also had an improvement in the gingival bleeding index, but in the control group this index increased by the end of the study [7].

The depth of the periodontal pocket in the non-surgical therapy group decreased to less than 2 mm at the final visit, a decrease that also occurred in the control group by at least 50% and even more until the end. The average loss of attachment decreased from 3.35 mm to 2.73 at the end in the non-surgical therapy group and in the control group decreased from an average of 2.79 to 2.56 (statistically significant but lower). Glycosylated hemoglobin and C-reactive protein were also evaluated in the 2 groups of patients to evaluate the effect of these interventions on glycemic control [7].

Similar to Raman et al, the study by Chen et al [8] assessed the effect of initial therapy on a control group that did not receive non-surgical treatment. Chen et al [8] followed the evolution of periodontal factors in 2 groups of patients who received non-surgical treatment compared to a control group who did not receive any treatment. 134 patients selected for this study with type 2 diabetes and periodontal disease were divided into 3 groups, treatment group 1 received scaling and root-planing at first and then subgingival descaling 3 months after the first treatment, the group for treatment 2 received only scaling and root-planing at the beginning of the study and at 3 months only supragingival prophylaxis without any intervention in the periodontal pockets [8].

Group number 3, the control group, did not receive any treatment or dental education from the beginning to the end of the study. Periodontal treatment was performed for a period of 24 hours without the use of antibiotics and antifungals, using standard rigid periodontal curettes and ultrasonic instruments. Both groups who received treatment had a significant improvement in plaque index and gingival bleeding, an improvement that was maintained until the end of the study. Also, the percentage of periodontal pockets with depths of 4-5 mm or more than 6 mm decreased significantly in both treatment groups compared to the control group where a decrease was not highlighted [8].

In the study by Lopez et al [9], a parallel of non-surgical treatment was made comparing 26 patients with type 2 diabetes and 26 patients without diabetes, all of whom had periodontal disease. The extraction of teeth that could not be repaired was performed and the restoration of the other teeth affected by carious lesions was performed urgently. All participants received dental education to perform brushing 3 times a day using the Charter technique and to perform daily dental floss cleaning.

Also, all patients underwent supragingival descaling and crown polishing. In this case, the descaling was done with an ultrasonic descaling device. Participants were monitored 3, 6 and 9 months after the initial treatment when a new series of prophylaxis treatments was performed. None of the patients included in the study had a worsening of periodontal status [9].

Patients with diabetes showed a significant improvement in the size of periodontal pockets, bleeding index and plaque index. Similar changes were present in patients without diabetes except for the depth of the periodontal pockets which did not decrease significantly compared to the initial assessment. In contrast, the group with diabetes had significant results at both 6 and 9 months. Both groups completed the study without achieving a significant increase in attachment. There were no significant differences in the periodontal status between the 2 groups analyzed. No significant change in glycemic control was also observed in terms of the evaluation of glycosylated hemoglobin [9].

In the the group that had a mild form of the condition (early stage), only the value of the depth of the periodontal pocket showed a significant reduction. A significant difference in the value of the plaque index was observed between the 2 groups [9].

The Kaur study [10] et al divided the population with diabetes and periodontal disease (100 patients) into 2 subgroups, those with good glycemic control (48 patients) and those with inadequate glycemic control (52 patients). Each subgroup was subsequently divided into half in patients who received non-surgical treatment for periodontal disease - scaling and root-planing or patients who did not receive any treatment. In addition to these subgroups, a subgroup of non-diabetic patients with periodontal disease was analyzed. Periodontal treatment was performed using a Gracey ultrasonic scaler and curette.

Patients were evaluated at 3 and 6 months for periodontal indices as well as for their glycosylated hemoglobin levels. Changes in periodontal parameters were significantly greater in patients receiving treatment than in others. It was also observed that non-surgical therapy led to a significant reduction in all periodontal parameters in all diabetic and non-diabetic patients [10].

All the studies included in this review had in common the evaluation of the periodontal status according to periodontal indices such as: gingival bleeding, periodontal sac depth, plaque index and loss of attachment. The evaluation was also performed in patients with a specific diagnosis of type 2 diabetes. Parameters for the evaluation of diabetes included glycosylated hemoglobin (HbA1C) and C-reactive protein. Also, all studies used in this review used non-surgical therapy and evaluated periodontal changes at both the beginning and end of the study [10].

DISCUSSIONS

The evaluated studies followed the evolution of patients with type 2 diabetes and periodontal disease who underwent initial non-surgical therapy. They were evaluated at the beginning of treatment according to various periodontal indices such as plaque index, periodontal pocket depth, bleeding at probing, etc. The aim was to evaluate the periodontal status at different time periods after the first treatment in terms of evaluating the same periodontal indices.

Non-surgical therapy involves multiple procedures in order to control the infection that causes pathological lesions in the periodontal tissue. The realization of scaling and root planing, combined with rigorous control measures of the supragingival plate is very effective because it alters the subgingival ecology by disturbing the microbial biofilm, reducing the amount of pathogenic bacteria and suppressing inflammation. The instrumentation used consists of: curettes - used for descaling and subgingival scaling and supragingival ultrasonic instruments [11].

Diabetes and periodontal disease are 2 chronic conditions that have long been considered biologically connected. In fact, diabetes is one of the primary risk factors for periodontal disease. Cross-sectional and longitudinal studies have identified that the risk of periodontal disease is approximately 3-4 times higher in people with diabetes than in non-

diabetic individuals. Patients with type 2 diabetes also have a higher risk of developing periodontal disease than non-diabetics.

A study of African-American patients found that 70.6% of patients with type 2 diabetes had moderate periodontitis and 28.5% had a severe form of the disease. This percentage is 10.6% higher than in a control group with patients without diabetes. There is a direct link between glucose levels and the severity of periodontal disease. The ratio between patients with diabetes with periodontal destruction compared to non-diabetics is 1.97, 2.10 and 2.42 in diabetics with well-controlled, moderately controlled and poorly controlled blood glucose [12].

The mechanism linking diabetes and periodontal disease is not fully elucidated but involves issues such as inflammation, immunity, neutrophil activity and cytokine biology. Diabetes increases inflammation in periodontal tissue with an increase in inflammatory mediators such as interleukin-1β (IL-1β) and tumor necrosis factor alpha (TNF-α) [3].

Regardless of the degree of glycemic control, the prevalence of periodontal disease is higher in men than in women. Also, the total loss of natural dentition is more common in people with diabetes and prediabetes between the ages of 45 and 64, but it is not as common in those over 65. Also, total loss of dentition is more common in those with an elevated level of glycosylated hemoglobin compared to the control group. And in the case of those with only a part of the missing dentition, it was observed that the number of missing teeth is higher in those with diabetes [13].

The study by Lopez et al [9] showed that occupational dental prophylaxis significantly improves periodontal status in patients with moderate-severe periodontal disease with or without type 2 diabetes. Repeated dental prophylaxis was maintained at 3 and 6 months. improvement of the periodontal status that was maintained until the evaluation of 9 months. Also, no patient showed a worsening of periodontal status. These data support the data presented in other studies performed on patients with diabetes in which the control of supragingival plaque performed by professional cleaning of the oral cavity has favorable effects in stopping the evolution of periodontal disease.

Chen et al [8] note that in order to prevent the recurrence and progression of periodontal infection, periodontal maintenance therapy should be performed at regular intervals. However, in the absence of clinical evidence, the recommendations for proper oral hygiene and subsequent visits to the dentist vary greatly depending on the country and the health system. Thus, the need to standardize an optimal maintenance regime is outlined, especially in patients such as diabetics who may have severe complications if not seen in time at the dentist. The authors note that appropriate periodontal therapy decreases intraoral bacterial levels and reduces the effects induced by oral bacteria. This could also have a positive impact on systemic inflammatory status and metabolic control in patients with diabetes.

Lin et al [6] also note the link between glycemic control and periodontal status. This study concludes that patients with adequate blood glucose control who benefit from well-controlled initial periodontal therapy show an improvement in long-term periodontal status. They also mention that significant results appear in the case of combining non-surgical therapy with surgical therapy. However, poor blood glucose control produces less favorable results in the context of initial therapy performed at regular intervals, especially in patients who are more prone to frequent recurrence of deep periodontal pockets.

Kaur et al [10] observed a statistically significant increase in periodontal variables in patients who did not receive periodontal treatment for 6 months but this increase was not large enough to be clinically relevant. Periodontal progression was observed in both untreated groups but was more significant in the group with poor blood glucose control. And

from this study we can point out again the importance of diabetes as a risk factor for periodontal disease in terms of assessing glycemic levels.

There was a significant decrease in the depth of periodontal pockets less than 3 mm deep and a significant increase in the depth of periodontal pockets greater than 7 mm in the group that did not receive initial treatment, indicating a significant decrease in healthy areas and an increase of those affected. The authors believe that this aspect could occur due to the defect of immune cell function that leads to an inhibition of bactericidal activity in periodontal pockets. This defect affects the severity of periodontal disease and influences its progression [10].

A separate branch of the study from Auyeung et al [5] is the evaluation of the effect of non-surgical treatment on blood glucose control, but this study did not have favorable results in connection with this hypothesis. In the case of Kaur et al [10] a decrease in glycosylated hemoglobin is mentioned but it is mentioned that this aspect is predominant depending on the initial level - a decrease in glycosylated hemoglobin is even greater the higher its value at the beginning of non-surgical treatment. Chen et al [8] also note the possibility of obtaining such results but due to the small population on which they conducted the study they consider that they cannot form an appropriate conclusion on this topic. In order to be able to say for sure what the effect of non-surgical therapy is on blood sugar control, a much larger population is needed to conduct a study.

CONCLUSIONS

In conclusion, evaluating the results of clinical trials analyzed in this review we can say that the initial therapy in the treatment of periodontal disease in patients with type 2 diabetes is very useful in stabilizing and also in improving periodontal status. In the absence of this treatment, a rapid evolution of periodontal disease can be observed, which can initially lead to systemic damage and worsening of general health.

Also, frequent assessment of blood glucose status and visits to the dentist at regular intervals to assess periodontal status can be extremely useful in treating diabetic patients and also in avoiding the evolution of periodontal status.

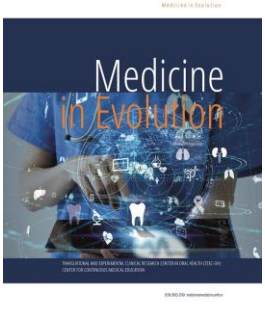
In a world where the prevalence of these two diseases, diabetes and periodontal disease is so high and the association between these two diseases is extremely widespread, prevention could be key. In the absence of prevention, initial non-surgical treatment is the gold standard for the treatment of periodontal disease, in both the diabetic and non-diabetic populations.

REFERENCES

1. Diabetes DOF. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2013;36(SUPPL.1):67–74.
2. Verhulst MJL, Loos BG, Gerdes VEA, Teeuw WJ. Evaluating all potential oral complications of diabetes mellitus. Front Endocrinol (Lausanne). 2019;10(FEB).
3. Casanova L, Hughes FJ, Preshaw PM. Diabetes and periodontal disease: A two-way relationship. Br Dent J. 2014;217(8):433–7.
4. Kharroubi AT. Diabetes mellitus: The epidemic of the century. World J Diabetes. 2015;6(6):850.
5. Auyeung L, Wang P-W, Lin R-T, Hsieh C-J, Lee P-Y, Zhuang R-Y, et al. Evaluation of Periodontal Status and Effectiveness of Non-Surgical Treatment in Patients With Type 2 Diabetes Mellitus in Taiwan for a 1-Year Period. J Periodontol. 2012;83(5):621–8.

6. Lin SJ, Tu YK, Tsai SC, Lai SM, Lu HK. Non-surgical periodontal therapy with and without subgingival minocycline administration in patients with poorly controlled type II diabetes: A randomized controlled clinical trial. Clin Oral Investig. 2012;16(2):599–609.
7. Raman RPC, Taiyeb-Ali TB, Chan SP, Chinna K, Vaithilingam RD. Effect of nonsurgical periodontal therapy verses oral hygiene instructions on Type 2 diabetes subjects with chronic periodontitis: A randomised clinical trial. BMC Oral Health. 2014;14(1):1–10.
8. Chen L, Luo G, Xuan D, Wei B, Liu F, Li J, et al. Effects of Non-Surgical Periodontal Treatment on Clinical Response, Serum Inflammatory Parameters, and Metabolic Control in Patients with Type 2 Diabetes: A Randomized Study. J Periodontol. 2012;83(4):435–43.
9. López NJ, Quintero A, Casanova PA, Martínez B. Routine Prophylaxes Every 3 Months Improves Chronic Periodontitis Status in Type 2 Diabetes. J Periodontol. 2014;85(7): e232–40.
10. Palka K, Kaur S, Narula R, Rajput R, Sharma S. Periodontal and glycemic effects of nonsurgical periodontal therapy in patients with type 2 diabetes stratified by baseline HbA. J Oral Sci. 2015;57(3):201–11.
11. Lang N, Lindhe J, Berglundh T, Clinical Periodontology and Implant Dentistry,6th edition. Wiley Blackwell,2015.
12. Wu YY, Xiao E, Graves DT. Diabetes mellitus related bone metabolism and periodontal disease. Int J Oral Sci. 2015;7(2):63–72.
13. Genco RJ, Borgnakke WS. Diabetes as a potential risk for periodontitis: association studies. Periodontol 2000. 2020;83(1)

Phytotherapy as an adjuvant in the treatment and prevention of oral cancer



Cosoroabă R.[1], Todor L.[2], Popovici R.A.[1], Todor S.A.[3], Motoc G.V.[2], Olariu I.[4]

[1]*Department of Management, Legislation and Communication in Dentistry, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania*
[2]*Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania*
[3]*Dentist doctor, private medical office, Oradea, Romania*
[4]*Department of Dentistry, Faculty of Medicine, Vasile Goldiş Western University of Arad, Romania*

Correspondence to:
Name: Liana Todor
Address: Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania, December 1st Square no.10, 410068 Oradea, Bihor County, Romania
Phone: +40 723517100
E-mail address: liana.todor@gmail.com

Abstract

Over time, plant extracts have been used to treat various diseases. Natural products have played an important role in anticancer therapy. Oral cancer is becoming more prevalent in elderly patients. Oral mucositis and xerostomia, induced by cancer therapy, are some of the most distressing morbidities after radio-chemotherapy. Phytochemicals present in fruits, vegetables and grains have a protective effect against the development of cancers. The protective role of phytochemicals may be associated with their antioxidant activity. Herbal remedies are often used alongside conventional treatments to care for cancer patients, with increasing interest in the use of complementary and alternative medicine. Cancer chemoprevention focuses on identifying agents that specifically influence the early stages of cell transformation.

Keywords: Oral cancer, phytochemicals, chemoprevention

INTRODUCTION

Early signs of oral cancer often go unnoticed by the patient and are often discovered during routine dental examinations. The most commonly used treatments for oral cancer include surgery, radiation, and chemotherapy, alone or in combination. Most cancers have the potential for angiogenesis, and their growth, metastasis, and invasion depend on angiogenesis.

Oncology researchers have reported a large number of plant species that have been used in the treatment of cancer since ancient times, and today, the trend toward using and evaluating the therapeutic effects of plants and their compounds as potential anticancer drugs is increasing. More than half of the anticancer drugs in use today are derived from natural resources such as plants, microorganisms and marine life [1].

The mechanisms by which these drugs act on cancer cells are largely unclear. The role of oxidative stress in inducing oral cancer and antioxidants in its prevention and treatment is proven, and most plants are good sources of antioxidants [2,3]. There are more than 25,000 phytochemicals in various plants that have biological effects [4,5].

Diets rich in plant resources provide the body with essential vitamins and minerals. Dietary changes, antioxidant supplementation, high-dose vitamin C therapy, and the use of cannabinoids have been suggested by various researchers to reduce cancer cell replication and increase the chance of remission. The therapeutic capacity of phytonutrients present in medicinal plants holds promise for obtaining natural products and plant compounds that are effective against cancer with low toxicity to healthy tissues [6].

Phytochemicals (Figure 1) can be divided into phenolic compounds, carotenoids, and others. Phenolic acid can be classified into hydroxycinnamic acid and hydroxybenzoic acid. Hydroxycinnamic acid is found in cinnamon, coffee, blueberries, kiwis, plums, apples, and cherries. Hydroxybenzoic acid is found in few consumable plants or can be synthesized chemically [7]. Most of the potent chemopreventive polyphenols disrupt or reverse carcinogenesis [8].

Carotenoids are members of the tetraterpene family that are responsible for the yellow, orange, or red color of fruits, leaves, and flowers. Carotenoid intake inhibits cell proliferation, arrests the cell cycle in different phases, and increases apoptosis and antioxidants in cancer cells [9,10].

Many natural compounds have been widely examined for their potential use in cancer prevention over the years. The growing volume of *in vitro* and *in vivo* data on the chemopreventive and chemotherapeutic outcomes of plant-derived compounds has prompted scientists to conduct clinical trials focused on the pharmacokinetics, efficacy, and safety of phytocompounds.

Aim and objectives

The purpose of this article is to review the current data from the published articles on the role of phytonutrients in the prevention and treatment of oral cancer and oral cavity manifestations after chemo and radiotherapy.

MATERIAL AND METHODS

By screening the literature on medicinal plants used as adjuvants in oral cancer prevention and therapy, we were able to compile a list of the plants most often recommended for the treatment and prevention of oral cancer, and oral discomfort following anticancer therapy.

The screening questions were as follows: "Which medicinal plants are effective in the prevention and treatment of oral cancer"; "Which herbs are effective in the treatment of oral mucositis/xerostomia induced by cancer treatment?" (PubMed, Medline, Web of Science, Scopus). The keywords were the following: phytotherapy; "herbal medicine"; "plant extract"; "medicinal plant"; and: mucositis; xerostomia; chemotherapy; radiotherapy; oral cancer/tumor/neoplasm.

Oral mucositis (OM) induced by cancer therapy is one of the most distressing morbidities after radio-chemotherapy. Age, nutritional status, tumor type, oral hygiene and treatment method are the determinants for the incidence of OM. In addition, oxygen free radicals can act as a trigger for an inflammatory environment that causes OM.

Xerostomia (dry mouth) causes many clinical problems, including oral infections, difficulty speaking, and disturbances in chewing and swallowing food. Many cancer patients have complained of xerostomia induced by cancer therapy.

Treatment methods vary from the local application of ointment, gel and extract, to the oral ingestion of phytotherapeutics.

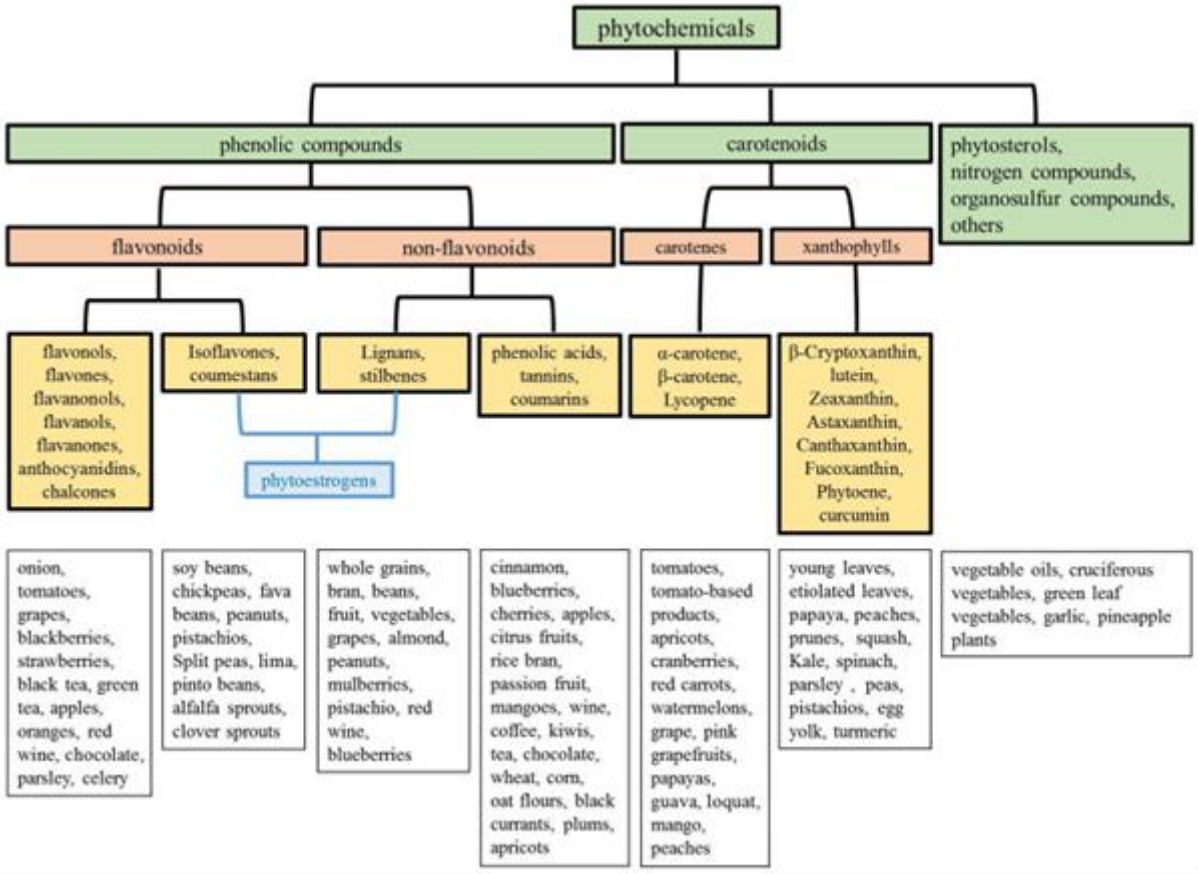


Figure 1. Food sources of phytochemicals [11]

RESULTS

Common phytochemicals for oral cancer chemoprevention and treatment are: green tea, black raspberry, resveratrol, quercetin, curcumin, allium vegetables.

Green tea contains rich flavonoids and other polyphenol antioxidants that protect against cancer. The major constituents of green tea (Figure 2) are EGCG, (-)-epigallocatechin (EGC), and (-)-epicatechin-3-gallate (ECG). EGCG (epigallocatechin gallate) is the major polyphenol that inhibits the growth and interferes with the carcinogenic process of various

cancer cells and inhibits the migration of oral cancer cells [12]. Green tea extract has a dose-dependent chemopreventive effect and an inhibitory effect on oral premalignant lesions (eg: leukoplakia) [13-15].

Clinical studies have shown that drinking more than 10 cups of green tea a day reduces the risk and delays the onset of cancer compared to those who drink less than 3 cups a day. Smokers who took green tea extract (2000–2500 mg/day) for 4 weeks had reduced DNA damage in oral keratinocytes [16,17].

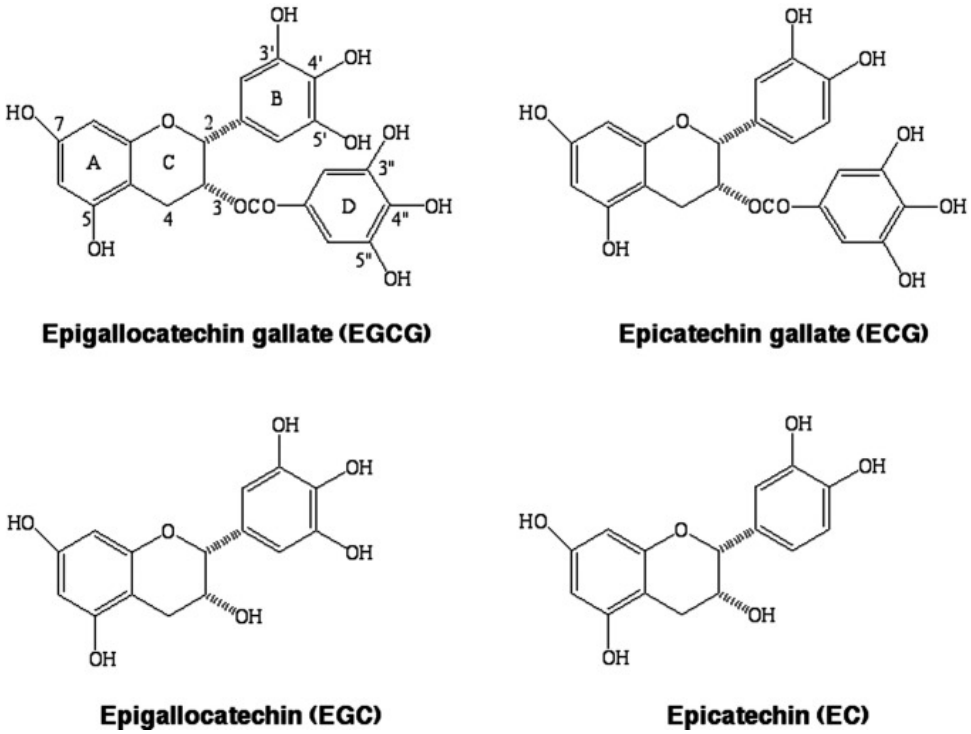


Figure 2. Chemical structure of tea catechins

Black raspberries (BRB) are rich in vitamins, minerals, fiber, anthocyanins, phenolic components and other bioactive components with oral cancer inhibition capabilities [17-20]. Local treatment for 3 months with BRB gel (0.5 g four times a day) on oral premalignant lesions resulted in considerable reductions in lesion size [20-22].

Grape skins, blueberries, raspberries, mulberries, peanuts and many other plant products have powerful polyphenolic compounds and are rich in resveratrol (3, 5, 4'-trihydroxy-trans-stilbene) (Figure 3).

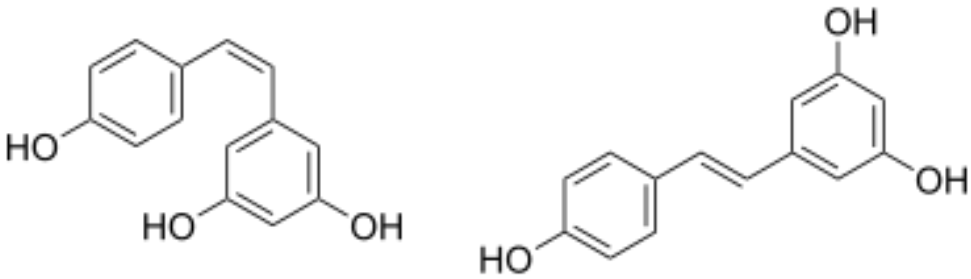


Figure 3. Chemical structure of cis- ((Z)-resveratrol, left) and trans-resveratrol ((E)-resveratrol, right)

Resveratrol, alone or in combination with quercetin, significantly decreases the toxic side effects associated with anticancer therapies and enhances the therapeutic effects against

oral cancer [23-25]. Resveratrol has been found to be safe and reasonably well tolerated at a single dose of up to 5 g/day or as part of a multi-day dosing regimen in healthy subjects [26,27]. The average daily intake of quercetin has been estimated at 25 mg, the serum concentrations of quercetin required for anticancer activity appear to be greater than 10 µM [28,29].

Curcumin (Figure 4), a xanthophyll carotenoid, the main active component of turmeric, which is derived from the rhizome (root) of Curcuma longa, is widely used for the chemoprevention of oral cancer [30-33]. Tetrahydrocurcumin is the key compound of natural curcuminoids and is of great interest in oral cancer research due to its increased water solubility [34].

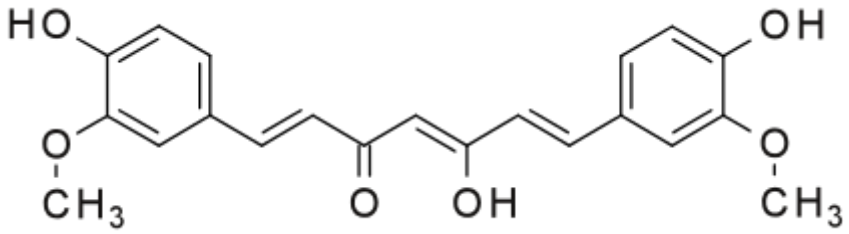


Figure 4. Chemical structure of curcumin

Curcumin is considered to be pharmacologically safe. The safety and tolerability of curcumin administered at a dose of 8 g/day has been demonstrated in clinical trials [35,36]. Curcumin treatment can reduce pain and the size of the tumor lesion [37].

Apigenin (4′, 5, 7, -trihydroxyflavone) (Figure 5) is a flavonoid with chemopreventive action present in fruits and vegetables, parsley, celery and chamomile tea being the most common sources [38,39].

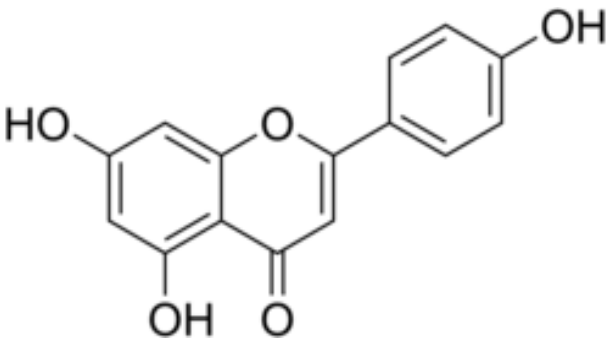


Figure 5. Chemical structure of apigenin

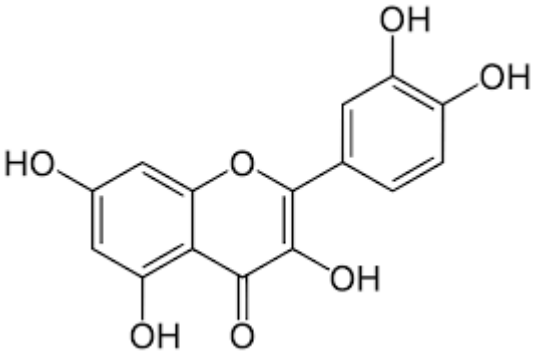


Figure 6. Chemical structure of quercetin

Curcumin and apigenin have an inhibitory effect on cancers related to tobacco smoking and HPV infections [40,41].

Increased consumption of allium vegetables, such as garlic and onions, may reduce the risk of oral cancer [42-46]. Quercetin (Figure 6), the main flavonoid compound in onion, induced cytotoxic effects and reduced cell migration and invasion SAS [47]. Quercetin is available as a dietary supplement, and the recommended dose is 200–1200 mg/day [48,49].

Herbal remedies are good at relieving oral mucositis induced by cancer therapy [50]. Among the herbs most used to treat oral discomfort are: Marticaria recutita L., Zingiber offinicale ROSCOE, Taraxacum Wigg. Calendula officinalis L., Salvia officinalis L., Carum carvi/Cuminum cyminum L., Mentha piperita [51-54]. Matricaria chamomilla (chamomilla) showed a reduction in the severity and incidence of lesions, with improvement in pain

symptoms. Isatis indigótica, Olea europaea, Calendula officinalis, A. digitatae and M. sylvestris plant extracts improved oral mucosal lesions. The herbal drugs MF 5232 (Mucotrol™) and QRLYD decreased the severity of lesions, while SAMITAL® and MUCOSYTE enabled better pain control [55,56].

Herbal medicines significantly improve saliva flow and reduce xerostomia symptoms in cancer patients [57].

DISCUSSIONS

Various studies have provided clinical and preclinical evidence for the use of herbal supplements as complementary treatments for oral cancer. Phytotherapeutic substances are studied as potential in chemopreventive treatment. Antioxidant supplements, high-dose vitamin C therapy, and cannabinoids have been suggested to reduce cancer cell replication and increase the chance of remission [58-61].

Green tea contains polyphenols that induce apoptosis (programmed cell death) in many types of tumor cells, including oral cancer cells, with the extract having a dose-dependent chemopreventive effect [62,63]. Melissa officinalis leaf total extract is a potential agent for the chemoprevention of tongue and pharyngeal cancers [64].

Herbal remedies are often used by cancer patients alongside conventional treatment methods. Herb-drug interactions should not be ignored by healthcare providers in the management of cancer patients. User rates are often underestimated and doctors usually feel unprepared to counsel patients [65,66].

CONCLUSIONS

Chemoprevention through edible phytochemicals is considered as an inexpensive, easy to apply, acceptable and accessible approach for the control and management of oral cancer.

Early detection of tumor lesions and lifestyle changes, the use of dietary supplements in the population at risk, are essential steps in the prevention and successful treatment of oral cancer. The main evidence for the use of herbal supplements is currently in the prevention of cancer rather than its treatment.

Combinations of cytotoxic antitumor agents and phytochemicals could act together to produce inhibitory mechanisms against the development of tumor lesions. The antioxidant effect of dietary phenolic compounds could represent a promising strategy for cancer prevention and reduction of risk factors associated with its progression.

More human clinical trials are needed to demonstrate the anticancer effects of phytochemicals, but their anticancer potential should not be underestimated.

REFERENCES

1. Cragg GM, Newman DJ. Plants as a source of anti-cancer agents. J Ethnopharmacol. 2005 Aug 22;100(1-2):72-9. doi: 10.1016/j.jep.2005.05.011. PMID: 16009521.
2. Scrobota I, Baciut G, Buzatu R, Szuhanek C, Todor L, Vlad SV, Bolfa P, Calniceanu H. Oxidative Stress Markers in Chemically Induced Oral Premaligne Lesions. Rev. Chim. 2017;68(6):1211-1215. https://doi.org/10.37358/RC.17.6.5643.
3. Scrobota I, Tatomir C, Calniceanu H, Baciut FM, Baciut G, Buzatu R., Onisei D. Antioxidative effects of the grape seed extract Burgund Mare during postinitiation of oral carcinogenesis in rat model. Medicine in Evolution, Volume XXI, Nr.2/2015, 261-264 ISSN 2065-376X.

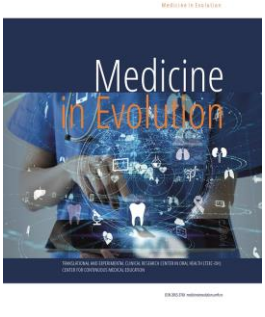
4. Gordaliza M. Natural products as leads to anticancer drugs. Clin Transl Oncol. 2007 Dec;9(12):767-76. doi: 10.1007/s12094-007-0138-9. PMID: 18158980.
5. Orlikova B, Legrand N, Panning J, Dicato M, Diederich M. Anti-inflammatory and anticancer drugs from nature. Cancer Treat Res. 2014;159:123-43. doi: 10.1007/978-3-642-38007-5_8. PMID: 24114478.
6. Nasri H, Shirzad H. Toxicity and safety of medicinal plants. J HerbMed Plarmacol. 2013;2:21–22.
7. Arora I., Sharma M., Tollefsbol T.O. Combinatorial epigenetics impact of polyphenols and phytochemicals in cancer prevention and therapy. Int. J. Mol. Sci. 2019;20:4567. doi: 10.3390/ijms20184567.
8. Surh Y.-J. Cancer Chemoprevention with Dietary Phytochemicals. Nat. Rev. Cancer. 2003;3:768–780. doi: 10.1038/nrc1189.
9. Milani A., Basirnejad M., Shahbazi S., Bolhassani A. Carotenoids: Biochemistry, pharmacology and treatment. Br. J. Pharmacol. 2017; 174:1290–1324. doi: 10.1111/bph.13625.
10. Leoncini E., Nedovic D., Panic N., Pastorino R., Edefonti V., Boccia S. Carotenoid intake from natural sources and head and neck cancer: A systematic review and meta-analysis of epidemiological studies. Cancer Epidemiol. Biomark. Prev. 2015;24:1003–1011. doi: 10.1158/1055-9965.EPI-15-0053.
11. Lee TY, Tseng YH. The Potential of Phytochemicals in Oral Cancer Prevention and Therapy: A Review of the Evidence. Biomolecules. 2020 Aug 6;10(8):1150. doi: 10.3390/biom10081150. PMID: 32781654; PMCID: PMC7465709.
12. Belobrov S., Seers C., Reynolds E., Cirillo N., McCullough M. Functional and molecular effects of a green tea constituent on oral cancer cells. J. Oral Pathol. Med. 2019; 48:604–610. doi: 10.1111/jop.12914.
13. Yuan JM. Cancer prevention by green tea: Evidence from epidemiologic studies. Am. J. Clin. Nutr. 2013;98(Suppl. 6):1676s–1681s. doi: 10.3945/ajcn.113.058271.
14. Shin DM. Oral cancer prevention advances with a translational trial of green tea. Cancer Prev Res (Phila). 2009 Nov;2(11):919-21. doi: 10.1158/1940-6207.CAPR-09-0207. PMID: 19892661.
15. Li N., Sun Z., Han C., Chen J. The chemopreventive effects of tea on human oral precancerous mucosa lesions. Proc. Soc. Exp. Biol. Med. Soc. Exper. Biol. Med. 1999;220:218–224. doi: 10.3181/00379727-220-44369.
16. Imai K., Suga K., Nakachi K. Cancer-preventive effects of drinking green tea among a Japanese population. Prev. Med. 1997;26:769–775. doi: 10.1006/pmed.1997.0242.
17. Yoshimura H., Yoshida H., Matsuda S., Ryoke T., Ohta K., Ohmori M., Yamamoto S., Kiyoshima T., Kobayashi M., Sano K. The therapeutic potential of epigallocatechin-3-gallate against human oral squamous cell carcinoma through inhibition of cell proliferation and induction of apoptosis: In vitro and in vivo murine xenograft study. Mol. Med. Rep. 2019;20:1139–1148. doi: 10.3892/mmr.2019.10331.
18. Casto B.C., Kresty L.A., Kraly C.L., Pearl D.K., Knobloch T.J., Schut H.A., Stoner G.D., Mallery S.R., Weghorst C.M. Chemoprevention of oral cancer by black raspberries. Anticancer Res. 2002;22:4005–4015.
19. Kresty L.A., Mallery S.R., Stoner G.D. Black raspberries in cancer clinical trials: Past, present and future. J. Berry Res. 2016;6:251–261. doi: 10.3233/JBR-160125.
20. Knobloch T.J., Ryan N.M., Bruschweiler-Li L., Wang C., Bernier M.C., Somogyi A., Yan P.S., Cooperstone J.L., Mo X., Bruschweiler R.P., et al. Metabolic regulation of glycolysis and amp activated protein kinase pathways during black raspberry-mediated oral cancer chemoprevention. Metabolites. 2019;9:140. doi: 10.3390/metabo9070140.
21. Mallery S.R., Tong M., Shumway B.S., Curran A.E., Larsen P.E., Ness G.M., Kennedy K.S., Blakey G.H., Kushner G.M., Vickers A.M., et al. Topical application of a mucoadhesive freeze-dried black raspberry gel induces clinical and histologic regression and reduces loss of heterozygosity events in premalignant oral intraepithelial lesions: Results from a multicentered, placebo-controlled clinical trial. Clin. Cancer Res. 2014;20:1910–1924.
22. Shumway B.S., Kresty L.A., Larsen P.E., Zwick J.C., Lu B., Fields H.W., Mumper R.J., Stoner G.D., Mallery S.R. Effects of a topically applied bioadhesive berry gel on loss of heterozygosity indices in premalignant oral lesions. Clin. Cancer Res. 2008;14:2421–2430. doi: 10.1158/1078-0432.CCR-07-4096.

23. Zlotogorski A., Dayan A., Dayan D., Chaushu G., Salo T., Vered M. Nutraceuticals as new treatment approaches for oral cancer: II. Green tea extracts and resveratrol. Oral Oncol. 2013;49:502–506. doi: 10.1016/j.oraloncology.2013.02.011.
24. Tyagi A., Gu M., Takahata T., Frederick B., Agarwal C., Siriwardana S., Agarwal R., Sclafani R.A. Resveratrol selectively induces DNA Damage, independent of Smad4 expression, in its efficacy against human head and neck squamous cell carcinoma. Clin. Cancer Res. 2011;17:5402–5411. doi: 10.1158/1078-0432.CCR-11-1072.
25. ElAttar T.M., Virji A.S. Modulating effect of resveratrol and quercetin on oral cancer cell growth and proliferation. Anticancer Drugs. 1999;10:187–193. doi: 10.1097/00001813-199902000-00007.
26. Singh C.K., Ndiaye M.A., Ahmad N. Resveratrol and cancer: Challenges for clinical translation. Biochim. Biophys. Acta. 2015;1852:1178–1185. doi: 10.1016/j.bbadis.2014.11.004.
27. Brown V.A., Patel K.R., Viskaduraki M., Crowell J.A., Perloff M., Booth T.D., Vasilinin G., Sen A., Schinas A.M., Piccirilli G., et al. Repeat dose study of the cancer chemopreventive agent resveratrol in healthy volunteers: Safety, pharmacokinetics, and effect on the insulin-like growth factor axis. Cancer Res. 2010;70:9003–9011. doi: 10.1158/0008-5472.CAN-10-2364.
28. Lamson D, Brignall MS. Antioxidants and cancer, part 3: quercetin. Altern Med Rev. 2000;5:196–208.
29. Gugler R, Leschik M, Dengler HJ. Disposition of quercetin in man after single oral and intravenous doses. European Journal of Clinical Pharmacology. 1975;9:229–34.
30. Xiao C., Wang L., Zhu L., Zhang C., Zhou J. Curcumin inhibits oral squamous cell carcinoma SCC-9 cells proliferation by regulating miR-9 expression. Biochem. Biophys. Res. Commun. 2014;454:576–580. doi: 10.1016/j.bbrc.2014.10.122.
31. Azuine M.A., Bhide S.V. Adjuvant chemoprevention of experimental cancer: Catechin and dietary turmeric in forestomach and oral cancer models. J. Ethnopharmacol. 1994;44:211–217. doi: 10.1016/0378-8741(94)01188-5.
32. Lee A.Y., Fan C.C., Chen Y.A., Cheng C.W., Sung Y.J., Hsu C.P., Kao T.Y. Curcumin inhibits invasiveness and epithelial-mesenchymal transition in oral squamous cell carcinoma through reducing matrix metalloproteinase 2, 9 and modulating p53-e-cadherin pathway. Integr. Cancer Ther. 2015;14:484–490. doi: 10.1177/1534735415588930.
33. Li N., Chen X., Liao J., Yang G., Wang S., Josephson Y., Han C., Chen J., Huang M.T., Yang C.S. Inhibition of 7,12-dimethylbenz[a]anthracene (DMBA)-induced oral carcinogenesis in hamsters by tea and curcumin. Carcinogenesis. 2002;23:1307–1313. doi: 10.1093/carcin/23.8.1307.
34. Lai C.-S., Ho C.-T., Pan M.-H. The Cancer Chemopreventive and Therapeutic Potential of Tetrahydrocurcumin. Biomolecules. 2020;10:831. doi: 10.3390/biom10060831.
35. Gupta S.C., Patchva S., Aggarwal B.B. Therapeutic roles of curcumin: Lessons learned from clinical trials. AAPS J. 2013;15:195–218. doi: 10.1208/s12248-012-9432-8.
36. Mirzaei H., Shakeri A., Rashidi B., Jalili A., Banikazemi Z., Sahebkar A. Phytosomal curcumin: A review of pharmacokinetic, experimental and clinical studies. Biomed. Pharmacother. 2017;85:102–112. doi: 10.1016/j.biopha.2016.11.098.
37. Kuttan R., Sudheeran P.C., Josph C.D. Turmeric and curcumin as topical agents in cancer therapy. Tumori. 1987;73:29–31. doi: 10.1177/030089168707300105.
38. Javed, Z., Sadia, H., Iqbal, M.J. et al. Apigenin role as cell-signaling pathways modulator: implications in cancer prevention and treatment. Cancer Cell Int 21, 189 (2021). https://doi.org/10.1186/s12935-021-01888-x
39. Salmani J.M.M., Zhang X.-P., Jacob J.A., Chen B.-A. Apigenin's Anticancer Properties and Molecular Mechanisms of Action: Recent Advances and Future Prospectives. Chin. J. Nat. Med. 2017;15:321–329. doi: 10.1016/S1875-5364(17)30052-3.
40. Aggarwal N, Yadav J, Chhakara S, Janjua D, Tripathi T, Chaudhary A, Chhokar A, Thakur K, Singh T, Bharti AC. Phytochemicals as Potential Chemopreventive and Chemotherapeutic Agents for Emerging Human Papillomavirus–Driven Head and Neck Cancer: Current Evidence and Future Prospects. Front. Pharmacol. 2021;12:699044. doi: 10.3389/fphar.2021.699044
41. Yin F, Zhao L, Zhang L, Chen Y, Sun G, Li J, Zhang N, Xu Y, Chan PK, Zhong R. Chemopreventive Role of Apigenin against the Synergistic Carcinogenesis of Human Papillomavirus and 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone. Biomedicines. 2020 Nov 4;8(11):472. doi: 10.3390/biomedicines8110472. PMID: 33158065; PMCID: PMC7694184.

42. Galeone C., Pelucchi C., Levi F., Negri E., Franceschi S., Talamini R., Giacosa A., La Vecchia C. Onion and garlic use and human cancer. Am. J. Clin. Nutr. 2006;84:1027–1032. doi: 10.1093/ajcn/84.5.1027.
43. Tang F.Y., Chiang E.P., Chung J.G., Lee H.Z., Hsu C.Y. S-allylcysteine modulates the expression of E-cadherin and inhibits the malignant progression of human oral cancer. J. Nutr. Biochem. 2009;20:1013–1020. doi: 10.1016/j.jnutbio.2008.09.007.
44. Pai M.H., Kuo Y.H., Chiang E.P., Tang F.Y. S-Allylcysteine inhibits tumour progression and the epithelial-mesenchymal transition in a mouse xenograft model of oral cancer. Br. J. Nutr. 2012;108:28–38. doi: 10.1017/S0007114511005307.
45. Balasenthil S., Ramachandran C.R., Nagini S. S-allylcysteine, a garlic constituent, inhibits 7,12-dimethylbenz[a]anthracene-induced hamster buccal pouch carcinogenesis. Nutr. Cancer. 2001;40:165–172. doi: 10.1207/S15327914NC402_13.
46. Bhuvaneswari V., Rao K.S., Nagini S. Altered expression of anti and proapoptotic proteins during chemoprevention of hamster buccal pouch carcinogenesis by tomato and garlic combination. Clin. Chim. Acta. 2004;350:65–72. doi: 10.1016/j.cccn.2004.07.002.
47. Lai W.W., Hsu S.C., Chueh F.S., Chen Y.Y., Yang J.S., Lin J.P., Lien J.C., Tsai C.H., Chung J.G. Quercetin inhibits migration and invasion of SAS human oral cancer cells through inhibition of NF-κB and matrix metalloproteinase-2/-9 signaling pathways. Anticancer Res. 2013;33:1941–1950.
48. Burak C., Brüll V., Langguth P., Zimmermann B.F., Stoffel-Wagner B., Sausen U., Stehle P., Wolffram S., Egert S. Higher plasma quercetin levels following oral administration of an onion skin extract compared with pure quercetin dihydrate in humans. Eur. J. Nutr. 2017;56:343–353. doi: 10.1007/s00394-015-1084-x.
49. Harwood M., Danielewska-Nikiel B., Borzelleca J.F., Flamm G.W., Williams G.M., Lines T.C. A critical review of the data related to the safety of quercetin and lack of evidence of in vivo toxicity, including lack of genotoxic/carcinogenic properties. Food Chem. Toxicol. 2007;45:2179–2205. doi: 10.1016/j.fct.2007.05.015.
50. Safarzadeh S, Shirban F, Bagherniya M, Sathyapalan T, Sahebkar A. The effects of herbal medicines on cancer therapy-induced oral mucositis: A literature review. Phytother Res. 2022 Jan;36(1):243-265. doi: 10.1002/ptr.7308. Epub 2021 Oct 28. PMID: 34709682.
51. Ritschel ML, Hübner J, Wurm-Kuczera R, Büntzel J. Phytotherapy known and applied by head-neck cancer patients and medical students to treat oral discomfort in Germany: an observational study. J Cancer Res Clin Oncol. 2022 Jul 23. doi: 10.1007/s00432-022-04200-0. Epub ahead of print. PMID: 35870011.
52. Gomes VTS, Nonato Silva Gomes R, Gomes MS, Joaquim WM, Lago EC, Nicolau RA. Effects of Matricaria Recutita (L.) in the Treatment of Oral Mucositis. ScientificWorldJournal. 2018 Jun 12;2018:4392184. doi: 10.1155/2018/4392184. PMID: 30008621; PMCID: PMC6020515.
53. de Lima Dantas JB, Freire TFC, Sanches ACB, Julião ELD, Medrado ARAP, Martins GB. Action of Matricaria recutita (chamomile) in the management of radiochemotherapy oral mucositis: A systematic review. Phytother Res. 2022 Mar;36(3):1115-1125. doi: 10.1002/ptr.7378. Epub 2022 Feb 7. PMID: 35129844.
54. Tavakoli Ardakani M, Ghassemi S, Mehdizadeh M, Mojab F, Salamzadeh J, Ghassemi S, Hajifathali A. Evaluating the effect of Matricaria recutita and Mentha piperita herbal mouthwash on management of oral mucositis in patients undergoing hematopoietic stem cell transplantation: A randomized, double blind, placebo controlled clinical trial. Complement Ther Med. 2016 Dec;29:29-34. doi: 10.1016/j.ctim.2016.08.001. Epub 2016 Aug 30. PMID: 27912953.
55. Naidu MU, Ramana GV, Ratnam SV, Sudhavani T, Naidu KJ, Roy P, Suresh P, Rani PU, Mohan IK. A randomised, double-blind, parallel, placebo-controlled study to evaluate the efficacy of MF 5232 (Mucotrol), a concentrated oral gel wafer, in the treatment of oral mucositis. Drugs R D. 2005;6(5):291-8. doi: 10.2165/00126839-200506050-00005. PMID: 16128599.
56. Eubank PLC, Abreu LG, Violante IP, Volpato LER. Medicinal plants used for the treatment of mucositis induced by oncotherapy: a systematic review. Support Care Cancer. 2021 Nov;29(11):6981-6993. doi: 10.1007/s00520-021-06247-0. Epub 2021 May 14. PMID: 33988743.

57. Park B, Noh H, Choi DJ. Herbal Medicine for Xerostomia in Cancer Patients: A Systematic Review of Randomized Controlled Trials. Integr Cancer Ther. 2018 Jun;17(2):179-191. doi: 10.1177/1534735417728336. Epub 2017 Sep 4. PMID: 28870110; PMCID: PMC6041902.
58. Godsey J, Grundmann O. Review of Various Herbal Supplements as Complementary Treatments for Oral Cancer. J Diet Suppl. 2016;13(5):538-50. doi: 10.3109/19390211.2015.1122693. Epub 2016 Feb 10. PMID: 26863913.
59. Iriti M, Varoni EM. Chemopreventive potential of flavonoids in oral squamous cell carcinoma in human studies. Nutrients. 2013 Jul 8;5(7):2564-76. doi: 10.3390/nu5072564. PMID: 23857227; PMCID: PMC3738988.
60. Rizeq B, Gupta I, Ilesanmi J, AlSafran M, Rahman MM, Ouhtit A. The Power of Phytochemicals Combination in Cancer Chemoprevention. J Cancer. 2020 May 18;11(15):4521-4533. doi: 10.7150/jca.34374. PMID: 32489469; PMCID: PMC7255361.
61. Kotecha R, Takami A, Espinoza JL. Dietary phytochemicals and cancer chemoprevention: a review of the clinical evidence. Oncotarget. 2016 Aug 9;7(32):52517-52529. doi: 10.18632/oncotarget.9593. PMID: 27232756; PMCID: PMC5239570.
62. Shin DM. Oral cancer prevention advances with a translational trial of green tea. Cancer Prev Res (Phila). 2009 Nov;2(11):919-21. doi: 10.1158/1940-6207.CAPR-09-0207. PMID: 19892661.
63. Hsu SD, Singh BB, Lewis JB, Borke JL, Dickinson DP, Drake L, Caughman GB, Schuster GS. Chemoprevention of oral cancer by green tea. Gen Dent. 2002 Mar-Apr;50(2):140-6. PMID: 12004708.
64. Guran K, Buzatu R, Pinzaru I, Boruga M, Marcovici I, Coricovac D, Avram S, Poenaru M, Susan M, Susan R, Radu D, Dehelean CA, In Vitro Pharmaco-Toxicological Characterization of Melissa officinalis Total Extract Using Oral, Pharynx and Colorectal Carcinoma Cell Lines. Processes 2021, 9, 850. https:// doi.org/10.3390/pr9050850
65. Clairet AL, Boiteux-Jurain M, Curtit E, Jeannin M, Gérard B, Nerich V, Limat S. Interaction between phytotherapy and oral anticancer agents: prospective study and literature review. Med Oncol. 2019 Apr 16;36(5):45. doi: 10.1007/s12032-019-1267-z. PMID: 30993543.
66. Prely H, Herledan C, Caffin AG, Baudouin A, Larbre V, Maire M, Schwiertz V, Vantard N, Ranchon F, Rioufol C. Real-life drug-drug and herb-drug interactions in outpatients taking oral anticancer drugs: comparison with databases. J Cancer Res Clin Oncol. 2022 Mar;148(3):707-718. doi: 10.1007/s00432-021-03645-z. Epub 2021 Apr 29. PMID: 33914124.

Restoration methods used for aesthetic dental dysfunction correction in Arad



Olariu I.[1], Bran L.R.[2], Damian G.[3], Porumb A.[4], Cosoroaba R.M.[5], Olariu T.[3]

[1]*Department of Denistry, Faculty of Dentistry, Faculty of Medicine, "Vasile Goldis" Western University Of Arad*
[2]*Arad College of Nursing*
[3]*Department of General Medicine, Faculty of Medicine "Vasile Goldis" Western University of Arad*
[4]*Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania*
[5]*Department of Management, Legislation and Communication in Dentistry, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania*

Correspondence to:
Name: Olariu Teodora
Address: No 86 Liviu Rebreanu street, Arad
Phone: +40 744700374
E-mail address: olariu_teodora@yahoo.com

Abstract

Aim and objectives: To evaluating dentists 'opinions on restoration methods, starting from the hypothesis that aesthetic restorative techniques are performed in more than 50% of dental department, the chosen methods being adapted to the requirements of each patient. Material and methods: A questionnaire referring to methods used in aesthetic dental restorations was applied to 105 dentists. Percentile, one sample t-test for normal distribution, Correlations and Pearson's r were used in statistical analysis. Results: Responders mean age was 29. The most applied methods in aesthetic dental restorations are weneer and metal-ceramic crowns. Conclusions: dental dyschromia, dental wear, interdental disproportions, changes in dental position were the most common aspects involved in dental aesthetics, Sig. (2-tailed) for items'correlation being between 0.000-0.041.

Keywords: dental dysfunction correction, correlation, weneer.

INTRODUCTION

Modern aesthetic dentistry, even if is not a specialty discipline itself, represents one goal of dental treatment interventions, covering a lot of specialty areas, including restorative dentistry, preventive dentistry, orthodontics, prosthodontics, periodontics and oral and maxillofacial surgery. It requires in-depth knowledge of natural tooth positions, colour, arrangements, shapes, and proportions in order to recreate the most natural aspect as much as possible. On the other hand, dental specialist must help the patient in identifying a personal aesthetic vision, to fulfill the psychological requirements of the final results [1].

The level of aesthetic requirement in clinical practice has increased over the past decade, and this has made it necessary for dentist to explore this field in order to satisfy the existing demand in this field [2].

Since their introduction in the early 1980's ceramic veneers have gained wide acceptance as a primary mode of restoration in esthetic dentistry [3]. Advances in ceramic materials and veneering techniques allow practitioners to restore function and aesthetics using conservative and biologically sound methods as well as promoting long term oral health [4].

Ceramics are replacing metals as materials of choice in dental crowns, as well as in other biomechanical prostheses [5]. The major advantage of ceramic crowns is the esthetic result. The thermal conductivity is low for ceramics also it is resistant to corrosion. Also, there are no galvanic reactions for ceramics. Dental ceramics are claimed to be the most biocompatible materials used to date for dental restorations [6].

Apart of some clinical practice guidelines of aesthetic dentistry, the latest published in 2022 in Journal of Conservative Dentistry [7], there are numerous valuable works on oral restoration, which take into account the functionality of the dental system, the patient's psychology, the perfect smile and self-esteem and last but not least, the costs involved in each chosen method.

Aim and objectives

To evaluating the opinions of trained dentists and of those registred in dental residency programs on dental restoration methods.

Hypothesis. Aesthetic restorative techniques are performed in more than 50% of dental department, the chosen methods being adapted to the requirements of each patient.

MATERIAL AND METHODS

An 11 questions questionnaire referring to methods used in aesthetic dental restorations was applied in June 2022 to 105 responders, for describing dental practice and techniques they experienced (in appendix). Sample size and margin of error (3.92%) were calculated taking into account the statistical data regarding the number of dentists in Arad in 2021 [8]. Frequency with percentile, one sample t-test for normal distribution, Paired Samples Correlations and Pearson's r were used in the statistical analysis.

RESULTS

Responders mean age was 29, StdDev. 5.04. Most of them work in private dental departments; gender ratio M:F = 1.36, 26% were frequently involved in aesthetic dental restorations and more than half motivate the patient in order to correct his dental dysfunctions through restorative techniques, table 1.

Table 1. Responders characteristics

Type of practice	Percent
Private	88.6
both private and budgeted	8.5
Budgeted	2.9
Gender	Percent
F	41.9
M	58.1
Performing aesthetic dental restorations	Percent
Never	21.0
Occasional	53.3
Frequent	25.7

The most applied methods in aesthetic dental restorations are weneer made by direct method and metal-ceramic crowns, table 2 and figure 1.

Table 2. Dental dysfunctions and elective aesthetic dental restorations

Item	Veneer/ direct method	Veneer/ indirect method	metal-ceramic crowns	full ceramic crowns
dental dyschromia	38.1	27.6	15.2	19.0
morphological changes consecutive to dental wear	29.5	13.3	31.4	25.7
interdental disproportions-interdental relations	29.5	20.0	25.7	24.8
changes in dental position	21.0	23.8	33.3	21.9
to increase the degree of exposure of maxillary anterior teeth	41.0	33.3	10.5	15.2

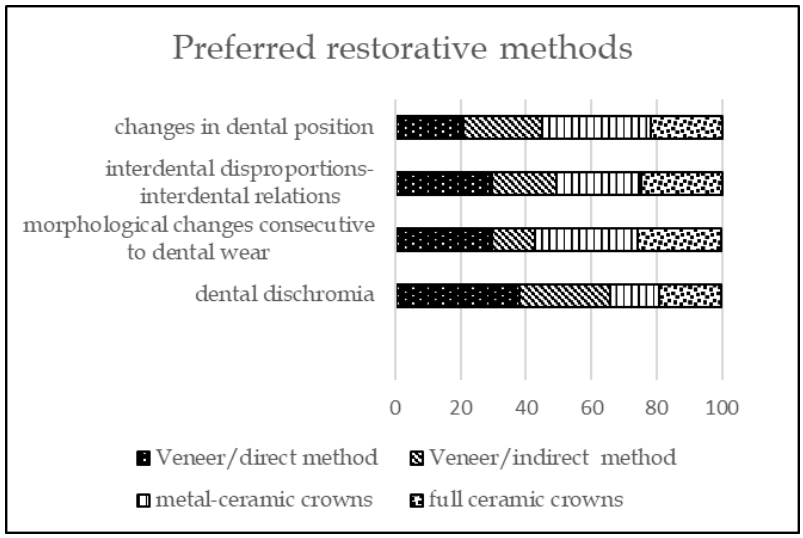


Figure 1. Dental dysfunctions and elective aesthetic dental restorations

Dental dyscromia. Porcelain laminate veneers are nowadays commonly used for aesthetic purposes owing to their better aesthetic properties, higher resistance to abrasion and discoloration, and better biological harmony with the oral flora [9]. Nowadays, restorative treatment has achieved high aesthetic standards. It protects the dental structure maximally thanks to the development of adhesive systems, resin cement, and ceramics. The resin infiltration technique, bleaching treatment, and laminate veneer applications, among other minimally invasive treatments, have gained importance due to greater protection rates of the tooth and high aesthetic standards [10]. More than half of the respondents use these techniques to correct dyschromia, table 3.

Table 3. Methods to correct dental dyschromia

methods to correct dental dyschromia	Percent
veneer/direct method	25.7
veneer/indirect method	23.8
full ceramic crowns	19
metal-ceramic crowns	11.4
veneer/ direct+indirect method+full ceramic crowns	9.5
veneer/direct+indirect method+metal-ceramic crowns+full ceramic crowns	6.7
metal-ceramic crowns+full ceramic crowns	3.8
Total	100

Dental wear. Early diagnosis and timely management of tooth or dental material wear is imperative to avoid extensive restorations. It is a normal physiological process that is macroscopically irreversible; Lambrechts et al. [11] estimated the normal vertical loss of enamel from physiological wear to be approximately 20-38 µm per annum. Various modalities, including direct or indirect techniques, can be successful in the treatment of these patients. More than half of the respondents use full ceramic crowns and veneer to correct the morphological changes consecutive to dental wear, table 4.

Table 4. Methods to correct the morphological changes consecutive to dental wear

methods to correct the morphological changes consecutive to dental wear	Percent
full ceramic crowns	25.7
veneer/direct method	24.8
metal-ceramic crowns	21
veneer/indirect method	10.5
metal-ceramic crowns+full ceramic crowns	10.5
veneer/indirect method+metal-ceramic crowns+ full ceramic crowns	1.9
veneer/direct+indirect method+metal-ceramic crowns+ full ceramic crowns	6
Total	100

Interdental spacing is disliked by all, and the size and pattern of spacing has an influence on aesthetic perception. Professionals tolerated interdental spacing more than their patients [12]. Restorations methods are in table 5.

Table 5. Methods to correct interdental disproportions-interdental relations and changes in dental position

methods to correct interdental disproportions-interdental relations	Percent
full ceramic crowns	24.8
veneer/direct method	21
metal-ceramic crowns	18.1
veneer/indirect method	17.1
metal-ceramic crowns+full ceramic crowns	7.6
veneer/ direct +indirect method+metal-ceramic crowns+full ceramic crowns	6.7
veneer/indirect method+full ceramic crowns	4.9
Total	100
methods to correct changes in dental position	Percent
metal-ceramic crowns	21.9
full ceramic crowns	21.9
veneer/indirect method	18.1
veneer/direct method	16.2
metal-ceramic crowns+full ceramic crowns	11.4
veneer/direct+indirect method+metal-ceramic crowns+full ceramic crowns	10.7
Total	100

Exposure of maxillary anterior teeth. In females aged 20 to 29, 30 to 39, 40 to 49 and 50 to 59 years, the mean exposure of central incisor is 2.16, 2.1, 2.18 mm and that of canine is 0.04, -0.36, -0.44 mm. For male of age group 20 to 29, 30 to 39, 40 to 49 and 50 to 59 years

exposed 2.04, 2.04, 1.84, 1.76 mm of central incisor respectively and 0.08, -0.52, -0.4 and -0.4mm exposure of canine. Female subjects with lip length 10 to 15, 15 to 20, 21 to 25, 25 to 30 and 31 to 35 mm showed 3.7, 3.4, 2.3, 0.9, 0.25 mm exposure of central incisor and 0.35, -0.15, -0.7, -0.8, -0.6 mm exposure of canine, respectively. Male subjects exposed 3.4, 3.3, 2.05, 0.7, 0.15 mm of central incisor and 0.4, 0.3, -0.6, -0.95, -0.7 mm of canine respective to lip length. The range of exposure of maxillary central incisors is wider than that of canine. The average dimensions for maxillary canines relating to age and sex were closer to the extremes of the range. The canine position relative to the maxillary lip appeared to be a more predictable determinant [13]. The correction methods used by the responders are in the table 6.

Table 6. Methods to increase the degree of exposure of maxillary anterior teeth

methods to increase the degree of exposure of maxillary anterior teeth	Percent
veneer/direct method	30.5
veneer/indirect method	28.6
full ceramic crowns	15.2
metal-ceramic crowns	5.7
metal-ceramic crowns+full ceramic crowns	4.8
veneer/direct+indirect method	3.8
veneer/direct method+full ceramic crowns	3.8
veneer/indirect method+metal-ceramic crowns+full ceramic crowns	2.9
veneer/indirect method+full ceramic crowns	1.9
veneer/direct+indirect method+metal-ceramic crowns+full ceramic crowns	3
Total	100

Psychologic assessment of the aesthetic facial patient. Surgeons and other medical professionals who perform aesthetic treatments should evaluate and monitor the psychosocial status and functioning of patients who seek these procedures. Most patients who present for aesthetic treatments are as psychologically stable as other individuals from the general population [14]. The responders say that less than a quarter of the patients requested invasive aesthetic intervention, table 7.

Table 7. Acceptance an invasive aesthetic intervention

Do you include surgical therapy as a pre-prosthetic stage in the treatment plan?	Percent
No	20
Yes	80
When do you aesthetically correct dental dysfunctions?	Percent
At the request of the patient	24.8
Both situations	2.9
I make the patient aware of the aesthetic dental dysfunction and I motivate him in order to correct it through restorative techniques	72.4
What method do you use for the patient's acceptance of an invasive aesthetic intervention (partial or total coverage of the teeth)?	Percent
Mock-ups	34.6
Photos of other patients, before and after treatment	24.3
Simulation on photos	19.8
Diagnostic models with wax models	19.8
Another method	1.2
Do you consider that the type of cementing material is important for obtaining an aesthetic result of restoration method?	Percent
No	14.3
yes	85.7
The translucency of some of the ceramic materials is important for obtaining an aesthetic effect	Percent
Both in the third incisal area and in the cervical area	46.7
In the third incisal area	44.8
In the cervical area	8.6

There are significant correlations between items in questionnaire, which shows that the aesthetic interventions are motivated by the existing dental dysfunctions, with the patients' acceptance, at their wish, at the specialist's recommendation, and the chosen corrective methods are appropriate, table 8.

Table 8. The correlations between the items of the questionnaire

Pearson Correlation	item	Sig. (2-tailed)
Age	correcting aesthetic dental dysfunctions	0.003
morphological changes consecutive to dental wear	changes in dental position	0.001
	patient's acceptance	0.001
	interdental disproportions	0.000
changes in dental position	patient's acceptance	0.003
	interdental disproportions	0.000
surgical therapy as a pre-prosthetic stage	performing aesthetic dental restorations	0.032
correcting aesthetic dental dysfunctions	performing aesthetic dental restorations	0.041
patient's acceptance	changes in dental position	0.003
	interdental disproportions	0.031
dental dyschromia	interdental disproportions	0.002
	to increase the degree of exposure of maxillary anterior teeth	0.005

DISCUSSIONS

This study was undertaken to find out whether dentists' perceptions of the aesthetic zone is it different from that of the patients or not, and if the decisions taken are mainly related to the presence of dental dysfunction versus just the aesthetic aspect. Some areas were assessed: restorative method to correct dental dyschromia, dental wear, dental dysfunctions, changes in dental position, to increase the degree of exposure of maxillary anterior teeth, interdental disproportions, patient's acceptance for invasive interventions, type of cementing material.

As the study was carried out both in budgeted and private general dental practices there will be a sampling bias and, although the responders were randomly selected, they may not represent the general dentistry population. One hundred and five responders took part in the study, 44 women and 61 men, ranging in age from 24 to 51years old. The small size of the study meant that in some of the age range groups there were only a very small number of participants, as is the case in the over 40 year - old category.

Esthetic dentistry is currently receiving increased attention in dental practice. Many studies and digital smile analysis programs have attempted to formulate a protocol for helping dentists assess smile esthetics to reach an accurate diagnosis and to plan the required treatment [15].

The results of this study demonstrated that dentists in Arad the dentists in Arad give equal importance to both real dental dysfunction and the wishes of the patients, with whom they form a team.

CONCLUSIONS

The hypothesis from which the study started is confirmed, aesthetic restorative techniques being performed in more than 50% of dental department and the chosen methods are adapted to the requirements of each patient.

Questionnaire for investigating the use of restoration methods for aesthetic dental dysfunction correction, in order to carrying out a specialized study

APPENDIX

Questionnaire for investigating the use of restoration methods for aesthetic dental dysfunction correction

1. Age 2. Gender 3. Type of practice:a. private b. budgeted c. both types

4. I perform aesthetic dental restorations: a. never b. occasional c. frequent

5. What restorative method do you use to correct dental dischromia?

a. veneer made by direct method

b. veneer made by indirect method

c. Metal-ceramic crowns

d. Full ceramic crowns

6. What restorative method do you use to correct the morphological changes consecutive to dental wear?

a. veneer made by direct method

b. veneer made by indirect method

c. Metal-ceramic crowns

d. Full ceramic crowns

7. What restorative method do you use to correct interdental disproportions - interdental relations?

a. veneer made by direct method

b. veneer made by indirect method

c. Metal-ceramic crowns

d. Full ceramic crowns

8. What restorative method do you use to correct changes in dental position?

a. veneer made by direct method

b. veneer made by indirect method

c. Metal-ceramic crowns

d. Full ceramic crowns

9. What restorative method do you use to increase the degree of exposure (visibility) of the maxillary frontals?

a. veneer made by direct method

b. veneer made by indirect method

c. Metal-ceramic crowns

d. Full ceramic crowns

10. Do you include surgical therapy as a pre-prosthetic stage in the treatment plan (for optimizing the aesthetic result of prosthetic restorations)? Yes No

11. Are you correcting aesthetic dental dysfunctions:

a. At the request of the patient

b. I make the patient aware of the aesthetic dental dysfunction and I motivate him in order to correct it through restorative techniques.

12. What method do you use for the patient's acceptance of an aesthetic intervention invasive (partial or total coverage of the teeth)

a. Photos of other patients, before and after treatment

b. Simulation on photos

c. Diagnostic models with wax models

d. Mock-ups

e. Another method

f. No method

13. Do you consider that the type of cementing material is important for obtaining an aesthetic result of restoration methods? Yes No

14. The translucency of some of the ceramic materials is important for obtaining an aesthetic effect:

a. In the third incisal area

b. In the cervical area

c. Both in the third incisal area and in the cervical area

REFERENCES

1. M B Blatz, G Chiche et all, Evolution of Aesthetic Dentistry, J Dent Res. 2019 Nov;98(12):1294-1304.
2. Yousef A. AlJehani, Jagan K. Baskaradoss et all, Current Trends in Aesthetic Dentistry, Health, Vol.6 No.15(2014), Article ID:48674,9 pages
3. Peumans, M., Van Meerbeek, B., Lambrechts, P. and Vanherle, G. (2000) Porcelain Veneers: A Review of the Literature. Journal of Dentistry, 28, 163-177
4. Malcmacher, L. (2003) Back to the Future with Porcelain Veneers. Dentistry Today, 22, 70-72
5. Kelly, J.R. (1999) Clinically Relevant Approach to Failure testing of All-Ceramic Restorations. Journal of Prosthetic Dentistry, 81, 652-661
6. Rykke, M. (1992) Dental Materials for Posterior Restorations. Dental Traumatology, 8, 139-148
7. Dibyendu Majumder, Mithra N. Hegde, et all, Recommended clinical practice guidelines of aesthetic dentistry for Indians: An expert consensus, J Conserv Dent. 2022 Mar-Apr; 25(2): 110–121.
8. http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table
9. Jang J.-H., Lee S.-H., Paek J., Kim S.-Y. Splinted porcelain laminate veneers with a natural tooth pontic: a provisional approach for conservative and esthetic treatment of a challenging case. Operative Dentistry. 2015;40(6): E257–E265. doi: 10.2341/15-020-S
10. H. Sevilay Bahadır, Gökhan Karadağ, and Yusuf Bayraktar, Minimally Invasive Approach for Improving Anterior Dental Aesthetics: Case Report with 1-Year Follow-Up, Case Rep Dent. 2018; 2018: 4601795. Published online 2018 Sep 6. doi: 10.1155/2018/4601795
11. Lambrechts P, Braeme M, Vuylsteke-Wauters M, Vanherle G. Quantitative in vivo wear of human enamel. J Dent Res 1989; 68: 1752–1754
12. Aarti Mehta, The influence of interdental spacing on perceived smile aesthetics, University of Birmingham, January 2018, https://dokumen.tips/documents/the-influence-of-interdental-spacing-on-perceived-smile-17-oral-health-related.html?
13. R Patel, Paranjay Prajapati, et all, A Comparative Evaluation of Effect of Upper Lip Length, Age and Sex on Amount of Exposure of Maxillary Anterior Teeth, March 2011The Journal of Contemporary Dental Practice 12(1):24-9
14. David B. Sarwer, Jacqueline C. Spitzer, Psychology of facial aesthetics, Aesthetic Surgery of the Facial Skeleton, 2022
15. LeSage BP, Dalloca L. Approaches to smile design, mathematical to artistic interpretation. Journal of Cosmetic Dentistry. 2012; 28:126–147

State of current knowledge of the aetiology and incidence of molar-incisor hypomineralization (MIH) - a bibliometric analysis

Luca M.M.[1], Popa M.[1], Buzatu R.[2], Penescu B.[3], Miron M.I.[4]

[1]*Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania*
[2]*Department of Dental Aesthetics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*
[3]*DMD, Timişoara, Romania*
[4]*Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania*

Correspondence to:
Name: Buzatu Roxana
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40 721236147
E-mail address: roxana.buzatu@umft.ro

Abstract

Molar-incisor hypomineralization (MIH) was defined in 2001 as a qualitative enamel defect of systemic origin affecting at least one permanent first molar and may also be associated with permanent incisors. Numerous papers have been published to shed light on and raise awareness of this global issue [3]. The condition can be associated with dental complications, including hypersensitive teeth, rapid caries progression, impaired mastication due to rapid wear, and aesthetic repercussions. They can affect patients' quality of life and create treatment challenges for dentists. The present study aims to carry out a bibliometric analysis on the aetiology and incidence of molar-incisor hypomineralization syndrome, this being one of the most pressing problems faced by paediatric dentistry.

Keywords: MIH, HSPM, aetiology, treatment options, VOSviewer

INTRODUCTION

Molar-incisor hypomineralization (MIH) was defined in 2001 as a qualitative enamel defect of systemic origin affecting at least one permanent first molar and may also be associated with permanent incisors [1]. The European Academy of Pediatric Dentistry noted the lack of knowledge about MIH and promoted research in this regard [2]. Numerous papers have been published to shed light on and raise awareness of this global issue [3]. The condition can be associated with dental complications, including hypersensitive teeth, rapid caries progression, impaired mastication due to rapid wear, and aesthetic repercussions. They can affect patients' quality of life and create treatment challenges for dentists. Given this lifetime burden, it clearly deserves increased attention as a global dental public health concern [4].

Regarding aetiology, many studies have investigated the association between systemic conditions, prenatal, perinatal, and postnatal drug use, early exposure to dioxins or bisphosphonates, and genetic factors. However, the available evidence is still insufficient to establish the exact cause [5,6].

Clinically, affected teeth show hypomineralization that can be seen as an alteration of enamel translucency. Hypomineralized enamel can vary in shade colour from white to yellow or brown, but always shows well-defined and distinct edges of healthy enamel. Porous enamel can fracture easily, especially under the influence of masticatory forces. Occasionally, the enamel of affected molars breaks down slightly after eruption, leaving the dentin exposed, referred to in the literature as "posteruptive enamel degradation". At the level of the permanent incisors, the affected enamel usually appears less disturbed due to much lower masticatory forces. Incisal enamel defects are, however, frequently extended to the vestibular surfaces of the teeth giving rise to aesthetic problems [7,8].

The causative mechanism of MIH is still unclear, but the clinical presentation of localized and asymmetric lesions suggests a systemic origin with disruption in the amelogenesis process that most likely occurs in the early maturation stage or even earlier in the late secretory phase [5,9].

In general, the cause appears to be multifactorial, including systemic factors such as acute or chronic diseases or exposure to environmental pollutants during the last trimester of pregnancy and the first three years of life have been suggested as causative or contributing factors. The number of affected teeth was associated with the time at which the potential systemic disorder occurred; children with prenatal, perinatal and postnatal problems have more affected teeth [5,10].

Several possible causes have been suggested in the literature, for example, respiratory tract infections, perinatal complications, dioxins, oxygen starvation, low birth weight, calcium and phosphate metabolic disorders, frequent childhood illnesses, antibiotic use, and prolonged breastfeeding [11].

Mathu-Muju and **Wright** classified MIH into three levels of severity:

1. Mild MIH:
   - delimited opacities located in unsolicited areas
   - non-association of caries with affected enamel, without hypersensitivity
   - incisor involvement is usually mild if present
2. Moderate MIH
   - limited opacities
   - present on molars and incisors
   - post-eruptive enamel damage limited to one or two surfaces without cuspid involvement

- atypical restorations may be required
- normal dental sensitivity

3. Severe MIH:

- post-eruptive enamel
- destruction of the crown, caries
- associated with affected enamel
- dental sensitivity and aesthetic concerns [12].

Aim and objectives

The present study aims to carry out a bibliometric analysis on the aetiology and incidence of molar-incisor hypomineralization syndrome, this being one of the most pressing problems faced by paediatric dentistry. It is desired to identify trends in the main research topics and groups—including authors and countries—for MIH over the years; also to explore the development of scientific evidence, possible etiological factors and types of proposed treatments that guide future research in the field.

MATERIAL AND METHODS

A. BIBLIOMETRIC ANALYSIS

The VOSviewer software is a tool for building and viewing bibliometric networks, being used in mapping and scientific research. Bibliometric charts are used to highlight the structure and network of journals, authors, universities or countries. Networks may include, for example, journals, individual publications, or researchers, and may be built on co-authorship, bibliographic coupling, or citation relationships. In order to create a network, bibliographic database files (Web of Science, Dimensions, Scopus and PubMed,) and reference management files (RIS EndNote and RefWorks files) can be provided as input to VOSviewer.

Bibliometric tools are used to study the flow of scientific publications, to rank the quality of work in a certain field, to assess the speed of its development, to identify experts, institutions and countries recognized worldwide for their contributions to scientific development and number of citations. With this data, more complex mathematical formulas can be constructed to obtain more specialized bibliometric indicators, such as a journal's impact factor or a researcher's Hirsch index.

Working steps in WoSviewer:

1. The words: "*molar incisor hypomineralisation* (MIH)", "*deciduous molar hypomineralisation*" and "*hypomineralised second primary molars (HSPM*)" were considered the most relevant words in order to carry out the study and obtain the most accurate and current potential results for all domains of knowledge in the WoS, following a selection of articles, according to the inclusion criteria, to be included in the research. Given that the results are numerous, they are closely related to incidence and prevalence.

All documents published in the period 2012-2022 were included in the study. Also, the final selection was limited to articles only, excluding oral presentations and abstracts. The sample includes 153 documents. The limitation was mainly applied to works published in English. Studies lacking demographic characteristics and those that included fluorosis were excluded. Additional reference searches were conducted against the references of the selected articles. For relevance, the collected articles were reviewed by title, abstract and text criteria.

B. CO-CITATION OF SCIENTIFIC SOURCES

This part of the analysis focuses on researching the network area of the most important sources. Regarding co-citation links, the link between them indicates the distance between two journals, thus a strong link is indicated by a small distance between them, while

a weak link is highlighted by a large distance between journals. Co-citation shows the frequency with which a document cites two other documents together.

Among the data selected in Web of Science, VOSviewer took only the names of the main sources of the works in the bibliometric map. Regarding source co-citation analysis, the unit of analysis is represented by the names of the sources in the data (set of journals) that were analyzed in VOSviewer. The data selected from the Web of Science and entered into the VOSviewer program identified the presence of 587 sources, but only 35 of them met the criterion of at least 3 citations per source. So, the journal set highlights only the 35 most productive journals in our research scope, and these journals fall into 4 different color clusters.

RESULTS

A. Bibliometric analysis of keywords

This method focuses on highlighting the most persistent keywords in terms of their coincidence (keywords that appear simultaneously in several articles). Therefore, it is important to emphasize that the keywords used by the author throughout the article are taken into account. The main aim is to observe the keywords most adopted by the authors in the field of molar-incisor hypomineralization syndrome (MIH).

In addition to the most used and relevant keywords in determining the results in Web of Science (MIH, prevalence, incidence, children), the map in Vosviewer shows us a major importance of other words that appear predominantly in the articles taken into analysis, such as: severity (with 17 occurrences), 2nd primary molars (with 16 occurrences), defects (with 15 occurrences) and enamel defects, caries, school-children (each with 18 occurrences) (Fig.1).

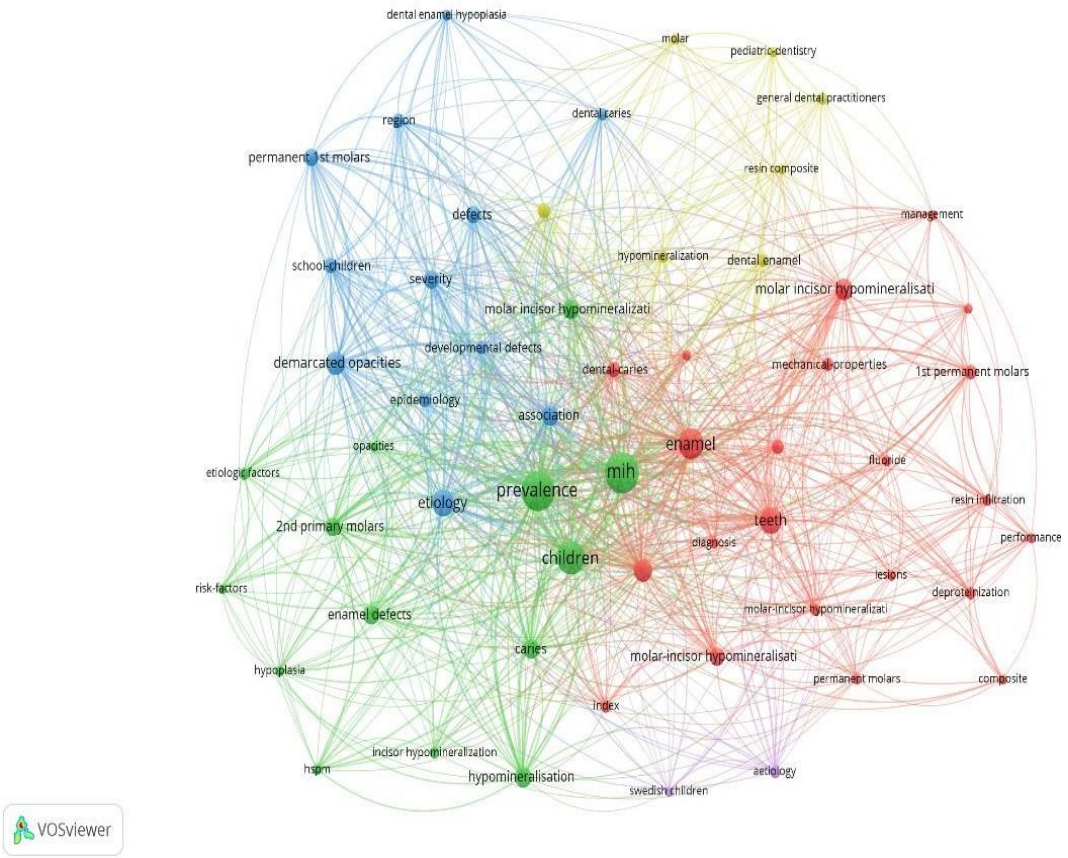


Figure 1. Word coincidence network regarding the incidence and prevalence of molar-incisor hypomineralization (MIH

The bibliometric map indicates the most important keywords and respectively the nodes between keywords:

- the bigger the keyword and the node we see, the more relevance has;
- the smaller the distance between the nodes, the stronger the relationship between them.
- we observe a more frequent co-occurrence when the lines are thicker.
- the same color indicates a series of related keywords or a group of keywords

Thus, the program identified 5 clusters.

Figure 1 represents the keywords with the most frequent matches (applying a threshold of one match).

The group containing the most keywords is group 1 (red), which is centered on words such as: 1st permanent molars, caries experience, enamel hypomineralisation and composite. Next, we have group 2 (green), which includes 14 keywords, such as: 2nd primary molars, caries, etiologic factors and hypoplasia.

Group 3 (blue) presents 2 keywords in addition to the green one, association, defects and demarcated opacities being included in it.

Group 4 (yellow) is headed by the words: dental enamel, pediatric dentistry and hypomineralization.

Further, group 5 (purple) consists of 2 objects each, but of major importance. Aetiology and Swedish children are the words the purple group is centered on. (Table 1).

Table 1. Keyword groups

Word no.	Group 1(red)	Group 2 (green)	Group 3 (blue)	Group 4 (yellow)	Group 5 (purple)
1	1st permanent molars	2nd primary molars	Association	Molar	Aetiology
2	Amorphous calcium-phosphate	Caries	Defects	Pediatric-dentistry	Swedish children
3	Caries experience	Children	Etiology	Dental enamel	
4	Composite	Enamel defects	Epidemiology	Resin composite	
5	Dental-caries	Etiologic factors	Demarcated opacities	General dental practitioners	
6	Deproteinization	Hspm	Developmental defects	Incisor hypomineralisation	
7	Diagnosis	Hypomineralisation	Severity	Hypomineralization	
8	Enamel	Hypoplasia	School-children		
9	Enamel hypomineralisation	Incisor Hypomineralization	Permanent 1st molars		
10	Fluoride	MIH	Region		
11	Index	Molar incisor hypomineralis ation	Dental enamel hypoplasia		
12	Lesions	Opacities	Dental caries		
13	Management	Prevalence			
14	Mechanical-properties	Risk factors			
15	Molar incisor hypomineralisation				
16	Molar-incisor hypomineralisation				
17	Molar-incisor hypominerazati				
18	Molar-incisor-hypomineralisation				
19	Performance				
20	Permanent molars				
21	Resin infiltration				
22	Teeth				

B. Co-citation regarding authors

Following the application of the criterion of appearing in at least 3 articles, the number of authors who published on the subject of MIH, was reduced from 587 to 35 authors.

They were grouped into 4 clusters of different colours (red, blue, green and purple) according to the approach of the topic in the articles. Among the 35 authors to whom the bibliometric map was narrowed, 19 are the ones that were most relevant to this study according to the criterion of citations and the total strength of the link (Fig.2).

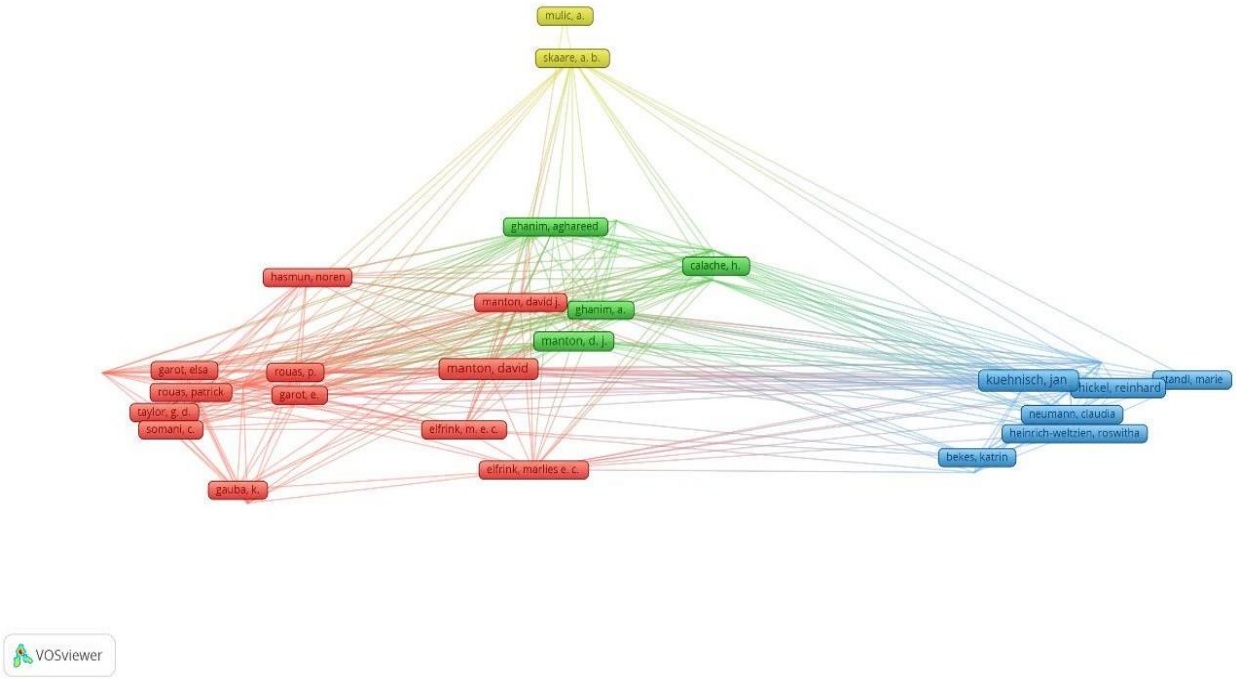


Figure 2. Bibliographic map regarding co-citation

The first three authors to publish on this topic were Manton DJ affiliated with the University of Melbourne-Australia, Kühnisch Jan and Hickel Reinhard, both affiliated with the Ludwig-Maximilians University in Munich. Thirty-five authors resulted following the criterion of being present with at least three publications on this topic. Most of them had publications in both MIH and DMH/HSPM, but the number of studies on DMH/HSPM was lower for all but one author (Elfrink ME). Further analysis of the collaboration between these authors with three or more publications on the topic of interest revealed the existence of four main geographical collaboration clusters: (1) Australia; (2) Continental Europe (Netherlands, Germany, Austria) (3) Brazil. The European Archives of Pediatric Dentistry was the most published journal, followed by the International Journal of Pediatric Dentistry and the European Journal of Pediatric Dentistry (Table 2).

Table 2. Citation groups and related link strength on the most relevant scientific authors

Group 1 (red)	Citations	Total link strength	Group 2 (blue)	Citatons	Total link strength	Group 3 (green)	Citations	Total link strength
Garot, E	11	82	Heinrich, Joachim	113	95	Ghanim, A.	95	72
Garot Elsa	45	78	Heinrich- Weltzien	93	52	Ghanim, Aghareed	123	62
Lygidakis, N.a	70	82	Heitmueller, Daniela	93	52	Manton, D.j	119	95
Manton, David	226	142	Hickel, Reinhard	122	100			
Manton, David J.	217	92	Kuehnisch, Jan	153	119			
Rouas, P	11	82	Standl, Marie	26	71			
Rouas, Patrik	45	78	Neumann, Claudia	93	52			
Somani	11	59						
Taylor, G.D	11	59						

DISCUSSIONS

A. Bibliometric keyword analysis

Molar-incisor hypomineralization (MIH) was defined in 2001 by the European Academy of Pediatric Dentistry (EAPD) as a qualitative enamel defect, ranging from demarcated yellow-white or yellow-brown opacities to severely hypomineralized damaged enamel [2,13].

Its global prevalence in 2015 was estimated at 12.9%, with 878 million reported cases and an incidence of 17.5 million new cases in 2016. In this regard, MIH has been considered a public health problem due to its impact on children's oral health and global health economy. Affected enamel is more prone to post-eruptive degradation, favouring the development of carious lesions, sensitivity, with a negative impact on their quality of life. In addition, the difficulty in obtaining adequate anaesthesia and the higher failure rate in adhesive restorations contribute to less cooperation of children during treatment. In fact, the management of the condition is still a challenge for dentists, made worse by the clinical variability of the lesions, the need for individualized treatments, and the existence of few clear clinical guidelines [13,14].

Thus, the red group is related to the treatment approaches to the lesions present in the teeth affected by MIH, depending on the stage, which can be grouped into:

- Prophylactic therapy - fluoride, amorphous calcium phosphate
- Sealing therapy - infiltration of resins
- Restoration therapy - composite materials [15,16]

Treatment is chosen according to an index that corresponds to MIH symptoms. Deproteinization with NaOCl 5% for 60 seconds after etching is considered to be a good way to increase the bond between the composite and the tooth [16].

On the other hand, the green group reveals the interrelation between MIH and HSPM, but also the most studied age group, children. Thus, children affected by HSPM are approximately five times more likely to have MIH. Especially the mild form of HSPM is considered to be a predictive factor for MIH. The reason for this may be that the aetiological factors appear at the end of the vulnerable period of the second temporary molar. Opacities are the most common feature. Discoloured areas, especially dull yellow/brown areas, are weaker and therefore more vulnerable not only to post-eruption enamel loss, but also to caries [17,18,19,20].

Regarding desensitization, laser together with fluoride varnish in the treatment combination (L + FV) had a greater desensitizing action on MIH teeth. Laser therapy demonstrated an immediate desensitizing effect, while fluoride varnish had a delayed effect. Regarding desensitization, laser together with fluoride varnish in the treatment combination (L + FV) had a greater desensitizing action on MIH teeth. Laser therapy demonstrated an immediate desensitizing effect, while fluoride varnish had a delayed effect [21].

Furthermore, the objectives of the blue group are to determine the prevalence of MIH/HSPM, the severity of caries lesions and their association in studies carried out in different regions, which had as subjects school children [22,23].

In the case of Lebanese children, it was concluded that MIH is the most prevalent enamel defect. According to the criterion of sex and location, the girls and upper arch teeth were leading in the case of children from Barcelona. The prevalence of MIH in Dubai is low. However, caries and fluorosis rates are much higher, which calls for strengthening caries prevention efforts. Complications during the mother's pregnancy, preterm birth, average duration of breastfeeding, frequency of diarrhea, diseases of the digestive system, bronchial asthma, high fever, ear infection, renal failure, rubella, and varicella were significantly

associated with MIH following the questionnaire and etiological questions asked parents of children in Istanbul [17,18,19,20].

The yellow group is focused on the management and level of understanding of general dental practitioners (GDPs) regarding MIH. They are in direct contact with small patients, children, often encountering cases of molar-incisor hypomineralization. The most frequently encountered problem was the behavioural management of the child, followed by the difficulty of anaesthesia. Despite the increase in research on MIH, a lack of understanding and management by physicians has been found [24].

It has also been shown that the preferred material of GDPs for restorative treatment is composite resin. Unanimously agreed was the need to implement continuous medical education programs in the reference field, which could contribute to the dissemination of knowledge and to a correct therapeutic and clinical management of the MIH syndrome [25].

According to the purple group, which focused on studies of children in Sweden, more consensus was reached. The incidence is higher in male than female subjects. The age of 9 is when we have the highest percentage of MIH. Also, the mandible is more affected compared to the maxilla. The prevalence in children in public schools is higher than in those who attend a private school. No significant associations with environmental, developmental or medical factors were found. It was concluded that nutrition in the first 6 months of life can influence the risk of developing severe demarcated opacities in the first permanent molars [17].

B. Co-citation regarding authors

The first group (red) presents a remarkable composition of 9 authors. From the citation point of view, we can state that this group contains the author with the highest number of citations (226) and a total link strength of 142.

The articles of these authors focused on determining the possible causality of hypomineralized lesions occurring in temporary molars - molar-incisor hypomineralization syndrome in the permanent dentition. Thus, the presence of HSPM is considered to be predictive of MIH, with a higher prevalence of MIH in the presence of mild HSPM. Early detection and preventive intervention could reduce MIH complications [26, 27, 28].

Another important group is the blue one (group 2) being led by the author Kuehnisch Jan who presents a number of 153 citations and 119 total link strength.

The interest of this cluster focused on elucidating the aetiology, which brought to light different hypotheses:

- Nutrition in the first year of life
- Bisphosphonates
- Dental caries
- Asthma (a significant association between medication-naïve asthmatic adolescents and MIH)
- Excess vitamin D supplements during pregnancy [29,30].

Group 3 (green) is built on the interest of the clinical approach of MIH, and a training manual for clinical studies and practice has been published, with the representatives of this group, Ghanim A. and Manton D., as co-authors.

Finally, we can say that these authors represent the most significant sources in our field of research, bringing the greatest emphasis, contribution and importance to scientific studies.

CONCLUSIONS

Scientific articles were retrieved by searching the Web of Science database. WOS is one of the most important sources of scientific documentation worldwide, containing valuable information about research carried out over 100 years, and is a license-based platform that, in

Romania, provides access to the abstracts of articles of over 20,000 scientific journals and over 170,000 scientific conference papers, academic books from 256 disciplines.

Web of Science offers researchers the opportunity to collect and analyze information to form an opinion on different trends and patterns in research, the opportunity to build an overview of the research phenomenon around the world, through a single platform and through a simple search sequence.

Finally, bibliometric data can be highly variable and constantly changing over time, and therefore the results presented should not be interpreted as absolute numbers, but by trends. Despite these limitations, this study provided important information that helped form a more comprehensive picture of this topic.

The continued implementation of medical education programs in the reference area could contribute to the dissemination of knowledge and the correct therapeutic and clinical management of MIH syndrome. It is necessary to continue educating primary dentists in recognizing and diagnosing this condition and offering the recommended treatment to patients with a mild clinical picture, while directing those with more serious problems to specialist doctors, pedodontists. At the same time, the multidisciplinary approach must be considered.

As aetiology, nutrition in the first year of life, bisphosphonates, dental caries, asthma (a significant association between asthmatic adolescents who do not follow medication and MIH) and excess vitamin D supplements during pregnancy were some of the relevant factors incriminated.

Composite resin was the most studied treatment option, followed by local prevention, sensitivity/pain, glass-ionomers, and other restoration materials. Extraction was the least accepted treatment option. The choice of treatment option must be made according to the severity of the defect and the age of the patient.

The Treatment Need Index has proven to be a reliable and valid tool for use in clinical and population-based screenings for the diagnosis of MIH and other enamel defects.

This bibliometric review provided a comprehensive overview of MIH research over the last 10 years. Within the limits of the present study, the following conclusions can be drawn: global trends indicate a growing peak of scientific publication, especially in the last decade, but there is a shortage of clinical studies on treatments. Finally, the multifactorial nature should be further explored by considering environmental and systemic factors together.

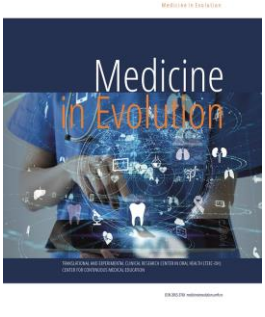
REFERENCES

1. Katrin Bekes, Molar Incisor Hypomineralization A Clinical Guide to Diagnosis and Treatment, Springer Nature Switzerland AG 2020
2. The Journal of Contemporary Dental Practice, July 2016;17(7):609-613)
3. Nanci A. Ten Cate's oral histology-e-book: development, structure, and function. Elsevier Health Sciences; 2017
4. Crombie FA, Manton DJ, Palamara JE, Zalizniak I, Cochrane NJ, Reynolds, EC. Characterisation of developmentally hypomineralised human enamel. J Dent. 2013;41:611-8.
5. Elhennawy K, Manton DJ, Crombie F, Zaslansky P, Radlanski RJ, Jost-Brinkmann PG, et al. Structural, mechanical and chemical evaluation of molar-incisor hypomineralization affected enamel: A systematic review. Arch Oral Biol. 2017;83:272-81
6. Silva MJ, Scurrah KJ, Craig JM, Manton DJ, Kilpatrick N. Etiology of molar incisor hypomineralization - a systematic review. Community Dent Oral Epidemiol. 2016;44(4):342-53

7. Costa Rosa T, Pintor A, Magno M, Mara√±√≥n-V√°squez G, Maia L, Neves A. Worldwide trends on molar incisor and deciduous molar hypomineralisation research: a bibliometric analysis over a 19-year period. European Archives of Paediatric Dentistry. 2021;23(1):133- 146.
8. Almuallem Z, Busuttil-Naudi A. Molar incisor hypomineralisation (MIH) - an overview. British Dental Journal. 2018;225(7):601-609.
9. Rao MH, Aluru SC, Jayam C, Bandlapalli A, Patel N. Molar Incisor Hypomineralization. J Contemp Dent Pract 2016;17(7):609-613.
10. Weerheijm KL, J√§levik B, Alaluusua S. Molar-incisor hypomineralisation. Caries Res 2011;35:390-391.
11. Craveia, J., Rouas, P., Carat, T., Manton, D. J., Boileau, M. J., & Garot, E. (2020). Knowledge and management of first permanent molars with enamel hypomineralization among dentists and Orthodontists. Journal of Clinical Pediatric Dentistry, 44(1), 20-27. https://doi.org/10.17796/1053-4625-44.1.4
12. Garot E, Couture-Veschambre C, Manton D, Beauval C, Rouas P. Analytical evidence of enamel hypomineralisation on permanent and primary molars amongst past populations. Scientific Reports. 2017;7(1).
13. Sukumaran G, Padavala S. Molar incisor hypomineralization and its prevalence. Contemporary Clinical Dentistry. 2018;9(6):246.
14. Allazzam S, Alaki S, El Meligy O. Molar Incisor Hypomineralization, Prevalence, and Etiology. International Journal of Dentistry. 2014;2014:1-8.
15. Abufarwa M, Noureldin A, Dziak R, Covell D. Efficacy of CPP-ACP fluoride varnish applied with and without acid etching in preventing enamel demineralization compared to light-curable fluoride varnish. The Angle Orthodontist. 2021;92(2):213-219.
16. Alanzi A, Faridoun A, Kavvadia K, Ghanim A. Dentists' perception, knowledge, and clinical management of molar-incisor-hypomineralisation in Kuwait: a cross-sectional study. BMC Oral Health. 2018;18(1).
17. Ridell K, Borgstr√∂m M, Lager E, Magnusson G, Brog√•rdh-Roth S, Matsson L. Oral health-related quality-of-life in Swedish children before and after dental treatment under general anesthesia. Acta Odontologica Scandinavica. 2014;73(1):1-7.
18. Al-Bluwi G. Epidemiology of dental caries in children in the United Arab Emirates. International Dental Journal. 2014;64(4):219-228.
19. Hern√°ndez M, Boj J, Espasa E, Peretz B. First Permanent Molars and Permanent Incisors Teeth by Tooth Prevalence of Molar-Incisor-Hypomineralisation in a Group of Spanish Schoolchildren. Acta Stomatologica Croatica. 2018;52(1):4-11.
20. Uhlen M, Valen H, Karlsen L, Skaare A, Bletsa A, Ansteinsson V et al. Treatment decisions regarding caries and dental developmental defects in children - a questionnaire- based study among Norwegian dentists. BMC Oral Health. 2019;19(1).
21. Muniz R, Carvalho C, Aranha A, Dias F, Ferreira M. Efficacy of low,Äêlevel laser therapy associated with fluoride therapy for the desensitisation of molar,Äêincisor hypomineralisation: Randomised clinical trial. International Journal of Paediatric Dentistry. 2019;30(3):323-333.
22. Ghanim A, Mari√±o R, Manton D. Validity and reproducibility testing of the Molar Incisor Hypomineralisation (MIH) Index. International Journal of Paediatric Dentistry. 2018;29(1):6-13.
23. Costa-Silva C, Paula J, Ambrosano G, Mialhe F. Influence of deciduous molar hypomineralization on the development of molar-incisor hypomineralizarion. Brazilian Journal of Oral Sciences. 2013;12(4):335-338.
24. Zhao D, Dong B, Yu D, Ren Q, Sun Y. The prevalence of molar incisor hypomineralization: evidence from 70 studies. International Journal of Paediatric Dentistry. 2017;28(2):170-179.
25. Bussaneli D, Restrepo M, Fragelli C, Santos-Pinto L, Jeremias F, Cordeiro R et al. Genes Regulating Immune Response and Amelogenesis Interact in Increasing the Susceptibility to Molar-Incisor Hypomineralization. Caries Research. 2018;53(2):217-227.
26. Gambetta-Tessini K, Mari√±o R, Ghanim A, Calache H, Manton D. Carious lesion severity and demarcated hypomineralized lesions of tooth enamel in schoolchildren from Melbourne, Australia. Australian Dental Journal. 2018;63(3):365-373.
27. Kopperud S, Pedersen C, Espelid I. Treatment decisions on Molar-Incisor Hypomineralization (MIH) by Norwegian dentists - a questionnaire study. BMC Oral Health. 2016;17(1).

28. Kassebaum NJ, Smith AGC, Bernab√© E, Fleming TD, Reynolds AE, Vos T, et al. Global, regional, and national prevalence, incidence, and disability-adjusted life years for oral conditions for 195 countries, 1990-2015: a systematic analysis
29. Schwendicke F, Elhennawy K, Reda S, Bekes K, Manton DJ, Krois J. Corrigendum to "Global burden of molar incisor hypomineralization" [J. Dent. 68C (2018) 10-18]. J Dent. 2019;80:89-92
30. Elfrink ME, Ghanim A, Manton DJ, Weerheijm KL. Standardised studies on molar incisor hypomineralisation (MIH) and hypomineralised second primary molars (HSPM): a need. Eur Arch Paediatr Dent. 2015;16(3):247-55.

Burnout Syndrome, a reality among dentists - systematic review



Miron M.I.[1], Luca M.M.[2], Bojoga (Mocuta) D.E.[1], Odobaşa D.[3], Buzatu R.[4]

[1]Department of Oral Rehabilitation and Dental Emergencies, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania and Interdisciplinary Research Center for Dental Medical Research, Lasers and Innovative Technologies, Timisoara, 9 Revolutiei 1989 Ave., 300070 Timisoara, Romania
[2]Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[3]DMD, Timişoara, Romania
[4]Department of of Dental Aesthetics, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Luca Magda
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40 725724706
E-mail address: luca.magda@umft.ro

Abstract

The aim of this paper is to provide an up-to-date systematic review of the literature dedicated to Burnout Syndrome and to assess the incidence, level of occurrence and spread of this syndrome among dentists. In order to select the appropriate studies, a systematic search of the literature was performed in the electronic databases PubMed, Science Direct and Google Scholar, reaching a number of 7 final studies included. A long-term conceptual and operational definition characterizes burnout as a triad of emotional exhaustion (emotional overexpression and exhaustion), depersonalization (negative, painful, and detached responses from others), and reduced personal achievement (feelings of incompetence). The research of individual stressors and the many ways in which those in the medical field can actively fight with them is a gateway to improving an entire medical environment by focusing on the individual and providing a successful education to the next generation of physicians.

Keywords: burnout, review, dentistry professionals

INTRODUCTION

Burnout Syndrome in health care professionals has gained significant attention in recent years. Given the intense emotional demands of the work environment, clinicians are particularly sensitive to the development of this syndrome more than in other workplaces [1,2].

The term "burnout" was described by psychologist Herbert Freudenberger in 1974 in an article entitled "Staff Burnout", in which he discussed dissatisfaction with work, precipitated by work-related stress. A broadly applicable description defines burnout as a state of mental and physical exhaustion related to work or care activities. Freudenberger (1974) was the first to describe the concept of staff burnout. The basic elements of his definition of exhaustion have described these experiences as failure, wear, or exhaustion due to excessive demands on energy, power, or resources [3].

Burnout is associated with a variety of negative consequences, including depression, increased risk of medical errors, and negative effects on patient safety. In recent years there has been disagreement as to whether exhaustion and depression are the same or are different constructions, as they seem to have some common features (for example: loss of interest and impaired concentration). However, the results so far are inconclusive, and researchers do not agree on the degree to which we should expect such an overlap [4].

The Maslach Burnout Inventory (MBI) is the most widely used questionnaire to measure exhaustion in research studies. The MBI Human Services Survey is a self-administered 22-item questionnaire that was developed to measure exhaustion in human services workers and is the "gold standard" for measuring exhaustion. MBI items are rated on a Likert scale from 0 to 6 (0 = never, 1 = several times a year, 2 = once a month, 3 = several times a month, 4 = once a week, 5 = several times a week, 6 = every day) and noting elements from the sample, such as "I feel emotionally exhausted because of my work" [2].

It is designed to evaluate the 3 main dimensions of exhaustion:

1. Emotional exhaustion
2. Depersonalization
3. Personal achievement [2].

Burnout is detected using high scores of: high emotional exhaustion (≥27), high depersonalization (≥10), low personal achievement (≥33), based on normative data of medical professionals [2].

Maslach summed it up in an extremely useful way, as well as methods to combat burnout, saying: "If all the knowledge and advice on how to overcome exhaustion could be summed up in one word, that word would be balance - balance between giving and receiving, balance between stress and calm, balance between work and home" [2].

One way to avoid the exhaustion of dentists and dental staff is to create enough time and space to meet work activities that promote involvement. Work aspects identified as providing an interesting and stimulating work environment include:

- Recognition of immediate and long-term work results;
- Patient care;
- Mastery / idealism / pride of work;
- Entrepreneurship;
- Material benefits;
- Professional mastery [5,6].

Aim and objectives

The aim of this paper is to provide an up-to-date systematic review of the literature dedicated to Burnout Syndrome and to assess the incidence, level of occurrence and spread of this syndrome among dentists of various specialities.

The aim of this systematic review was also to find, evaluate and synthesize evidence of burnout in the workplace of dentists.

MATERIAL AND METHODS

The question that led to the need for this study was formulated according to the PICOS qualitative analysis tool, composed of the following elements: "P" - population, "I" - intervention, "C" - comparison, "O" - result and "S" - type of study.

The formulation of the question was made by selecting the following eligibility criteria:

- P - dentists suffering from burnout
- I - assessment of the incidence and spread of Burnout syndrome
- C - comparing the incidence between different dental specialties and countries
- O - the spread of Burnout syndrome
- S - cross-sectional studies

Thus, the final research question led to the following goal: Comparative assessment of the incidence and spread of Burnout Syndrome among dentists in different dental specialties and countries.

The selection of studies for this systematic review paper was made in accordance with the PRISMA guide (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) on the development of systematic reviews and meta-analyzes.

In order to select the appropriate studies, a systematic search of the literature was performed in the electronic databases PubMed, Science Direct and Google Scholar. As keywords used in the search, terms such as: burnout, syndrome, dentist, dentistry were used. The terms used could be found in both titles, abstracts or topic titles. For the selection of studies in these search engines, certain specific filters were used that do not allow an age of more than 10 years and the finding of "free full-text" articles as much as possible.

The titles and abstracts of the recording studies were exported to the EndNote X8 computer program and were scanned to exclude irrelevant studies and duplicates.

To be eligible, the studies had to meet the chosen inclusion and exclusion criteria:

Inclusion criteria:	**Exclusion criteria:**
- studies specifying Burnout syndrome in dentists	- studies published before 2011 (older than 10 years),
- cross-sectional studies	- studies written in a language other than English
- studies using the Maslach Burnout Inventory (MBI) questionnaire as a data collection tool	- studies which included the term 'dentist' but investigated Burnout syndrome in other medical or dental professions than dentists
- studies using only dentists as subjects	- letters to the publisher, case studies, systematic review
- studies published between 2011 and 2021	

The search strategy eventually led to a total of 106 articles. After reading all the titles, 27 duplicates were found, which were removed, leaving a number of 79 articles. Also, another

31 articles were excluded because they were not relevant for the present study. The analysis of the 48 articles from the point of view of abstracts led to the elimination of another 18. The remaining 30 articles were fully reviewed and were subject to inclusion and exclusion criteria. Thus, we reached a number of 7 final studies included in the systematic review.

RESULTS

The validated data measurement tool used in the 7 studies underlying this systematic review is the The Maslach Burnout Inventory (MBI) questionnaire. It consists of 22 questions, with 5 answer options (on a scale of 1 to 5), which include three fundamental aspects of Burnout syndrome: emotional exhaustion (assessed by 9 questions), depersonalization (assessed by 5 questions) and personal fulfilment (assessed by 8 questions). The questionnaire was distributed to dentists by post, personally at their private practices [7] or distributed during postgraduate courses [8-10].

Also, all studies present as population of interest only dentists, these being mostly generalists [7], [8] or specialists [9,11,12]. Both public and dental practitioners [8], [12] or academics [10] were included.

The selection of study participants was generally made using data taken from the lists of dental councils [9] or dental associations [8], [11], public or private sector dental institutions [12], their personal practices [7] or were recruited during continuing education courses [10]. The participation of the subjects in the studies was done voluntarily [10].

The studies integrated in this paper vary greatly in terms of their location. Thus, two of them were performed in two different cities in India [8], [11], another in Iran [7], China [8], America [10], Pakistan [12] and Brazil [13].

The methodological quality of the primary studies was assessed using a modified version of the Newcastle Ottawa Scale (NOS) for the qualitative evaluation of cross-sectional studies. It uses 8 elements to assess the methodological quality of the study. For each item, 1 point is awarded for each "yes" answer, with a maximum possible score of 8 (Table 1).

Table 1. Study quality analysis based on the modified Newcastle-Ottawa quality assessment scale for cross-sectional studies. Legend: 1. Representativeness of the sample 2. Size of the sample 3. Non-respondents 4. Determination of exposure (absent or excluded) 5. Subjects in groups with different results are comparable, based on the design of the study or analysis. Confusion factors are controlled 6. Evaluation of the result (self-harm or suicide) 7. Statistical test 8. Clear variables (additional parameter)

Author, Year (Country)	Selection				Comparison	Results		Clear variables	Total score (%)
	1	2	3	4	5	6	7	8	
Bolbolian et al[7], 2017 (Iran)	1	1	0	0	2	0	1	0	5(62.5%)
Reddy et al[8], 2017 (India)	1	1	0	0	2	0	1	0	5(62.5%)
Choy et al [9], 2017 (China)	1	1	0	0	2	0	1	0	5(62.5%)
Calvo et al [10], 2017 (America)	1	1	0	0	2	0	1	1	6(75%)
Chainani et al[11], 2015 (India)	1	1	1	0	2	0	1	1	7(87.5%)
Azad et al [12], 2013 (Pakistan)	1	1	1	0	2	0	1	1	7(87.5%)
Carneiro et al [13], 2013 (Brazilia)	1	1	0	0	2	0	1	0	5(62.5%)
Methodological assessment score (%): Inadequate (0-33); Satisfactorily (34-66); Good (67-100)									

Thus, according to the analysis performed in Table 1, it can be seen that three of the studies integrated in this systematic review have a good methodological evaluation score [10], [11], [12], and the remaining four have a satisfactory score [7], [8], [9], [13].

Analyzing comparatively the seven studies, it was observed that only five of them specify the response rate of the subjects to the study, of which only three have a satisfactory value of over 60% [11], [12], [13]. One of the two items that specifies the response rate, but which has an inadequate value, approaches the satisfactory one, but does not exceed it (56%) [10], and the second has a much too low value (28.3%) [2. 3]. Instead, all 7 studies included, analyze subjects by age and sex and in addition, present other additional factors of comparison such as: specialty [8], [9], [10], [11], marital status [9], [12], if the spouse works [9], working environment (state or private) [8], [9], [9], [10], [11], [12], hours working [7], [12], [13].

The incidence and prevalence of Burnout Syndrome in dentists found in the seven cross-sectional studies analyzed, can be seen in Table 2 which compares the results in terms of sample size, specialization, country where the study was conducted and also analyzes work environment, which can be state or private.

Table 2. Characteristics of cross-sectional studies included in the systematic review. Abbreviations: EE = emotional exhaustion, DP = depersonalization, PA = personal accomplishments

Article, Author, Country	Year	Disease	Evaluation instrument	Sample size and type	Results
[7], Bolbolian et al, Iran	2017	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	103, General dentists, state and private	6.7% presented with Burnout syndrome
[8], Reddy et al, India	2017	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	150, General dentists, state and private	11.3% presented with a high level Burnout syndrome
[9], Choy et al, China	2017	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	301, General dentists, state and private	7% presented with a high level Burnout syndrome
[10], Calvo et al, America	2017	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	167, General dentists, state and private	13.2% presented with a high level Burnout síndrome, 79.6% moderate and 7.2% low
[11], Chainani et al, India	2015	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	140, General dentists, state and private	11.4% presented with a high level Burnout síndrome,84.3%moderate and 4.3% low
[12], Azad et al, Pakistan	2013	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	General dentists, state and private	18,6% presented a high or moderate leve lof EE, 43,4% moderate or high leve lof DP şi 31,8% low level of PA.
[13], Carneiro, Brazilia	2013	burnout	Questionnaire - The Maslach Burnout Inventory(MBI)	100, not specified speciality	32% presented Burnout syndrome

DISCUSSIONS

The results of the study conducted by Bolbolian et al. they showed that more than half of them practiced their profession both in the morning and in the evening, and half of them worked between 21 and 30 hours a week [7]. More than two-thirds of them treated more than 6 patients a day and also more than two-thirds reported more than 30 years of experience [7]. Most dentists were over 40 years old and more than 60% reported moderate emotional exhaustion, but almost 14% reported severe emotional exhaustion [7]. The investigation reported that most dentists had a moderate level of depersonalization and only 15% had

severe depersonalization [7]. In this study, all dentists had a high and sufficient performance at work [7].

In the study by Reddy et al, a high level of burnout was observed in only 11.3% of participants [8]. Although small in number, this syndrome can lead to harmful addictions such as alcohol, drug addiction, extramarital affairs or self-destructive behaviors [8]. Burnout syndrome can thus be considered a serious risk for the dental profession, causing both a threat to the available workforce and a tragedy for the individual [8]. Therefore, burnout prevention is of key importance for dental professionals [8]. This study found that there is a statistical significance between the association between sex and Burnout syndrome [8]. Other findings of this study show the same results as other studies, that there was a high level of burnout in the age group under 25 years and in the age group 25-35 years, predominantly in women and those with only a university degree [12,13].

Choy et al, observed that 6 of the top 10 largest stressors are patient-related stressors and 3 are time-related [9]. Women dentists had higher average scores than men in terms of stressors related to the patient, work, staff or technical stressors [9]. This may be due to the fact that in addition to working as a dentist, they must also take care of their family [9]. Dentists with more than 20 years of practice who had postgraduate qualifications or completed their training as specialists had a lower average score of patient-related stressors than those with less than 20 years of professional experience [9]. It was also observed that the chance of having an increased total level of burnout was 5.08 times higher among dentists without postgraduate qualifications [9]. This may imply that dentists with broader skills and more knowledge have been less stressed [9]. Those with postgraduate qualifications had more knowledge, better techniques, better communication skills regarding the relationship with the patient, and this could have contributed to lowering the total burnout score.

The limitations of the study by Choy et al are the low response rate to the study [9]. The authors assumed that it was possible that the selected dentists were very busy and did not allocate the necessary time to complete the questionnaire or that they might not be interested [9].

Calvo et al, consider that it is possible that some of these dentists who suffer from Burnout syndrome continue to practice actively, which can be harmful both for them, for their health and for their patients [10]. Although most dentists in this study appear to be very involved in the work, they experience low levels of exhaustion [10]. Thus, in this study, burnout was negatively correlated with work commitment [10]. Burnout has been correlated with reduced cognitive performance and reduced practice safety [10]. It has been observed that younger doctors tend to be more exhausted due to less work experience, and doctors who are in the middle of their career have a higher risk of burnout because they work most hours, the balance between personal life and profession is the lower and have the highest rates of emotional exhaustion [10].

As limitations, Calvo et al. States that their target population used in the study may not be the most representative of the U.S. workforce, as participants were selected from dentists in 4 geographic locations who participated. to a course for further education [10]. Thus, it can be assumed that dentists who experience high levels of burnout are less likely to be among the participants in this course [10].

In the study by Chainani et al., Dentists with postgraduate qualifications showed high levels of professional fulfillment, which may be due to many reasons such as: the fact that receiving a diploma is an important thing, that there are qualification benefits that can be applied in general practice routine and that these qualifications allow access to more diverse career opportunities [11]. Also, high levels of professional fulfillment among those with other sources of income could be due to a sense of financial stability [11].

As limitations, Chainani et al., States that overtime was not assessed in association with Burnout syndrome, which can be explained by various levels of the syndrome [11]. Also, the data were cross-sectional and were collected through individual reports, which does not allow causal conclusions [11].

In the study by Azad et al. there were some limitations [12]. First, the data were collected using self-administered questionnaires, this being acknowledged, some subjects may have responded much more positively, although the survey was conducted anonymously [12]. Second, another limitation was the proportion of the target population composed predominantly of women practicing dentistry [12]. And thirdly, the sample size was reduced [12].

Carneiro et al. points out that the analysis of dentists with burnout syndrome (n = 32) showed a significantly high value, as less than a third of them had at least one of the dimensions of Burnout syndrome at critical levels [13]. This study did not show a significant difference in the relationship between sex and working hours, marital status and years of practice [13].

One of the limitations of the correct diagnosis of Burnout syndrome is that there is no general consensus regarding the interpretation of the questionnaire The Maslach Burnout Inventory (MBI), so each study shows different criteria for classification and diagnosis [10], [13]. The most used interpretations are those that use the parameters used by Grunfeld et al. in relation to the three dimensions of the questionnaire as follows: when there are high scores of emotional exhaustion and depersonalization and low scores for personal fulfillment, the existence of Burnout syndrome can be assessed [13].

CONCLUSIONS

Dentists are part of a profession characterized by many hours of work and involving direct daily contact with patients, who are often tense and anxious about the treatment, because there is an idea implemented that suggest dental treatments can cause pain. As health care providers, dentists are subject to interpersonal stress due to the demanding nature of the occupation and the closeness to the patient. Therefore, dentists practice a profession, being prone to the development of Burnout Syndrome.

Burnout does not occur suddenly, but is the final stage of a process, leading to symptoms related to the size of the syndrome. Burnout poses a significant risk to dentists that should not be ignored. While restoring oral health and maintaining the patient's well-being is of paramount importance in the dental profession, the well-being of the service provider should not be neglected. In addition, it is obvious that the exhaustion of dentists has implications on the oral health of patients.

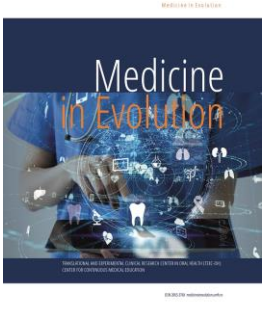
Thus, the present study highlights a clear incidence of Burnout Syndrome among dentists, with high prevalence rates in both women and men. It also shows us that its spread is varied around the globe and affects both general and specialist dentists, whether they work in the private sector or in state institutions.

REFERENCES

1. Eisenstein L. To fight burnout, organize. N Engl J Med 2018; 379: 509–511.
2. Maslach C, Jackson SE. The measurement of experienced burnout. J Occup Behav 1981;2:99e113.
3. Freudenberger HJ. Staff burn-out. J Soc Issues 1974; 30: 159–165.

4. Koutsimani P, Anthony M and Georganta K, (2018) The relationship between burnout, depression and anxiety: A systematic review and meta-analysis. Front. Psychol. 10:284. doi:10.3389/fpsyg.2019.00284.
5. Gorter RC, Freeman F: Burnout and engagement in relation with job demands and resources among dental staff in Northern Ireland. Community Dent Oral Epidemiol 39:87-95, 2011.
6. Kwak EJ, Ji YA, Baek SH, Baek YS. High levels of burnout and depression in a population of senior dental students in a school of dentistry in Korea. J Dent Sci. 2021;16(1):65-70.
7. Bolbolian M, Mirkeshavarz M, Sefidi F, Mir A. The prevalence of burnout syndrome among general dentists in Qazvin, Iran in 2017. J Craniomaxillofac Res. 2019;5(4):148-156.
8. Reddy, M., Shwetha, H. and Mishra, M., 2017. Assessment of occupational burnout among private dental practioners in Bengaluru city-a cross sectional study. International Journal of Dental Research, 5(1), pp.55-9.
9. Choy, H.B. and Wong, M.C., 2017. Occupational stress and burnout among Hong Kong dentists. Hong Kong Med J, 23(5), pp.480-8.
10. Calvo, J.M., Kwatra, J., Yansane, A., Tokede, O., Gorter, R.C. and Kalenderian, E., 2021. Burnout and work engagement among US dentists. Journal of patient safety, 17(5), pp.398-404.
11. Chainani, S.H., Sunitha, S., Reddy, C.V.K., Manjunath, M. and Rudraswamy, S., 2015. Working conditions and personal characteristics: Predicting burnout among dental professionals in Mysore, India: A questionnaire survey. Journal of Indian Association of Public Health Dentistry, 13(3), p.313.
12. Azad, A.A., SHAFQAT, Q.U.A., Nisar, N., Ashfaq, M., Munir, A., Ahmed, A. and Bin Saeed, M.H., 2013. PREVALENCE OF STRESS AND BURNOUT AMONG DENTISTS OF RAWALPINDI & ISLAMABAD. Pakistan oral & dental journal, 33(3).
13. Carneiro, S.D.R.M., Tourinho, C.C., do Vale, T.A.P., Campêlo, Y.D.S.G., de Almeida Gomes, F. and Lima, D.L.F., 2013. Burnout syndrome: evaluation in dentists in the city of Fortaleza, Brazil. RSBO Revista Sul-Brasileira de Odontologia, 10(3), pp.266-271.

An orthodontic approach in the management of Molar-Incisor Hypomineralisation (MIH)



Mărginean Khattab M.A.[1], Motoc G.V.[1], Vaida L.[2], Olariu I.[3], Motoc O.[2], Milutinovici R.A.[4], Dinu S.[1], Popa M.[1]

[1]*Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania*
[2]*Department of Dental Medicine, Faculty of Medicine and Pharmacy, University from Oradea, Romania*
[3]*Department of Dentistry, Faculty of Medicine, Vasile Goldiş Western University of Arad, Romania*
[4]*Department of Orthodontics, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy Timisoara, Romania*

Correspondence to:
Name: Iustin Olariu
Address: Department of Dentistry, Faculty of Medicine and Pharmacy, Vasile Goldiş Western University of Arad, Romania, Liviu Rebreanu Street, no.86, Arad, Arad County, Romania
Phone: +40 723423263
E-mail address: iustin_olariur@yahoo.com

Abstract

Molar Incisor hypomineralisation is a frequent disorder of the enamel of permanent first molars and incisors during childhood. The management of compromised first molars in children represents a clinical challange to the dental team. Management is a multidisciplinary approach and sometimes orthodontist involvement is needed. Extraction of the first molar is a difficult decision for the dental team and also for the parents during early ages. Clinicians should be aware of orthodontic results of extractions when they decide to perform them during the treatment. An extractive strategy with orthodontic considerations is a valid therapeutic option with a good cost-effectiveness ratio in the management of MIH.

Keywords: Orthodontics, Paediatric dentistry, MIH

INTRODUCTION

Objectives:

The aim of this review is to highlight the importance of the diagnosis as well as the treatment plan. The following review will present the clinical consideration alongside an orthodontic approach in managing MIH. It is crucial for clinicians including pedodontists to understand the significance of an orthodontic examination around the age of 8 years old so they can establish together the best treatment option.

The term molar incisor hypomineralisation (MIH) was first introduced in 2001 by Weerheijm, and defined as a developmental defects of systemic origin of the enamel of one or more first permanent molar (FPM) with/without the affection of incisors [1]. Recently, new patterns have been observed, such as the cusp tips of permanent canines and premolars and hypomineralised second primary molars [2].

Clinically, hypomineralisation can be seen as an opacitie in the translucency of the enamel. The opacities can be of different colours, depends on the severity of the MIH and they may undergo post-eruptive enamel breakdown due to soft and porous enamel. Several classifications criteria were developed to classify molar-incisor hypomineralisation. The European Academy of Paediatric dentistry first classified MIH in 2003, as the demarcation of the opacity, enamel disintegration, atypical restorations, sensitivity, extracted and unerupted teeth. The next classification includes three categories: mild, moderate and severe [3].

- Mild MIH: Demarcated opacities located at non-stress bearing areas, no caries associated with the affected enamel, no hypersensitivity and incisor involvement is mild if present.
- Moderate MIH: Demarcated opacities present on molars and incisors, the post-eruptive enamel breakdown limited to one or two surfaces without cuspal involvement, atypical restorations can be needed and normal dental sensitivity.
- Severe MIH: Post-eruptive enamel breakdown, crown damage, caries accompanying affected enamel, a history of dental sensitivity and aesthetic problems;

Review:

The MIH management can raise some orthodontic questions. In children with moderated and severe affected first permanent molars, the clinical consideration is to decide whether to restore or extract.

Researches have demonstrated that children presenting with moderate or severe MIH, most often require life-long, extensive and repeated restorative treatments that will may eventually fail. Studies have demonstraded that children with MIH show a greater chance of having their teeth restored compared to unaffected children.

Extraction of affected first molars may be preferable to attempting complicated restorative management in young age [4].

The decision shoud be taken in accordance with some important aspects such as: age, degree of severity, pulp involvement, restorability of the tooth/teeth, expected long term treatment, orthodontic considerations (amount and site of crowding, maloclusion), presence of additional dental anomalies, presence or absence of other teeth, presence of third molar germs, oral hygiene, patient and parent motivation to orthodontic treatment.

Situations in which the literature recommends extraction as a possible option are: severe hypomineralisation, severe sensitivity or pain, lage multi-surface lesions or restorations, difficult restorations or with history of restorative failure, difficult behaviour, apical pathology, orthodontic space requirements where first molars are damaged and premolars are healthy, posterior crowding and the third molar in a good position [5].

To avoid a long and complicated treatment, it is recommended that extractions are done in the precise timing. It is important to have a clinical examination and to take a panoramic radiograph that will corroborate the ideal dental age of 8-9 years [6].

Management of upper first permanent molars extractions

The extraction done between the age of 8-10 years old with unerupted second permanent molar has a satisfactory potential of closing the space by bodily moving and a low level of tipping if there is an anterior crowding, if there is insufficient crowding, the space will remain.

The extraction done after the eruption of the second permanent molar will led to tipping and rotation of the molar. The extraction of the FPM has a limited effect of reducing the crowding in the anterior segment. In these cases, fixed appliance will be recommended. In cases where we have an anterior crowding it is recommended the extraction of the homonym molar to avoid the midline deviation. An alternative could be the extraction of a tooth other than the molar on the contralateral side [6].

The extraction of the permanent first molar will accelerate and help the eruption of the third molar.

It is important to note that Class I cases have a better success rate then Class II cases that are more critical to plan, particularly with regard to the timing of upper FPMs extraction, due to the space needed in order to correct the overjet and the incisors relation.

Management of lower first permanent molar extraction

The best time for extracting the first permanent molar in the lower arch is at the dental age of 8-9 years when the crown of the unerupted second permanent molar is completed and the bifurcation of the roots started. In these cases, there is a satisfactory potential of closing the space by a bodily movement and low level of tipping resulting in a good contact point between the second permanent molar and the second molar, if there is crowding. If there is reduced/ no crowding, a fix appliance will be required to close the remaining space [7].

If the extraction of the first permanent molar is done before the ideal age, it is a risk of the second premolar distally drifting. The second premolar could erupt in to the first permanent molar socket or it could be impacted against the crown of the second permanent molar, remaining a space between the two premolars. To avoid this, it is recommended to extract the second primary molar in the same time as the first permanent molar, allowing the eruption of the second premolar [8-10].

The extraction of the first permanent molar after the age 12 years old when the second permanent molar has erupted, leads to a slow and reduced mesialization of the second permanent molar, especially if there is no pressure from the third molar and the tongue position in between, which is acting like a space maintainer. The second permanent molar will tip mesial and rotate lingually.

If the remaining space and the tipping are left untreated may lead to periodontal problems [9-11].

In cases with crowding, it is recommended to extract the contralateral first permanent molar or premolar to avoid the midline shifting. Vertically an overeruption of the upper first permanent molar can take place, if the upper molar is not in occlusion with lower mesial tooth of the extraction site. If the overeruption occurs it will impede the second molar to move forward and will complicate the orthodontic treatment [6].

CONCLUSIONS

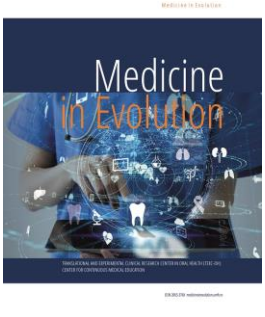
The treatment plan and the timing of the extraction is essential if we want to have a good result, especially when a malocclusion is present.

The importance of a multidisciplinary team that includes an orthodontist, represents a valid treatment approach that is not only cost effective, but aslo limits the repeated restorative events whom child is normally subjected to, which can lead to increase anxiety in those children.

REFERENCES

1. Weerheijm, K.; Jälevik, B.; Alaluusua, S. Molar–incisor hypomineralisation. Caries Res. 2001; 35, 350-351 200135, 390–391
2. Weerheijm KL. Molar Incisor Hypomineralisation (MIH). Eur J Paediatr Dent 2003; 4, 114-120.
3. Wright, J. Diagnosis and treatment of molar-incisor hypomineralization. In Handbook of Clinical Techniques in Paediatric Dentisty; Wiley: Hoboken, NJ, USA, 2015; 99–10
4. Kotsanos, N.; Kaklamanos, E.; Arapostathis, K. Treatment management of first permanent molars in childrenwith Molar-Incisor Hypomineralisation. Eur. J. Paediatric. Dent. 2005,179
5. Fitzpatrick L, O'Connell A. First permanent molars with molar incisor hypomineralisation. Journal of the Irish Dental Association Volume 53: 32 - 37, 2007.
6. Williams JK, Gowans AJ. Hypomineralised first permanent molars and the orthodontist. Eur J Paediatric Dent 2003; 129-132.
7. B Jälevik, Moller M. Evaluation of spontaneous space closure and development of permanent dentition after extraction of hypomineralised permanent first molars. International Journal of Paediatric Dent 2007; 328-335
8. Elhennawy K, Jost-Brinkmann PG, Manton DJ et al. Managing molars with severe molar-incisor hypomineralization. A cost-effectiveness analysis within German healthcare. Journal of Dentistry (2017).
9. Mittal, R.; Chandak, S.; Chandwani, M.; Singh, P.; Pimpale, Assessment of association between molar incisor hypomineralization and hypomineralized second primary molar. Int. Soc. Prev. Community Dent
10. William V, Messer LB, Burrow MF. Molar incisor hypomineralization: review and recommendations for clinical management. Paediatric Dent 224-232.
11. Lygidakis NA. Treatment modalities in children with teeth affected by molar-incisor enamel hypomineralisation (MIH): A systematic review. European Archives of Paediatric Dentistry //11(Issue 2). 2010
12. Steffen, R.; Krämer, N.; Bekes, K. The Würzburg MIH concept: The MIH treatment need index (MIH TNI). Eur. Arch. Paediatric. Dent. 2017, 355–361
13. Jälevik, B.; Klingberg, G.A. Dental treatment, dental fear and behaviour management problems in children with severe enamel hypomineralization of their permanent first molars. Int. J. Paediatric. Dent. 12, 24-32

Correlation of salivary ph and tooth decay at the pediatric population



Motoc G.V.[1], M.A. Mărginean K.[2], Vaida L.[3], Olariu I.[4], Cosoroaba R.M.[5], Motoc O.[3], Dinu S.[2], Popa M.[2]

[1]Faculty of Medicine and Pharmacy from the University of Oradea, Doctoral School of Biomedical Sciences, Oradea, Bihor County, Romania
[2]Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[3]Department of Dental Medicine, Faculty of Medicine and Pharmacy, University from Oradea, Romania
[4]Department of Dentistry, Faculty of Medicine, Vasile Goldiş Western University of Arad, Romania
[5]Department of Management, Legislation and Communication in Dentistry, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Iustin Olariu
Address: Department of Dentistry, Faculty of Medicine and Pharmacy, Vasile Goldiş Western University of Arad, Romania, Liviu Rebreanu Street, no.86, Arad, Arad County, Romania
Phone: +40 723423263
E-mail address: iustin_olariu@yahoo.com

Abstract

Early from the affected tooth to the surrounding soft tissues, resulting in swelling and inflammation in highly childhood caries (ECC) is the most usual oral disease in children. It affects approximately half of children worldwide and incurs enormous societal ECC leads to sustained demineralization of enamel and dentin, and the infection can spread progressed cases. Food and drink play a critical role in the integrity of saliva samples. Salivary pH directly impact an individual's dentition through chemical dissolution whether the demineralization is erosive or cariesbased. After eating or drinking, particulate matter may be left in the oral cavity having the potential to influence salivary pH levels or viscosity.

Keywords: early childhood caries, salivary pH, oral health, dental caries

INTRODUCTION

Objectives:

The aim of this review was to evaluate the changes in salivary ph and oral health at the pediatric pacients after intake diffrents foods. The following review will present that saliva is improbable to be a substitution for traditional diagnostic specimens in many situation.

Good oral health is an essential and integral component of good general health. Although enjoying good oral health ensures having more than healthy teeth, many children have inadequate oral and general health because of active and uncontrolled dental caries. Despite the fact that the prevalence of dental caries has declined over the past decades, ECC remains one of the most common chronic diseases of childhood; especially in developing countries and some minority community in the western world. Yet, little attention and few resources have been spent to understand the nature of this dreadful disease.

The ECC is a virulent form of caries beginning soon after the eruption of primary teeth, develops on smooth surfaces, progressing rapidly, and with a lasting detrimental impact on the dentition [1].

Whilst it is desirable that a patient should be managed in primary care there will be occasions that a referral to an oral medicine specialist in secondary care is required. In such circumstances the criterion must involve communication of all the relevant clinical information and an indication of the urgency of need for assessment.

While bacterial diversity and acid production obviously imparts effects in the mouth (for better or worse, which will be discussed in greater detail below), saliva provides a host of therapeutic and palliative effects in the maintenance of oral health, providing key functions such as: antimicrobial benefits (e.g. antibacterial, antifungal, antiviral) Cleansing, debridement, and carbohydrate clearance), water balance and pH regulation, source of mineralizing ions to counter demineralization processes, deposition of biofilms to limit bacterial adhesion and acid diffusion, initiation of digestive process.[2]

The salivary ph is an exciting and expanding field of research. Salivary ph is crucial to health as it can cause both oral and systemic diseases. It rests within biofilms throughout the oral cavity and forms an ecosystem that maintains health in a state of equilibrium. However, certain imbalances in this state of equilibrium allow pathogens to manifest and cause disease. Disruption of the salivary ph leads to dysbiosis. Identifying the salivary ph in health is the first step of human most research, after which it is necessary to understand the role of the salivary ph and the buffering capacity in the alteration of functional and metabolic pathways associated with the diseased states.

It is recognized that causes of caries include microorganisms in the mouth and host factors. The oral cavity is one of the most diverse and complex microbial environments. Some studies demonstrated that oral plaque film has high relevance in dental caries. The acid produced from bacteria break the balance of tooth mineralization and demineralization and the body have no rapid response to pH changes, which lead to organic degradation. Saliva is the main microenvironment of oral microorganisms, and to some extent, saliva microorganism determines the structure of plaque. Salivary protein has a crucial role in monitoring health status or monitoring disease. It was reported that the proteins in saliva could modulate the balance of oral health and homeostasis, maintain a stable ecosystem, and inhibit the growth of cariogenic bacteria. [3]

Review:

Salivary pH a Risk Markers for Early Childhood Caries (ECC)

A lot of studies says that it is generally accepted that the caries process is supervised largely by a natural protective mechanism implicit within the saliva. The salivary flow, dilution, pH, buffering, and remineralizing capacity of saliva are admited as the critical factors that affect and control the progression and regression of the caries process.[4]

The use of saliva as a biospecimen has greatly expanded the integration of biologic data into research studies conducted across a wide range of scientific disciplines.

Salivary PH variations and dental caries risk:

The key in the management of dental caries is addressing the causative factors, both general and local, especialy obtaining a neutral oral pH.

Connections between the pH values and the prevalence of caries have been pointed out, the influence of local and general factors, as well as the impact of pH variations upon the tooth structure. An acidogenic oral environment results in an imbalanced demineralization and remineralization process, with a multiplying community of acidophilic bacteria.

It is generally accepted that the caries process is controlled largely by a natural protective mechanism implicit within the saliva. If the oral environment is favorable, saliva can contribute to the strengthening of the tooth by supplying the components known to help and build strong apatite structure.[5]

Salivary pH and buffering capacity to prevent pediatric caries.

The present review was aimed at risk prediction for ECC by assessment of salivary pH and buffering capacity. The ability to predict an individual's risk for caries would offer a potentially huge natural way to promote better oral health. Saliva serves as a first line of both non-specific and specific defense in the oral cavity against a number of diseases. Various caries risk assessment models were proposed with salivary analysis as a main component.

The pH of stimulated saliva a correlation with the oral health to pediatric dentistry compare to the adults.

Positive correlation was reported between salivary pH the increase in salivary pH mean is usually accompanied by reducing dental caries this is in accordance with other. However, this could be explained by the fact that need of treatment in children will lead to more advanced carious lesion which is a good environment for the growth of acidogenic microorganisms. So, more acidic salivary pH was found in children than in adults. [6]

Positive correlation was reported between salivary pH and salivary flow rate, this comes in agreement with previous studies. Although this correlation was statistically not significant in children and adults but it was highly significant in the total sample. This may be attributed to that saliva in sufficient quantity had a cleansing and neutralization effect.

For children and adolescents, low buffering capacity was associated with a decrease in dental caries, not an increase in dental caries, as we had presupposed. For older adults, a low stimulated salivary flow rate was associated with increased dental caries. Resting salivary pH was statistically significant overall, but not within the specific age groups.

One studies show that a low resting salivary pH was not associated with higher caries experience. However, resting salivary pH was significant overall. Resting saliva bathes the oral cavity 90 percent of the time, and its pH usually is lower than the pH of stimulated saliva.

The pH of saliva plays an important role in people's oral health

The pH of saliva has a considerable impact on oral health, as it is a factor in the protection against tooth decay. It should range between 6.5 and 7 to maintain the balance for good oral health. [7]

The mouth is an ecosystem that, like other parts of the body, requires a balanced pH. When sugary and acidic foods are consumed very frequently throughout the day, salivary pH becomes unbalanced because bacteria metabolise sugars and produce acids, which increases the risk of decay.[8]

Salivary Viscosity in Relation to Oral Health

Saliva is a unique biologic fluid produced by different salivary glands. It is composed of approximately 99% water and 1% protein and salts. Concerning periodontal diseases, studies reported that subjects with viscous saliva are at higher risk for periodontal disease. Salivary viscosity was significantly higher among individuals with increased caries severity compared with caries free ones.

The possible clarification is that when salivary viscosity increased that mean reduction in water content with an increased salivary thickness because the rate of production is low. Salivary secretion whose related capacity is compromised is less capable of flowing freely to oral sites where its protective functions such as clearance would be affected which is essential for removal of food debris and bacteria thereby increasing the susceptibility to dental caries. From these results we can suggest that the effect of increased salivary viscosity is more obvious regarding dental caries, but unpronounced effect was recorded regarding gingival inflammation.[9]

CONCLUSIONS

Saliva is an essential factor in the maintenance of oral health and salivary parameters are therefore taken into account when assessing caries risk, as well as changes in salivary flow rate and composition can be utilized to assist in the diagnosis of various oral and systemic diseases.

REFERENCES

1. Definition of Early Childhood Caries (ECC). Pediatr Dent 2006; 28(7):13. Reference manual.
2. McDonald RE, Avery DR, Stookey GK. Dentistry for the child and adolescent. 8th ed. St. Louis: Mosby Co; 2005, Dental caries in the child and adolescent, p. 203-235.
3. Seow WK. Biological mechanisms of early childhood caries. Community Dent Oral Epidemiol 1998;26(suppl 1):8-27.
4. Schipper RG, Silletti E, Vingerhoeds MH. Saliva as research material: Biochemical, physicochemical and practical aspects. Arch Oral Biol 2007;52(12):1114-1135.
5. Lamberts BL, Pederson ED, Shklair IL. Salivary pH-rise activities in caries-free and caries-active naval recruits. Arch Oral Biol 1983;28(7):605-608.
6. Ericson T, Makinen KK. Textbook of clinical cariology. Copenhagen: Munksgard; 1986. Saliva formation, composition and possible role, 28-45.
7. Moynihan P (2005). The interrelationship between diet and oral health. P Nut Soc 64(4): 571-580.
8. Iacopino AM (2006). Maintaining oral health in the aging population: the importance of the periodontal-systemic connection in the elderly. Grand Rounds Oral-Sys Med 3: 25-37.
9. Pachori A, Kambalimath H, Maran S, Niranjan B, Bhambhani G & Malhotra G (2018). Evaluation of changes in salivary pH after intake of different eatables and beverages in children at different time intervals. Int J Clin Pediatr Dent 11(3): 177.

Oral Health Knowledge among Healthcare Personnel in Arad, Romania

Olariu T.[1], Bran L.R.[2], Olariu I.[3], Lile I.E.[3], Tanase A.D.[4], Damian G.[1]

[1]Department of General Medicine, Faculty of Medicine "Vasile Goldis" Western University of Arad
[2]Arad College of Nursing
[3]Department of Denistry, Faculty of Dentistry, Faculty of Medicine, "Vasile Goldis" Western University of Arad
[4]Department of Management, Legislation and Communication in Dentistry, Faculty of Dental Medicine, Victor Babes University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Iustin Olariu
Address: No 86 Liviu Rebreanu street, Arad
Phone: +40 723423263
E-mail address: iustin_olariu@yahoo.com

Abstract

Oral health reflects health in general, being an important indicator of knowing the determinants of health. This study examines the knowledge of oral health and oral hygiene habits among 144 respondents. Methods: The study was based on 15 questions, data being processed by IBM SPSS Statistics. Results: only one question received the correct answer unanimously, the percentages of correct answers to the others being variable between 4.9-98.5% ($p \leq 0.001$). The better oral health knowledge ($p \leq 0.001$) it was related to fluoridation, visits to the dentist, gingivitis prevention and ideal toothbrush, while other subjects were disappointingly poorly known. Conclusion: the results show that oral ealth education must be continuous, especially among health workers, who also have the role of trainers of the general population regarding the determinants of health status.

Keywords: knowledge; oral health; oral hygiene

INTRODUCTION

Oral health can be defined as a standard of health of the oral and related tissues, which enables an individual to eat, speak and socialize without active disease, discomfort or embarrassment and which contributes to general well-being [1]. Oral health has been documented as equally important as general health. Moreover, knowledge about oral health has been cited as an important factor that determines overall health [2]. Treatment of the dental diseases involves high costs like many other diet and health related diseases [3]. Oral health is an integral part of overall health, and each influences the other [4]. Improper diet, smoking, alcohol intake, and poor oral hygiene practices are the most significant factors influencing the occurrence of various oral diseases [5]. Diet affects the development of dental caries, dental erosion, periodontitis, oral cancer, and many other diseases of the soft tissues of the oral cavity [6]. Smoking has been linked to oral cancer, gingival and periodontal disease, periimplantitis, tooth discoloration, halitosis, taste bud changes, and difficulty healing wounds after surgery. High alcohol intake is associated with an increased risk of developing oral cancer or other potentially malignant disorders, periodontitis, dental caries, and xerostomia. Poor oral hygiene can lead to the development of dental caries and periodontitis, and is also associated with heart disease, cancer, and diabetes [7]. The most effective method for preventing dental caries or periodontitis is the removal of dental plaque by regular and proper mechanical cleaning of the teeth, a key step in maintaining oral health [8].

Aim and objectives

To determine oral health awareness among Healthcare Personnel in Arad.

MATERIALS AND METHODS

The study sample consisted of 144 subjects selected using a simple random sampling technique. Individuals older than 18 years of age were included in the study. The purpose of the study was informed and explained to the participants and those who voluntarily agreed to participate in the study and gave a written consent were asked to fill the questionnaire according to the response format provided in the questionnaire.

A self-made closed ended questionnaire was given to each one of them, in July 2022. The questionnaire form includes 15 questions regarding the knowledge, attitude and practices related to oral health.

Statistical analyses. The data was first transferred to Microsoft Excel and IBM SPSS Statistics. For data analyses, each positive response was given a score '1' and each negative response was assigned a score '0'. Results were statistically analyzed using SPSS package in terms of percentages, depending on gender and age category, under 30year-old and over.

RESULTS

This study was carried out on 144 subjects. Among them, 54.9% were males (n=79) and 45.1% were females (n=65). Most of them were living in urban area, 73.61% (n=106). All the subjects were above 18 years of age, age ranged 21-54. The number of subjects in 21-30 age group was maximum, 104 (72.2%). Mean age was 29.48, Std. Deviation 5.818 Regarding their education background, these 104 responders were having education up to short-cycle tertiary education.

The worst result was recorded for the question regarding gingival bleeding during usual tooth brushing, only 4.9% (n=7) admitting that gum bleeding can occur normally,

without pathological significance. Less than a third know how to brush their teeth correctly and only half of them brushed their teeth twice a day (n=77). Replacing the toothbrush every 3 months is the usual practice only for 61.8% (n=89) and 70.1% (n=101) consider the carious process as non-transmissible, table 1.

Table 1. The least known notions of oral health practice, percentages of correct answers

Question	%	under30	over30	F	M
Bleeding gums is normal when brushing our teeth	4.9	5.1	4.4	6.2	3.8
The correct tooth brushing	28.5	23.2	40	23.1	32.9
Brushing our teeth in 24 hours	53.5	49.5	62.2	55.4	51.9
When should the toothbrush be changed	61.8	61.6	62.2	78.5	48.1
Carious processes can be transmissible	70.1	67.7	75.6	64.6	74.7

The following set of 5 questions were solved correctly especially by respondents under 30year-old, compared to those over 30year-old. Only 75.7% (n =109) know that dental caries have different etiologies, germs having their non-exclusive role; also 111 (77.1%) responders admit that parents' oral health influences theirs children' oral health. Only 118 recognize the role of the profession in oral health (81.9%), 84.7% (n= 122) know that non-alcoholic mouthwashes are recommended. The infectious etiology in gingivitis is recognized by130 responders (90.3%), table 2 and imagine 1.

Table 2. The generally known elements of oral health, percentages of correct answers

Question	%	under30	over30	F	M
Caries are caused only by germs	75.7	78.8	68.9	84.6	68.4
Parents' oral health influences children' oral health	77.1	82.8	64.4	84.6	70.9
Profession can influence the patient's oral health	81.9	82.8	80	78.5	84.8
Recommended mouthwashes	84.7	85.9	82.2	78.5	89.9
Germs are causing gingivitis	90.3	88.9	93.3	89.2	91.1

A visit every 6 months to the dentist is important for 91.7% (n=132). Fluoridation is essential to prevent carious processes (n= 137) and 141 of the responders admit that brushing teeth is preventing gingivitis. The same percent of oral health importance for human health 97.9% it is surpassed only by knowing the ideal type of toothbrush to be used, table 3.

Table 3. The bestknown notions of oral health, percentages of correct answers

Question	%	under30	over30	F	M
How often is it recommended to visit the dentist	91.7	92.9	88.9	90.8	92.4
Fluoridation is useful to prevent carious processes	95.1	93.9	97.8	93.8	96.2
Brushing teeth is useful to prevent gingivitis	97.9	97	100	95.4	100
Oral disease can affect human health	97.9	97	100	98.5	97.5
The ideal toothbrush	100	100	100	100	100

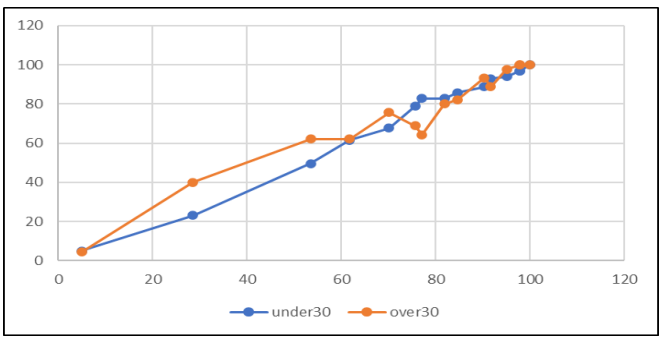


Figure 1. Comparison of correct answers, in percentages, depending on age category

DISCUSSIONS

The positive oral health behaviors and attitudes of under 30year-old category, could be explained by the generally greater concern about appearance in younger people, who are more likely to visit a dentist and to educate themselves about oral health. Periodic dental examinations are important in preventing oral diseases, educating patients, and encouraging the maintenance of good oral hygiene [9]. A study conducted in China in 2019 on a sample of 263 middle-aged respondents found a significant link between age, low educational level, and poor oral health. This also affected oral health knowledge, with respondents of lower socioeconomic status showing a lower level of oral health knowledge. Poor knowledge of oral health is associated with poor oral hygiene and a higher number of lost teeth [10]. In a study by Peltzer and Pengpid on a sample of 19,560 undergraduate students from 27 universities in 26 countries in Asia, Africa, and America, the results showed that 67.2% of students brush their teeth twice or more times a day, 28.8% approximately once a day, and 4.0% never. The prevalence of brushing teeth less than twice a day appears to be higher among students in low- and middle-income countries than in high-income countries; e.g., 52.2% in India, 35% in Lebanon, 32% in Turkey compared with 7.9% in Italy, or 25% in the United States [11].

More than half of our respondents (61.8%) change their toothbrush every three months. Most respondents (53.8%) of a survey of the Military College in Bucharest change their brush every three months, and 34.3% once a month [12], while in Zagreb, 48.3% of students use the same brush for less than three months [13].

CONCLUSIONS

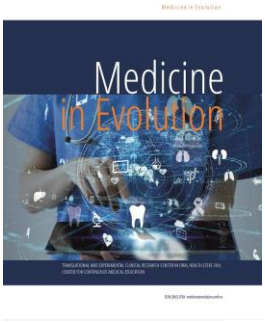
In general, the results showed good oral health knowledge among healthcare personnel, but education on this topic is a fundamental "must" for understanding and maintaining of oral health. The awareness about oral hygiene and dental health needs to be spread by dental professionals.

REFERENCES

1. Udoye C, Aguwa E. Oral health related knowledge and behaviour among nursing students in a Nigerian tertiary hospital. Int J Dent Sci. 2009;7:2.
2. Dagli RJ, Tadakamadla S, Dhanni C, Duraiswamy P, Kulkarni S. Self-reported dental health attitude and behavior of dental students in India. J Oral Sci. 2008;50:267–72.
3. Petersen PE. The World Oral Health Report 2003: Continuous improvement of oral health in the 21st century – The approach of the WHO global oral health programme. Community Dent Oral Epidemiol. 2003;31(Suppl 1):3–23
4. Peres, M.A.; Macpherson, et al. Oral diseases: A global public health challenge. Lancet 2019, 394, 249–260
5. Shah, A.F.; Batra, M.; Sudeep, C.B.; Gupta, M.; Kumar, R. Oral habits and their implications. Ann. Med. 2014, 1, 179–186.
6. Richards, D. Impact of diet on tooth erosion. Evid. Based Dent. 2016, 17, 40
7. Pitts, N.B.; Zero, et al, Dental caries. Nat. Rev. Dis. Primers 2017, 3, 17030
8. Griffin, S.O.; Jones, et al,. Burden of oral disease among older adults and implications for public health priorities. Am. J. Public Health 2012, 102, 411–418.
9. Farsi, N.J.; Merdad, Y.; et al,, J. Oral Health Knowledge,Attitudes, and Behaviors Among University Students in Jeddah, Saudi Arabia. Clin. Cosmet. Investig. Dent. 2020, 12, 515–523.
10. Ho, M.H.; Liu, M.F.; Chang, C.C. A Preliminary Study on the Oral Health Literacy and Related Factors of Community Mid-Aged and Older Adults. Hu Li Za Zhi 2019, 66, 38–47.

11. Peltzer, K.; Pengpid, S. Oral health behaviour and social and health factors in university students from 26 low, middle and high income countries. Int. J. Environ. Res. Public Health 2014, 11, 12247–12260
12. Dan, A.D.; Ghergic, D.L. Knowledge and Skills Level on Oral Health among Students at the "Ferdinand I" Military Technical Academy in Bucharest. J. Med. Life 2020, 13, 562–567.
13. Simat, S.; Mostarcic, K et al, S. A Comparison of Oral Status of the Fourth-Year Students of Various Colleges at the University of Zagreb. Acta Stomatol. Croat. 2011, 45, 177–183.

The benefits of Calendula officinalis extract as therapeutic agent in oral healthcare



Potra-Cicalău G.I.[1], Ciavoi G.[1], Todor L.[1], Iurcov R.C.[1], Iova G.[1], Ganea M.[2], Scrobotă I.[1]

[1]*Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania*
[2]*Department of Pharmacy, Faculty of Medicine and Pharmacy, University of Oradea, Romania*

Correspondence to:
Name: Liana Todor
Address: Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania, December 1st Square no.10, 410068 Oradea, Bihor County, Romania
Phone: +40723 517 100
E-mail address: liana.todor@gmail.com

Abstract

People's health is favorable impacted by medicinal plants. In addition to their conventional purpose, many isolated chemicals from herbs have beneficial therapeutic characteristics for treating various disorders. In this review, the usage of *Calendula officinalis* will be discussed in relation to pathologies that affect the oral cavity, such as dental caries, gingivitis or periodontitis. *Calendula officinalis* extract is able to decrease inflammation through pro-inflammatory cytokines down modulation and promotes antioxidant and immunomodulatory effects—as a result of the presence of polysaccharides and flavonoids in the plant—the main biological actions that make it effective in oral healthcare.

Keywords: natural extracts, *Calendula officinalis*, oral health

INTRODUCTION

Different plant extracts have been proven to have medicinal properties, benefic to oral healthcare. Tulsi (*Ocimum sanctum*), oregano (*Origanum vulgaris)*, green tea (*Camellia sinensis)*, red gum (*Eucalyptus camaldulensis)*, magnolia (*Magnolia officinalis)*, hibiscus (*Hibiscus sabdariffa)*, aloe vera (*Aloe barbadensis)*, mint (*Mentha Piperita)* and rosemary (*Rosmarinus officinalis*) have been established to inhibit a series of bacterial agents responsible for the occurrence of dental caries and periodontal disease [1, 2, 3, 4, 5]. Along with these, marigold (*Calendula officinalis*) is also counted, due to its phytotherapeutic properties [6, 7, 8, 9, 10].

Calendula officinalis, also known as marigold, pot marigold, bride of the sun or butterworth, grows in shrubs and it is native to the Mediterranean area, but it is widely spread around the world, being met especially in the sunny soils areas [11, 12]. About twenty five herbaceous annual or perennial species make up the genus Calendula (Asteraceae), with *Calendula officinalis Linn.*, *Calendula arvensis Linn.*, *Calendula suffruticosa Vahl.*, *Calendula stellata Cav.* and *Calendula alata Rech.* being the most popular [13].

This yellow-orange iridescence flower is considered to be a therapeutic plant due to its multiple medicinal qualities, including those that are antibacterial, anti-inflammatory, antioxidant, antifungal, re-epithelializing and immunomodulatory. *Calendula officinalis* is widely utilized in traditional medicine [12]. The extract of *Calendula officinalis* can be presented as tinctures, lotions, ointments or infusions [11].

Flavonoids, sterols, polysaccharides, saponins, triterpene alcohols, phenolic acids, tannins, glycosides and carotenoids are all present in the marigold flowers and leaves natural extract [11, 12]. Utilizing cutting-edge analytical technology, fresh chemical compounds with biological activity such as isorhamnetin, rutin and quercetin glucoside have been identified in *Calendula officinalis* extract [6]. These numerous biological active elements have been identified both in-vitro and in-vivo [14].

Aim and objectives

This review objective is to discuss the use of *Calendula officinalis* in conditions affecting the oral cavity, including dental caries, gingivitis and periodontitis. We also intend to emphasize the applicability of this extract in endodontics, dento-alveolar surgery and diabetology.

CALENDULA OFFICINALIS PHARMACOLOGICAL EFFECTS

Numerous studies have looked into the medical benefits of calendula extract, which can be used in both dental and general medicine.

The three primary biological actions of calendula that make it effective in dental care are its ability to reduce pro-inflammatory cytokines, decrease inflammation and promote antioxidant and immunomodulatory effects due to the presence of polysaccharides and flavonoids in the plant [8, 9, 15, 16].

Several researchers reported the antibacterial properties of marigold extract [17]. *Calendula officinalis* extract can modulate the formation of the oral microbiome induced by *Streptococcus Mutans*, chronic gingivitis, while also having fungistatic activity against *Candida albicans* [6, 7, 10, 18].

In terms of anti-inflammatory activity, it has been demonstrated that the oral administration of 250-500 mg/kg of body weight significantly inhibits plantar edema induced by carrageenan and dextran in experimental animals [8]. Since the presence of dextran and

carrageenan, *Calendula officinalis* extract exhibits anti-inflammatory effects on plantar edema, the anti-inflammatory impact being comparable to indomethacin dosages [19].

Also, the increased levels of pro-inflammatory cytokines (TNF-α, IL-1β, 1L-6), respectively acute phase proteins (C-reactive protein (CRP) and cyclooxygenase-2 (COX-2)) are significantly inhibited in mice by marigold extract treatment [8].

The amount of cytokines can be controlled by *Calendula officinalis* extract, which can also lessen oxidative stress and increase polymorphonuclear cell activity. *Calendula officinalis* containing mouthwashes can be used as an adjuvant in oral prophylaxis because they have been found to lower bacterial plaque load and prevent gingival irritation [6].

It has been stated that the antioxidant properties of *Calendula officinalis* extract are due to the content of quercetin, lutein, ruby, xanthophylls, ubiquinone and carotenoids [6, 7, 10, 18]. At the same time it was highlighted that the extract of *Calendula officinalis* of different polarity shown antioxidative activity on liposomal lipid peroxidation caused by ferrous ion and ascorbic acid [20]. In-vitro and in-vivo assessments showed that the antioxidant potential of marigold extract is due to the removal of superoxide radicals and OH groups [19].

DISCUSSIONS

Even though there is little information in the literature about the antibacterial activities of plant extracts against periodontal diseases, many mouthwashes containing medicinal plant extracts are routinely utilized for maintaining oral hygiene. From this point of view, *Calendula officinalis* extract has been intensively investigated.

In an vitro study, Priyanka et al. demonstrated the significant antibacterial effect of *Calendula officinalis* on dental plaque pathogens, but still inferior to chlorhexidine (CHX) and tetracycline gels [21]. Khairnar et al. in an experimental study on human subjects demonstrated that mouthwashes containing marigold extract can be effective in reducing the oral microbiome involved in the formation of bacterial dental plaque and in the occurrence of gingivitis. In case of using mouthwash with marigold tincture, periodontal indices (PI, GI, SBI) are significantly reduced, even in the absence of scaling [6]. Another clinical study, carried out by Amoian et al. investigated the anti-inflammatory effect of a mouthwash with marigold extract in case of patients diagnosed with gingivitis and demonstrated that the incorporation of this extract into oral toothpastes reduces PI, GI and BOP index, recommending its introduction as an adjunctive treatment in improving the gingival status [22]. The results of these authors show that this extract has phytotherapeutic properties, beneficial in the prevention and control of dental plaque, gingivitis and periodontitis [6, 21, 22].

Mouthwashes containing *Calendula officinalis* have been identified as alternatives to the use of CHX 0.12%, which did not exert the expected results in postoperative healing after free gingival grafts. The use of marigold extract mouthwash promotes fast healing of the affected oral mucosa in a few days and has antimicrobial effect [23]. As opposed to that, other researchers stated after a clinical research that phytotherapeutic mouthwashes containing *Calendula officinalis* delivers similar effects to CHX 0.12% mouthwashes in patients with chronic periodontitis, regarding clinical parameters (PI, BOP, CAL). In case of GI index, CHX showed superior effects [24].

Besides the antibacterial activity, another important aspect is mouthwashes is the taste. A clinical study by Arief et al. demonstrated that a commercial preparation with marigold extract - Plandula® - resulted in obtaining a slightly higher average plaque index compared to the use of CHX, but statistically insignificant [25].

The outcomes of a mouthwash based on hydrophilic extracts of *Zingiber officinale*, *Rosmarinus officinalis* and *Calendula officinalis* were compared to those attained after using

mouthwashes containing CHX by Mahyari et al. in patients with gingivitis and the results were similar [26]. These plant extracts have the potential to reduce bacterial plaque and gingivitis [27]. Other authors have shown that the association of *Calendula officinalis* extract with propolis in mouthwashes with different pharmaceutical formulas can be useful in maintaining oral hygiene and preventing periodontal disease [28].

Gram-positive and gram-negative flora is greatly reduced by *Calendula officinalis* leaves extract, as demonstrated by Chakraborty et al. [7]. Shankar et al. investigated the antimicrobial activity of *Calendula officinalis* against five gram-positive and gram-negative germs involved in tooth decay pathology (*Streptococcus Mutans*), respectively in periodontal pathology (*Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis, Prevotella intermedia*, *Fusobacterium nucleatum*) and demonstrated that *Calendula officinalis* is very effective against *Streptococcus Mutans* (3.12 µg/ml), having a MIC close to CHX 0.2% (6.25 µg/ml). Also, *Porphyromonas gingivalis* and *Prevotella intermedia* showed sensitivity to *Calendula officinalis*, while *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* showed reduced sensitivity. Accordingly, *Calendula officinalis* represents a potential treatment in the case of periodontal disease, but especially in the prevention of dental caries [29].

When calendula oil was used, Yadav et al. have shown in vitro that it has antimicrobial activity against numerous periodontal pathogens. *Porphyromonas gingivalis* showed sensitivity at the concentration of 0.8 µg/ml, *Aggregatibacter actinomycetemcomitans* showed sensitivity at the concentration of 25 µg/ml, *Fusobacterium nucleatum* showed sensitivity at the concentration of 100 µg/ml and *Tanerella forsythia* showed resistance through out [30]. Rodriguez-Garcia et al. sought to develop bioadhesive films based on polymers and natural extracts with antimicrobial activity against periodontal pathogens, including calendula extract. They identified the MIC for *Calendula officinalis* as being 62.5 mg/ml for *Porphyromonas gingivalis* and 250 mg/ml for *Aggregatibacter actinomycetemcomitans* and the MBC of *Calendula officinalis* was 250 mg/ml for *Aggregatibacter actinomycetemcomitans* and 111 mg/ml for *Porphyromonas gingivalis* [31].

Thus, mouth rinsing with calendula will allow its anti-inflammatory properties to work against the swollen, irritated gums and its antibacterial properties deal with the periodontopathic microorganisms [32].

Tanideh et al. demonstrated in an experimental study on rats that the association of the hydrophilic extract of *Calendula officinalis* with *Hypericum perforatum* can be an adjuvant in periodontal therapy by decreasing the inflammatory marker IL-1β, while increasing the antioxidant capacity (2,2-diphenyl-1-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP)) [33].

In a clinical study on human subjects, Jamwal et al. investigated the effect of different concentrations of calendula extract on the pathogens involved in periodontal disease, demonstrating that mouthwash with a 100% concentration of *Calendula officinalis* is the most effective in reducing the periodontal microbiome, compared to mouthwash with 5% or 20% content of *Calendula officinalis*, so it can be used as a treatment for patients with gingivitis and periodontitis [34].

Recent in vivo research illustrated that *Calendula officinalis* favors postextractional bone preservation, due to its collagenogenic effect and through its antiseptic and analgesic properties [35], while experiments on rats demonstrated that *Calendula officinalis* modulates bone resorption and reduces inflammation in periodontal disease induced in experimental animals, emphasizing the anti-inflammatory effects of this plant extract and the involvement in bone metabolism [36]. In addition, Lima et al. highlighted that *Calendula officinalis* extract exhibit antiresorptive effect, preserves collagen fibers and present antioxidant activity [37]. Calendula mouthwash has anti-inflammatory and antibacterial effects that fight periodontopathic bacteria as well as swollen, inflamed gums [6]. These clinical and

experimental results show that *Calendula officinalis* is a potential therapeutic adjuvant in the treatment of periodontal disease and bone resorption.

In stopping desquamative gingivitis and reducing the progression of periodontal disease, *Calendula officinalis* actively participates by reducing the growth factor of hepatocytes, mediated by the breakdown of collagen and the activity of matrix metalloproteinases (MMP) [38]. Machado et al. proposed a gel based on clobetasol and *Calendula officinalis* as a treatment for desquamative gingivitis [39].

Parente et al. showed in an experimental investigation that *Callendula officinalis* extract has anti-inflammatory and antibacterial activities, improving the healing process by reducing inflammation and promoting the growth of fibroblasts in the experimental model [40]. Another research investigated the effects of chamomile and calendula mouthwash on human fibroblasts, demonstrating that they do not have anti-proliferative effects on fibroblastic cells, calendula extract also favoring wound healing [41]. Following an in vitro experiment, Saini et al. concluded that *Calendula officinalis* extract inhibits human gingival figroblast-mediated collagen degradation and MMP-2 in a superior way compared to quercetin at similar concentration [42].

This extract has also found applicability in endodontics. In an in vitro study, Vinola et al. made a comparison between the antimicrobial effect of the extract of *Calendula officinalis* with CHX 2% and identified that the extract of *Calendula officinalis* has antimicrobial and antifungal activity against *Enterococcus faecalis* and *Candida albicans*, thus being an alternative in endodontic infections treatment [43]. In a clinical experiment on human subjects, Yalgi et al. have demonstrated that *Calendula officinalis* can be used as a promising endodontic treatment, in order to suppress microorganisms from the root canal, especially *Streptococcus Mutans*, the results obtained by endocanalicular lavages being similar to those of sodium hypochlorite, used by choice in endodontic treatment [44].

El-Sayed et al. proposed topical formulas based on *Calendula officinalis* with the aim of being used post-surgically after free gingival graft surgeries, the topical gel with marigold extract exerting the best healing during the second postoperative week [45]. *Calendula officinalis* mouthwashes promote wound healing by enhancing local vascularization and increasing the rate of hyaluronic acid deposition, which actively contributes to the differentiation of mesenchymal cells. They also reduce the microbial load and the adhesion of microorganisms to the suture threads used postextractional [38]. Furthermore, Faria et al. found that *Calendula officinalis* and *Camellia sinensis* incorporated in mouthwash and used for a week, until the suture threads are removed, show antimicrobial activity, but the antimicrobial effect is not as efficient as that of CHX 0.12% [46].

Calendula officinalis has also been studied as an alternative treatment in exfoliative cheilitis [38]. Because of its anticancer properties, *Calendula officinalis* could be effective in treating oral mucositis in radiation therapy patients. It has cytotoxic effect on tumor cell lines [47].

Not least, Ebrahimi et al. have investigated the effects of this aromatic hydroalcoholic flower extract on the biological and histological parameters in diabetic rats and demonstrated trat the oral administration of this extract reduce body wight and decreed blood glucose. Also the diabetes mellitus complications upon pancreas, liver and kidneys were improved after treatment with marigold extract [48]. The therapeutic impact on diabetes raises the possibility that it may also be helpful in avoiding or controlling periodontal disease given that it is one of the complications of diabetes mellitus [49, 50].

Rare cases of anaphylactic shock following gargling with *Callendula officinalis* infusion and allergic reactions to skin contact with marigold plants have both been documented [20]. Other scientists, however, contend that the marigold extract is not toxic, genotoxic or mutagenic [12]. To further understand this issue, more research is required.

CONCLUSIONS

Plant extract-based mouthwashes, such as *Calendula officinalis*, stand out as a preventive treatment in dentistry since they offer a straightforward way to avoid tooth decays and periodontal diseases.

Given its antibacterial, anti-inflammatory and antioxidant excipients qualities, natural extract of *Calendula officinalis* can successfully be included in the oral cavity pathologies treatment, particularly in gingivitis and periodontitis.

It is essential to develop innovative dental therapies that are safe for the body, non-toxic and without negative consequences.

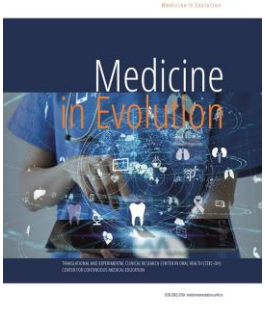
REFERENCES

1. Chandra Shekar BR, Nagarajappa R, Suma S, Thakur R. Herbal extracts in oral health care - A review of the current scenario and its future needs. Pharmacogn Rev. 2015;9(18):87-92.
2. Cicalău GIP, Babes PA, Calniceanu H, Popa A, Ciavoi G, Iova GM, Ganea M, Scrobotă I. Anti-Inflammatory and Antioxidant Properties of Carvacrol and Magnolol, in Periodontal Disease and Diabetes Mellitus. Molecules. 2021;26(22):6899.
3. Megalaa N, Kayalvizhi G, Silas AJ, Sajeev R, Saravana Kumar MS. Role of herbal leaf extracts in caries prevention. Int J Cont Med Res. 2014;1(2):71-78.
4. Bilge Ş, Mehtap K. Herbal Extracts Used in Dental Disorders. Biomed J Sci Tech Res. 2019;19(1):14107-14111.
5. Cicalău GIP, Miere F, Mandal AK, Ganea M, Scrobota I, Ciavoi G, Jurca MC. Formulation and Characterization of Hydrophilic Ointment Bases with Carvacrol and Magnolol for Periodontal Application. Pharmacophore. 2022;13(2):26-32.
6. Khairnar MS, Pawar B, Marawar PP, Mani A. Evaluation of Calendula officinalis as an anti-plaque and anti-gingivitis agent. J Indian Soc Periodontol. 2013;17(6):741-7.
7. Chakraborthy GS. Antimicrobial activity of leaf extract of Calendula officinalis Linn. J Herb Med Toxicol. 2008;2:65–6.
8. Preethi CG, Kuttan G, Kuttan R. Anti-inflammatory activity of flower extract of Calendula officinalis. Linn and its possible mechanism of action. Indian J Exp Biol. 2009;47:113–20.
9. Preethi KC, Utta GK. Antioxidant potential of an extract of Calendula officinalis in vitro and in vivo. Pharm Biol. 2006;44:691–7.
10. Zilda CG, Claudia MR, Sandra RF. Antifungal activity of the essential oil from Calendula officinalis L growing in Brazil. Braz J Microbiol. 2008;39:61–3.
11. E.S.C.O.P. (Ed) Monographs (Monographs on Medicinal Uses Of Plants Drug) Exeter (Uk) 1997 V 01-12/06.
12. Ashwlayan VD, Kumar A, Verma M, Garg VK, Gupta SK. Therapeutic potential of calendula officinalis. Pharm Pharmacol Int J. 2018;6(2):149-55.
13. Baciu AD, Mihalte L, Sestras AF, Sestras RE. Variability of decorative traits, response to the Aphis fabae attack and RAPD diversity in different genotypes of Calendula. Not Bot Hort Agrobot Cluj. 2010;38:265–70.
14. Karthikeya Patil, CJ Sanjay, Nagabhushana Doggalli, KR Renuka Devi, N Harshitha. A Review of Calendula officinalis-Magic in Science. JCDR. 2022;16(2):ZE23-ZE27.
15. Gazim ZC, Rezende CM, Fraga SR, Svidzinski TIE, Cortez DAG. Antifungal Activity of the Essential Oil from Calendula officinalis L. (Asteraceae) Growing in Brazil. Braz. J. Microbiol. 2008;39(1):61–63.
16. Milutinovici RA, Chioran D, Buzatu R, Macasoi I, Razvan S, Chioibas R, Corlan IV, Tanase A, Horia C, Popovici RA, Dinu S, Dehelean C, Scurtu A, Pinzaru I, Soica C. Vegetal Compounds as Sources of Prophylactic and Therapeutic Agents in Dentistry. Plants. 2021;10(10):2148.
17. Bissa S, Bohra A. Antibacterial potential of pot marigold. J Microbiol Antimicrob 2011;3:51-4.
18. Jaini JL, Jeeva PP, Raj RS, Mohan SG. Ethnopharmacological Reflections in Oral Health: A Review on Current Concepts. Int J Oral Care Res 2017;5(4):310-316.

19. Al-Snafi AE. The chemical constituents and pharmacological effects of calendula officinalis- a review. Indian Journal of Pharmaceutical Science & Research. 2015;5(3):172-85.
20. Arora D, Rani A, Sharma A. A review on phytochemistry and ethnopharmacological aspects of genus Calendula. Pharmacogn Rev. 2013;7(14):179-87.
21. Priyanka M, Gokul Nivas M, Ranjana devi M, Anitha V. Antimicrobial effect of marigold leaves extracts on periodontal pathogens: Invitro study. World Journal of Advanced Research and Reviews. 2022;15(1):183–187.
22. Amoian B, Moghadamnia AA, Mazandarani M, Amoian MM, Mehrmanesh S. The Effect of Calendula Extract Toothpaste on the Plaque Index and Bleeding in Gingivitis. Res J Med Plant. 2010;4(3):132-140.
23. Fang ML, Herrera HA, Díaz CA. Calendula officinalis mouthrinses as an alternative to oral antiseptics. Rev Cubana Estomatol. 2013;50(4):436-442.
24. Vinagre NP de Lima, Farias CG, Araujo RJG de, Vieira JM dos Santos, Silva Junior JOC, Correa AM. Clinical efficacy of a phytotherapic mouthrinse with standardized tincture of Calendula officinalis in the maintenance of periodontal health. Rev Odontol UNESP. 2011;40(1):30-35.
25. Arief EM, Abidin ZZ, Sitheeque M, Md Azman PKM Mohamad S. A study of anti-plaque efficacy and taste perception of Calendula officinalis mouth rinse. Padjadjaran Journal of Dentistry. 2020;32(3):190-196.
26. Mahyari S, Mahyari B, Emami SA, Malaekeh-Nikouei B, Jahanbakhsh SP, Sahebkar A, Mohammadpour AH. Evaluation of the efficacy of a polyherbal mouthwash containing Zingiber officinale, Rosmarinus officinalis and Calendula officinalis extracts in patients with gingivitis: A randomized double-blind placebo-controlled trial. Complement Ther Clin Pract. 2016;22:93-8.
27. Tidke S, Chhabra GK, Madhu PP, Reche A, Wazurkar S, Singi SR. The Effectiveness of Herbal Versus Non-Herbal Mouthwash for Periodontal Health: A Literature Review. Cureus. 2022;14(8): e27956.
28. Ansiliero R, Baratto CM, Megiolaro F, Gelinski JMLN. Antimicrobial and antioxidant activity of hydroalcoholic extracts of bee propolis (Tetragonisca angustula) and/or Calendula officinalis and potential use in mouthwash formulation. BJDV. 2022;8(4):27211-30.
29. Shankar SM, Bardvalli SG, Jyotirmayee R, Chethana, Bhushan K, Kumar S. Efficacy of Calendula officinalis Extract (Marigold Flower) as an Antimicrobial Agent against Oral Microbes: An Invitro Study in Comparison with Chlorhexidine Digluconate. JCDR. 2017;11(10):ZC05-ZC10.
30. Shiva Charan Yadav1, Babitha G.A2, Shobha Prakash3, K.Suresh4, Sachin Gaikwad5, Snehal P. Deotale 6. Calendula: A Blooming Alternative Against Periopathogens. IOSR-JPBS. 2017;12(2):36-39.
31. Rodriguez-Garcia A, Galan-Wong LJ, Arevalo-Niño K. Development and in vitro evaluation of biopolymers as a delivery system against periodontopathogen microorganisms. Acta Odontol Latinoam. 2010; 23(2): 158-63.
32. Iauk L, Lo Bue AM, Millazoa I, Rapisarda A, BLandino G. Antibacterial activity of medicinal extracts against periodontopathic bacteria. Phytother Res. 2003; 17: 599–604.
33. Tanideh N, Ghafari V, Ebrahimi R, Habibagahi R, Koohi-Hosseinabadi O, Iraji A. Effects of Calendula Officinalis and Hypericum Perforatum on Antioxidant, Anti-Inflammatory, and Histopathology Indices of Induced Periodontitis in Male Rats. J Dent. 2020; 21(4): 314-321.
34. Jamwal D, Kanade K. Evaluation of anti-microbial effect of different concentrations of calendula extract (calendula officinalis) on periodontal pathogens. J Sci Ind Res. 2020;10(6):650-62.
35. Uribe-Fentanes LK, Soriano-Padilla F, Pérez-Frutos JR, et al. Action of Calendula officinalis essence on bone preservation after the extraction. Rev Med Inst Mex Seguro Soc. 2018;56(1):98-105.
36. Alexandre JTM, Sousa LHT, Lisboa MRP, Furlaneto FAC, do Val DR, Marques M, Vasconcelos HC, de Melo IM, Leitão R, Castro Brito GA, Goes P. Anti-inflammatory and antiresorptive effects of Calendula officinalis on inflammatory bone loss in rats. Clin Oral Investig. 2018;22(6):2175-2185.
37. Lima MR, Lopes AP, Martins C, Brito GAC, Carneiro VC, Goes P. The Effect of Calendula officinalis on Oxidative Stress and Bone Loss in Experimental Periodontitis. Front. Physiol. 2017;8:440.

38. Roveroni-Favaretto LH, Lodi KB, Almeida JD. Topical Calendula officinalis L. successfully treated exfoliative cheilitis: A case report. Cases J. 2009;23:9077.
39. Machado MA, Contar CM, Brustolim JA, Candido L, Azevedo-Alanis LR, Gregio AM, Trevilatto PC, Soares de Lima AA. Management of two cases of desquamative gingivitis with clobetasol and Calendula officinalis gel. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2010;154(4):335-8.
40. Parente LM, Lino Júnior Rde S, Tresvenzol LM, Vinaud MC, de Paula JR, Paulo NM. Wound Healing and Anti-Inflammatory Effect in Animal Models of Calendula officinalis L. Growing in Brazil. Evid Based Complement Alternat Med. 2012;2012:375671.
41. Wyganowska-Swiatkowska M, Urbaniak P, Szkaradkiewicz A, Jankun J, Kotwicka M. Effects of chlorhexidine, essential oils and herbal medicines (Salvia, Chamomile, Calendula) on human fibroblast in vitro. Cent Eur J Immunol. 2016;41(2):125-31.
42. Saini P, Al-Shibani N, Sun J, Zhang W, Song F, Gregson KS, Windsor LJ. Effects of Calendula officinalis on human gingival fibroblasts. Homeopathy. 2012;101(2):92-8.
43. Vinola SM, Sekar M, Renganathan SK, Dhiraviam S. Comparative evaluation of Calendula officinalis and 2% chlorhexidine against Enterococcus faecalis and Candida albicans. J Interdiscip Dentistry 2021;11:119-23.
44. Yalgi VS, Bhat KG. Compare and evaluate the antibacterial efficacy of sodium hypochlorite and Calendula officinalis against Streptococcus mutans as a root canal irrigating solution: An in vivo study. J Int Oral Health 2020;12:74-9.
45. El-Sayed MK, Hommos AM, Kotry GS, Labib GS. The effect of a calendula based topical formula versus oxidized regenerated cellulose on palatal wound healing: A randomized controlled clinical trial. Alex Dent J. 2021;46(2):45-53.
46. Faria RL, Cardoso LM, Akisue G, Pereira CA, Junqueira JC, Jorge AO, Santos Júnior PV. Antimicrobial activity of Calendula officinalis, Camellia sinensis and chlorhexidine against the adherence of microorganisms to sutures after extraction of unerupted third molars. J Appl Oral Sci. 2011;19(5):476-82.
47. Babaee N, Moslemi D, Khalilpour M, Vejdani F, Moghadamnia Y, Bijani A, et al. Anti-oxidant capacity of Calendula officinalis flowers extract and prevention of radiation induced oropharyngeal mucositis in patients with head and neck cancers: A randomised controlled clinical study. DARU Journal of Pharmaceutical Sciences. 2013;21(1):18-24.
48. Ebrahimi E, Kheirollah A, Mansouri E, Babaahmadi-Rezaei H, Mohammadzadeh G. Effects of Hydroalcoholic Flower Extract of Marigold (Calendula officinalis) on the Biochemical and Histological Parameters in STZ-Induced Diabetic Rats. Jundishapur J Nat Pharm Prod. 2019;14(3):e55456.
49. Potra Cicalău GI, Babeş PA, Domocoş D, Pogan M. The assessment of two-way relationship between periodontal diseases and diabetes mellitus. Acta Stomatologica Marisiensis.2021;4(1):18-24.
50. Potra Cicalău GI, Todor L, Ciavoi G, Scrobotă I, Baciu OA, Jurca MC. Clinical study on the frequency of dental examinations and oral prophylaxis in patients diagnosed with type 2 diabetes mellitus and periodontal disease. Medicine in Evolution. 2022;28(2):138-146.

Inventory of dental students´ needs regarding oral health literacy concept



Sfeatcu R.[1], Cărămidă M.[1], Bencze M.A.[2], Dragomirescu A.O.[2], Dumitrache M.A.[1]

[1]*Oral Health and Community Dentistry Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania*
[2]*Orthodontics and Dento-facial Ortopedics Department, Faculty of Dental Medicine, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania*

Correspondence to:
Name: Bencze Maria Angelica
Address: Eforie Street no. 4-6, district 5, Bucharest, Romania
Phone: +40 744 318 013
E-mail address: maria.bencze@umfcd.ro

Abstract

Aim: to evaluate the knowledge among a group of dental students regarding oral health literacy concept and their needs to improve education level in this regard. Material and method: They were collected data on oral health literacy (OHL) knowledge among 6th year dental students from "Carol Davila" U.M.P. Bucharest, Romania. Students involved in the study attended a lecture on this subject and a practical course about OHL level's evaluation tools. Results: before lessons, 210 dental students (mean age 24.3±1.82; 64.8% females) have answered to an anonymous questionnaire and we found out a medium level of knowledge regarding the definition of the concept (33.7% give the right answer) and about the OHL role in: communication with patients (57.5%), health promotion (25.8%), oral diseases prevention (37.3%) and adherence to dental treatment (12.4%). After attending the course and the practical training, most of students recognized the factors affected by oral health literacy skills: dental health knowledge of the individuals/patients (89.9%), health behavior (78.9%) and doctor-patient communication (98.2%). Conclusion: dental students, as future health providers need dental education throughout curricula regarding oral health literacy, an important aspect associated with inequalities in health status and getting communication skills for a patient-centered dental care, according with individual's oral health literacy abilities.

Keywords: health literacy, dental students, education, comunication

INTRODUCTION

On the European Union's agenda finds the need to focus on the concept of health literacy, defined as the ability to read, select and understand medical information for the formation of judgments or the right choices about health [1-3].

The level of oral health literacy level heavily influences the way people interact with dental professionals, therefore the literacy of the individual and patient on the right to health is required in order to facilitate transformation the consumer of medical services as an active partner in the system health care [4-6].

It is necessary to introduce in the curriculum of compulsory education a discipline that addresses health issues and develops the skills necessary for the proper functioning of the individual or patient as recipient of health services [7,8].

Every patient needs oral health education, and medical information should be tailored to individual needs [1,2].

Dental students and dentists must be able to adapt medical information depending on each patient´ level of understanding, to have educator skills, and theoretical and practical knowledge on health education methods to meet the needs of their patients [1,8].

Patient oral health education is a responsibility of dental health care providers, even more so as at present, patients need more medical information. Adequate provision of medical and dental information will increase patient satisfaction, compliance to treatment, and will improve the condition of oral and general health status [1,5,8].

Aim and objectives

The present study aims to evaluate the knowledge of dental students regarding oral health literacy concept and their needs to improve dental education in this regard.

MATERIALS AND METHODS

They were collected data on oral health literacy (OHL) knowledge among 6th year dental students from "Carol Davila" U.M.P. Bucharest, Romania.

In order to be involved in a research project focused on OHL assessment among adolescents in various communities and adults in dental offices within Oral Health and Community Dentistry Department, dental students attended a lecture on this subject and a practical course about OHL level's evaluation tools.

The Ethical Committee of the above-mentioned university approved the study. This work was supported by „Carol Davila" University of Medicine and Pharmacy, a project number 33898/11.11.2014.

Before and after lessons, 210 dental students (mean age 24.3±1.82; 64.8% females) have answered to the same questionnaire that assessed the knowledge of respondents regarding: the definition and the role of OHL concept in dental practice, as well as factors affected by oral health literacy skills (dental health knowledge of the patient; health behavior, and the dentist-patient communication).

In terms of oral health literacy role, there were four variants of answer, namely: communication, health promotion, oral disease prevention, and adherence to dental treatment.

In order to assess the differences, p-value<0.05 was considered statistically significant.

RESULTS

Present study revealed a medium level of knowledge regarding the definition of the concept (33.7% give the right answer) and about the OHL role in communication with patients (57.5%), health promotion (25.8%), oral diseases prevention (37.3%) and adherence to dental treatment (12.4%) (Figure 1).

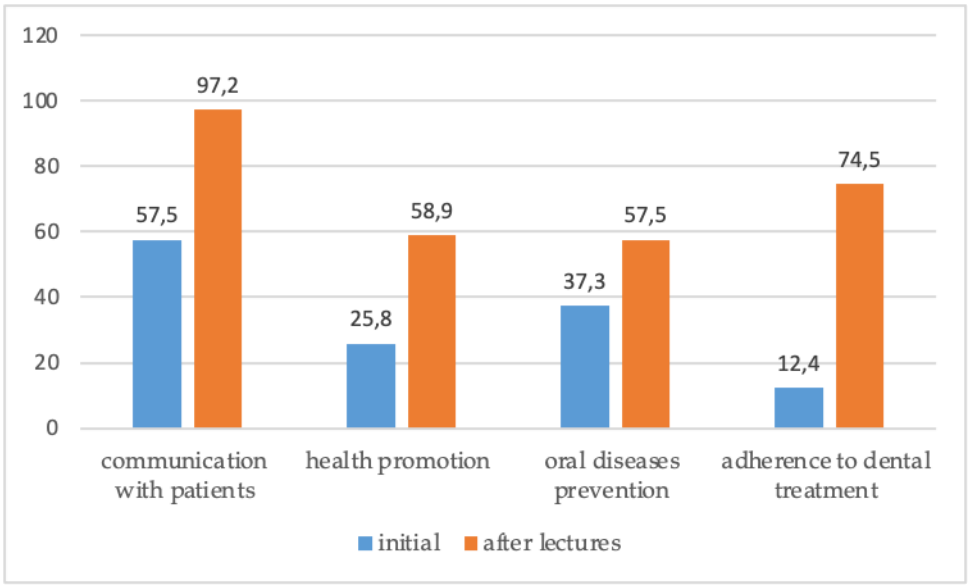


Figure 1. Dental students' knowledge regarding OHL role in dentistry (%)

After attending the course and the practical training, most of students recognized the factors affected by oral health literacy skills: dental health knowledge of patients (89.9%), health behavior (78.9%) and doctor-patient communication (98.2%) (Figure 2).

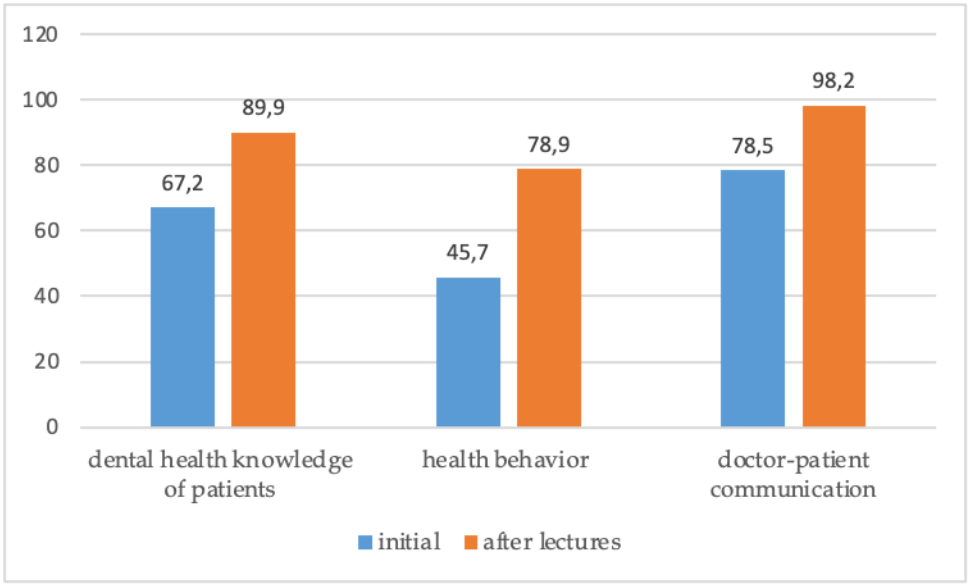


Figure 2. Knowledge regarding factors affected by oral health literacy skills (%)

Statistical improvement of students' knowledge regarding all three aspects evaluated in terms of oral helath literacy (OHL) concept is presented in Tabel I.

Table I. Improvement of students' knowledge regarding OHL

	Before education lessons	**After education lessons**	***p*-value**
Definition of oral health literacy	33.7 %	98.5 %	*p**=0.00
Oral health literacy role			
Communication	57.5 %	97.2 %	*p**=0.02
Health promotion	25.8 %	58.9 %	*p*=0.09
Oral disease prevention	37.3 %	57.5 %	*p**=0.07
Adherence to dental treatment	12.4 %	74.5 %	*p**=0.00
Factors affected by oral health literacy skills			
Dental health knowledge of the patient	67.2 %	89.9 %	*p*=0.04
Oral health behavior	45.7 %	78.9 %	*p*=0.04
Dentist-patient communication	78.5 %	98.2 %	*p*=0.10

DISCUSSIONS

Two studies that assessed the level of health literacy in adults and adolescents in Bucharest confirm data from the literature showing that there is correlation between patients´ education level, socio-economic status, pattern of dental visits, and self-perception of the oral health status [9, 10].

Prevention in dental care is less effective in patients with low level of knowledge and oral health literacy because they usually don´t understand the importance of prophylaxis, regular check-ups and a healthy life-style [10].

There is a bidirectional relationship between health literacy and medical knowledge: literacy skills increase vocabulary and this could improve the comprehension of medical information [9].

Lack of dental knowledge is an important predictor for reduced oral health literacy level; therefore, in dental practice it is necessary to identify patients with low health literacy level in order to tailor the education message [10].

In this regard, dental students need to receive continuing education in terms of oral health literacy concept in order to realise the importance of practical aspects in daily practice in offices and communities [9, 10].

It is important to raise awareness about the need to know and apply health literacy strategies in dentistry with the aim to improve the oral health outcomes for patients and individuals, whereas dentists and dental students are the main sources of adequate medical and dental information [9].

CONCLUSIONS

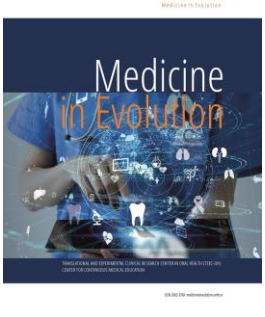
Dental students, as future health providers need dental education throughout curricula regarding oral health literacy, an important aspect associated with inequalities in health status and getting communication skills for a patient-centered dental care, according with patient's oral health literacy abilities.

REFERENCES

1. Sfeatcu IR, Dumitrache MA şi colab. Conceptul de alfabetizare în sănătatea orală. Editura Curtea Veche, Bucureşti, 2016.
2. Kickbusch I, Pelikan JM, Apfel F, Tsouros AD. (ed.) World Health Organization. Regional Office for Europe. Health literacy. Solid facts. 2013.
3. Nutbeam D. Evolving concept of health literacy. Soc Sci Med 2008;67(12):2072-78.

4. Zarcadoolas C, Pleasant A, Greer DS. Understanding Health Literacy: An Expanded Model. Health Promot Int 2005;20(2):195-203.
5. Vasilache S. The relationship between medical literacy and trust in healthcare in Romania. Management and marketing. 2010;5(2):93-102.
6. O'Loughlin K. Health Literacy: Foundation of Patient Understanding. Presentation 101 at The Art of Patient Understanding Symposium, Chicago, IL, October 29, 2014.
7. Bohlman LN, Panzer AM, Kindig DA. Health literacy: a prescription to end confusion. National Academy of Sciences. 2004
8. Zastrow S. Oral Health Literacy. Alternate Delegate, Minnesota, Resolution Number: 201/2015.
9. Sfeatcu R, Dumitrache MA, Cărămidă M, Funieru C, Oancea R, Didilescu A. Aspects of oral health literacy in adults. Medicine in Evolution 2019;XXV(4):427-431.
10. Sfeatcu R, Caramidă M, Funieru C, Dumitrache MA, Ionescu E. The relationship between teenagers' oral health literacy, dental use behavior and dental health knowledge. Medicine in Evolution 2016; XXII(2):262-267

Factors influencing the success of replantation in periodontal trauma



Talpoș Ș.[1], Nikolajevic-Stoican N.[2], Popa M.[2], Talpoș R.[3], Urechescu H.[1], Hajaj T.[4], Mărăcineanu R.[5], Urtilă F.[1], Pricop M.[1]

[1]Department of Maxillofacial Surgery, Faculty of Dentistry, "Victor Babes" University of Medicine and Pharmacy,
Timisoara, Romania
[2]Department of Pediatric Dentistry, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[3]Discipline of Restorative Dentistry and Endodontics, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[4]Department of Prostheses Technology and Dental Materials, Faculty of Dental Medicine, "Victor Babeş" University of Medicine and Pharmacy, Timişoara, Romania
[5]PhD student, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Popa Mălina
Address: Bd. Revoluţiei 1989, no. 9, Timişoara, Romania
Phone: +40722406390
E-mail address: popa.malina@umft.ro

Abstract

Traumatic injuries to permanent teeth include crown and root fractures, subluxations, dislocations, and avulsions. The most common complications following replantation are pulp necrosis and root resorption. Treatment is often complex, time-consuming and requires multidisciplinary approaches, such as endodontic and periodontal treatments, surgical interventions, orthodontic movements, as well as aesthetic crown restoration.

The objectives of this study are to observe the factors that can intervene in the successful implementation of the treatment of a replantation, their consequences and the realization of the treatment plan, according to the case in order to minimize or even obtain a favorable result over a longer period of time.

Keywords: dental trauma, necrosis, root resorption, avulsion

INTRODUCTION

Dento-alveolar trauma (avulsions, dislocations, fractures) requires emergency treatment that consists in repositioning the fragments in their anatomical positions, immobilization or tooth extraction [1].

The importance of this theme is due to the polymorphism and variety of clinical forms under which the avulsion manifests itself, giving uniqueness to each case. The consequences of dento-cranio-facial trauma can be dramatic for the person involved, both from the perspective of physical, psychological and social impact. Beyond the acute nature, two important aspects give specificity to dento-periodontal trauma: the age of the patients and the multidisciplinarity of the therapeutic approach [2]. Primary care decisively influences the subsequent evolution of the affected structures and states the future therapeutic decisions [3].

Avulsion is a relatively uncommon type of trauma, that appears rarely, but most frequently between the ages of 7-14, with prevalence at the maxillary central incisors [4].

The average prevalence of dental and oral lesions reported in the literature ranged from 14% to 27% [5]. Males showed a higher prevalence than females, but this difference was only significant for the 12 and 14-year age groups. Avulsed teeth represent statistically 1% to 16% of all traumatic injuries in the permanent dentition [6].

The new therapeutic philosophy recommends the correct evaluation of the avulsed tooth based on the physiological state of the cells of the periodontal ligament, the stage of development of the apex and the duration of preservation in the extraoral environment.

According to Krasner, 10 aspects are taken into account [7].

In the case of the tooth with the apex fully developed:

1. If the extra-oral time is less than 15 minutes, replantation will be performed after a simple saline or Hanks solution rinse.

2. If the extra-oral time is less than 2 hours, without any preservation medium, replantation is preceded by a 30-minute immersion in Hanks' medium.

3. If the tooth is replanted after an extra-oral time of 6 hours, with an immediate immersion in a standard preservation medium (saliva, milk or physiological serum), it is recommended to perform a 30-minute immersion in Hanks medium, before performing replanting.

4. If the tooth is replanted after an extra-oral time of 24 hours, with preservation in Hanks medium, the replantation can be performed without special measures.

5. If the extra-oral time exceeds 2 hours without conservation measures and the periodontal ligament is destroyed, there is no possibility of healing without resorption. A specific protocol must be applied to cause an iatrogenic ankylosis:

a) curettage of the periodental ligament;

b) successive immersion in a solution of citric acid for 3 minutes, in a solution of stannous fluoride for 5 to 20 minutes, in a solution of doxycycline for 5 minutes;

c) endodontic treatment;

d) dental replantation. Immobilization is done for 4-8 weeks. They cannot exceed 2 months to avoid any risk of ankylosis. Endodontic treatment will be equally systematized, either before replantation or during the first months.

In the case of the tooth with an incompletely developed apex:

The eventuality of a pulpal revascularization modifies the therapeutic attitude. Immobilization will be limited to 3 weeks in order not to stop root development.

6. If the extra-oral time is less than 15 minutes, the tooth will be replanted after being immersed in a doxycycline solution for 5 minutes.

7. If the extra-oral time is less than 2 hours, without any conservation measure, it can be hoped that there is still a sufficient percentage of healthy periodental ligament, able to cover the denuded tooth surface. Replantation will be performed after a 30-minute immersion in Hanks medium and 5 minutes in a doxycycline solution.

8. If the tooth is replanted after an extra-oral time of 6 hours and was immediately immersed in a standard preservation medium (saliva, milk or saline), it will be immersed in Hanks solution for 30 minutes before replantation, then 5 minutes in a doxycycline solution.

9. If the tooth is replanted after an extra-oral time of 24 hours, with preservation in Hanks medium, the replantation is performed after a 5-minute immersion in doxycycline solution.

10. If the extraoral time has exceeded 2 hours, without preservation medium, the same protocol as for mature teeth will be applied.

Follow-up assessments should occur at 3 months, 6 months, and annually for at least 5 years. External resorption of the root, pulp complications of infectious origin of sub-epithelial origin or cervical, are considered reversible in most cases [8].

The working hypothesis of this study is based on the verification of the factors that lead to the success of the long-term treatment of dento-periodontal trauma, factors represented both by the emergency care provided in the minutes immediately following the trauma, and by the time elapsed until the patient receives treatment. The statistical analysis of the obtained results reveals the importance of the care of the affected structures and configures future therapeutic decisions.

Aim and objectives

The purpose of this study is to observe the factors that can influence the evolution of an oro-maxillo-facial trauma, considering the fact that this appears in patients between ages of 7 and 14, taking into account the fact that the development of the facial massif is not complete, the type of trauma, the medical history, the environment in which the fractured element was transported, the treatment performed and the course of healing until the final result - the success of replantation.

The objectives of this study are to observe the factors that can intervene in the successful implementation of the treatment of a replantation, their consequences and the realization of the treatment plan, according to the case to minimize or even obtain a favourable result over a longer period of time.

MATERIAL AND METHODS

The type of study performed is analytical, observational and prospective because it investigates relationships between exposure, risk factors and outcome.

The methods of data collection are direct and indirect, the direct ones through: observation; clinical/paraclinical examination; interview; and the indirect ones by: collecting individual data from the consultation form.

The subjects involved in the study are patients between the ages of 7 and 14, belonging to both sexes. A total of 8 participants and 10 avulsed teeth. They presented in a private practice, as an emergency following a dento-periodontal trauma, between 2020-2022, including the follow-ups.

The selection criteria for the study are patients presenting dento-periodontal trauma at the oro-maxillo-facial level that includes dislocation, avulsion or intrusion of at least one dental unit, implicitly lesions of the surrounding soft tissues.

The treatment of avulsed teeth is divided into 2 main stages:

1. emergency treatment that must be provided as soon as possible; and

2. definitive treatment based on a clinical follow-up and radiographic examination.

From a total of 10 teeth of which 8 were replanted and 2 of them showed an incompletely formed apex and an extra-oral time longer than one hour, kept in a dry environment, not being subjected to replantation.

The following protocol was applied to eligible cases:

1. Topical anesthesia Lidocaine 10%, spray, solution.
2. Loco-regional anesthesia using an anesthetic without vasoconstrictor, injectable solution. Local anesthesia will be performed by infiltration and anesthesia at the interincisive hole. Hemostasis with sterile compresses, if appropriate.
3. The alveolar wound will be cleaned by performing a gentle curettage and irrigation with 0.9% saline solution.
4. Inspection of the alveolar process, if a fracture of the alveolar process is found, the respective fragment is returned to the correct position by manual pressure.
5. Manual replantation will be performed, reocclusion of the dental units by manual pressure, followed by immobilization for 7-14 days, with semi-rigid fixation. Wire immobilization "in 8" (hippocratic ligature), 0.25mm orthodontic wire. Preferably, two teeth before and two after the fracture site will be anchored.
6. The teeth are etched using 37% phosphoric acid, conditioned with an adhesive, bonding system, then the wire is placed at the level of the tooth with a light-curing composite material.
7. Inspecting the soft tissues, dressing and suturing them in place, if necessary.
8. The traumatized tooth will be removed from occlusion for 2-3 weeks.
9. The patient is recommended a semi-liquid diet for 2-3 weeks, no sustained physical exertion and antibiotic therapy for 7 days.
10. Even if a degree of dental mobility persists when the immobilization is removed, it will not be prolonged, because it stimulates root resorption.
11. Institution of endodontic treatment 14 days after replantation.

RESULTS

Statistical analysis was performed in the Microsoft Excel Worksheet program. This tracked the percentage of successful healing of each individual tooth. All the factors that can influence the success of the replantation were noted, then a percentage was assigned to them that shows its importance for the study carried out, how it works and the healing capacity of each one (Table 1).

Table 1. Representative table of statistical analysis

Tooth no.	Apex	Percent A	Medium	Percent M	Time	Percent T	Necrosis	Percent N	Resorbtion	Percent R	Total percent/tooh
1	Imature	0%	Dry	0%	360 min	0%	Absent	0%	Absent	0%	**0%**
2	Imature	0%	Dry	0%	1200 min	0%	Absent	0%	Absent	0%	**0%**
3	Mature	20%	Wet	20%	40 min	20%	Absent	20%	Absent	20%	**100%**
4	Mature	20%	Wet	20%	25 min	20%	Absent	20%	Absent	20%	**100%**
5	Mature	20%	Wet	20%	70 min	20%	Absent	20%	Absent	20%	**100%**
6	Mature	20%	Wet	20%	90 min	10%	Present	5%	Absent	20%	**75%**
7	Mature	20%	Wet	20%	120 min	10%	Present	5%	Absent	20%	**75%**
8	Mature	20%	Wet	20%	200 min	10%	Present	5%	Present	10%	**65%**
9	Mature	20%	Dry	10%	30 min	20%	Absent	20%	Absent	20%	**90%**
10	Mature	20%	Dry	10%	170 min	10%	Present	5%	Present	10%	**55%**

Out of the total number of 10 avulsed teeth, 2 of them had an incompletely formed apex and did not undergo replantation treatment, so they were assigned a percentage of 0%. The remaining 8, showing a fully formed apex, were replanted, giving them a percentage of

20%, this representing the maximum percentage that can be attributed to each factor. Thus, the percentage M, attributed to the storage environment, taking into account the time elapsed since the accident, receives values of 10% for the dry environment and 20% for the wet one. The percentage T, representing the percentage attributed to the time factor was divided into 2 categories less than 60 minutes, receiving the maximum percentage and more than 60 minutes, receiving a percentage of 10%. For postoperative complications, pulp necrosis and root resorption were assigned percentages based on the healing capacity of each.

The rate of successful replanting was 66%.

6 teeth were kept in a wet environment (i.e. own saliva), and the other two out of a total of 8 were brought in a dry environment. The time interval from the moment of the accident to the arrival of the patient varies from 20 minutes, the shortest time to 7 hours, the longest time (Table 2).

Table 2. Extra-oral time and storage environment for the selected teeth

	EXTRA-ORAL TIME	*STORAGE ENVIRONMENT*	*NUMBER OF TEETH*
A	< 60 min	Saliva	2
BC	>60 min	Saliva	4
D	<60 min	Dry	1
	>60 min	Dry	1

After replantation, the most common complications were pulp necrosis and root resorption. Of the 8 replantation cases, 4 were successfully treated during the study period, respectively 2 years after the intervention, and 4 of them presented complications as follows (Table 3):

Table 3. Type of complication encountered in each case

Case no.	Resorbtion	Occurrence time	Necrosis	Occurrence time
A1	No		No	
A2	No		No	
B1	No		No	
B2	Yes	18 months	No	
B3	Yes	3 months	No	
B4	Yes	1 month	Yes	2 weeks
C1	No		No	
D1	Yes	6 months	Yes	1 weeks

Endodontic therapy was performed for each of the 8 replanted teeth 14 days after replantation, consisting of root canal instrumentation and its filling with calcium hydroxide paste. This aspect was beneficial due to the characteristics of calcium hydroxide, the incidence of resorption was low compared to previous scientific studies. Root canal filling with calcium hydroxide paste was done every 3 weeks.

The best results were obtained in those teeth that had an extra-oral time of less than 60 minutes, kept in the respective humid environment, the success of the replantation having a percentage of 100% (2 out of 2 teeth) with no complication in the next 2 years.

From the total of 4 teeth with an extra-oral time longer than 60 minutes, kept in a dry environment, a percentage of 50%, i.e. 2 out of 2 teeth presented 1 of the 2 complications followed, respectively, pulp necrosis. 25%, respectively 1 tooth presented 2 out of 2 complications, both pulp necrosis and root resorption. The tooth with the shortest period of exposure to the moist environment showed a 100% success rate.

Keeping it in the dry environment for a period that did not exceed 60 minutes achieved a 100% success rate. In this case, the tooth in question did not present any complications over a determined period of 2 years.

DISCUSSIONS

After replantation, the most common complications were pulp necrosis and root resorption. Of the 8 replantation cases, 4 were successfully crowned during the study period, respectively 2 years after the intervention, and 4 of them presented complications.

According to the studies carried out, the treatment plan in the case of avulsions is established according to the clinical case, the age of the patient, the maturity of the apex, the storage environment of the tooth, as well as the time elapsed from the time of the injury to the time of the patient's dispensary [9,10,11].

The objective of the paper is to observe the factors that influence the success of replantation, as well as to adapt the appropriate treatment plan to minimize possible complications. For a higher success rate, teeth showing incompletely formed apex, long extra-oral duration, and inadequate storage medium were excluded from the current study [12,13,14]. They presented a diminished capacity for pulpal revascularization, an increased percentage of the incidence of root resorption, as well as pulpal necrosis, due to the inability to form cells of the periodontal ligament, given the prolonged extra-oral time in a dry environment, unlike the scientific studies carried out to date, where the transport medium of the avulsed tooth recommended and used is the ideal preservation medium, Hanks or Eagle medium [15]. ViaSpan medium, which is used in organ transplantation, is also recommended [16]. Unlike other conservation medium, the proposed ones have a targeted mode of action. Undoubtedly, it targets and favours pulpal revascularization and reduces the risk of infection. On the other hand, they are preferred for the percentage of resorption and distant ankylosis [17,18].

The working protocol, according to the clinical studies carried out to date, places a high value on the preparation of the root before its repositioning in the alveolus. The work protocol used in the current study coincides with the one recommended in scientific studies, with the exception of preparing the root with antibiotic solutions, performing an immersion in 9% saline solution for 5 minutes before replanting the tooth in the alveolus [19].

Another difference is the initiation of endodontic treatment, where pulpal revascularization is attempted as the first step, if this does not occur, it is moved to the next step, the preparation of the root canal and filling it with calcium hydroxide paste. In the present case, endodontic therapy was instituted 14 days after replantation of the avulsed tooth, followed by testing the vitality of the neighboring teeth over a period of 6 months [20].

Antibiotics were administered systemically for a period of 7 days after replantation [21].

No tooth was replanted at the site of the accident.

CONCLUSIONS

Treatment of avulsed teeth with saline solution did not cause any consequences after replantation and thus replantation with full success occurred in 4 out of 10 cases.

Complications of replantation were pulp necrosis and root resorption with a total of 4 of 8 cases showing resorption, 2 of 8 cases showing pulp necrosis and 1 of 8 cases showing both necrosis and resorption.

The most important factors that influence the success of replantation are the time elapsed until the time of intervention and the conservation environment of the avulsed tooth as follows:

- Replanting in the shorter time frame of 60 minutes has the highest success rate.
- The correct treatment plan is crucial in the long-term preservation of the avulsed tooth.
- Of particular importance is the maturity level of the apex.
- Immobilization for longer than 14 days produces ankylosis of the tooth.
- Endodontic therapy performed 14 days after replantation prevents pulp inflammation.
- Evaluation of neighboring teeth is important to prevent infection of the traumatized area.
- Prolonged extra-oral time reveals a higher incidence of complications.
- The ideal storage medium, in the present case, is the moist one, which is the patient's saliva.
- Systemic drug treatment prevents infections.
  Removing the tooth from occlusion is essential for its fixation in the alveolus.

REFERENCES

1. Andreasen JO, Andreasen FM. Dental traumatology, quo vadis. Endod Dent Traumatol 1990; 6: 78– 80.
2. Al-Jundi SH. Type of treatment, prognosis, and estimation of time spent to manage dental trauma in late presentation cases at dental teaching hospital: a longitudinal and retrospective study. Dent Traumatol 2004; 20: 1– 5.
3. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. Endod Dent Traumatol 1995; 11: 76–89.
4. Traebert J, Peres MA, Blank V, Boell Rda S, Pietruza JA. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianópolis, Brazil. Dent Traumatol 2003; 19: 15– 18.
5. Marcenes W, Al Beiruti N, Tayfour D, Issa S. Epidemiology of traumatic injuries to the permanent incisors of 9–12 year-old schoolchildren in Damascus, Syria. Endod Dent Traumatol 1999; 15: 117– 23.
6. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 1. Diagnosis of healing complications. Endod Dent Traumatol 1995; 11: 51– 8.
7. Krasner, P., & Person, P. (1992). Preserving avulsed teeth for replantation. Journal of the American Dental Association (1939), 123(11), 80–88. https://doi.org/10.14219/jada.archive.1992.0300
8. Hammarstrom L, Blomlof L, Lindskog S. Dynamics of dentoalveolar ankylosis and associated root resorption. Endod Dent Traumatol 1989; 5: 163– 75.
9. Barrett EJ, Kenny DJ. Avulsed permanent teeth: a review of the literature and treatment guidelines. Endod Dent Traumatol 1997; 13: 153– 63.
10. Trope M. Clinical management of the avulsed tooth: present strategies and future directions. Dent Traumatol 2002; 18: 1– 11.
11. Flores MT, Andreasen JO, Bakland LK, Feiglin B, Gutmann JL, Oikarinen K, et al. Guidelines for the evaluation and management of traumatic dental injuries. Dent Traumatol 2001; 17: 193– 6.
12. Malhotra N, Cyriac R, Acharya S. Clinical implications of storage media in dentistry: a review. Endo (Lond Engl) 2010 Sep;4(3):179–188
13. Poi WR, Sonoda CK, Martins CM, Melo ME, Pellizzer EP, de Mendoncja MR, Panzarini SR. Storage media for avulsed teeth: a literature review. Braz Dent J. 2013 Sep-Oct;24(5):437–445

14. Bazmi BA, Singh AK, Kar S, Mubtasum H. Storage media for avulsed tooth - a review. Ind J Multidis Dent. 2013;3(3):741–749
15. Blomlof L. 1981. Milk and saliva as possible storage media for traumatically exarticuled teeth prior to replantation. Swed Dent J. 8:1–26
16. Trope M, Friedman S. Periodontal healing of replanted dog teeth stored in ViaSpan, milk, Hank's Balanced Salt Solution. Endod Dent Traumatol. 1992;8:183–188
17. Malmgren B, Malmgren O. Rate of infraposition of reimplanted ankylosed incisors related to age and growth in children and adolescents. Dent Traumatol. 2002;18(1):28–36.
18. Andersson L, Bodin I, Sorensen S. Progression of root resorption following replantation of human teeth after extended extraoral storage. Endod Dent Traumatol 1989; 5: 38– 47.
19. Oikarinen K. Tooth splinting: a review of the literature and consideration of the versatility of a wire-composite splint. Endod Dent Traumatol 1990; 6: 237– 50.
20. Krastl, G., Weiger, R., Filippi, A., Van Waes, H., Ebeleseder, K., Ree, M. et al. (2021) European Society of Endodontology position statement: endodontic management of traumatized permanent teeth. International Endodontic Journal, 54, 1473– 1481
21. Hammarstrom L, Blomlöf L, Feiglin B, Andersson L, Lindskog S. Replantation of the teeth and antibiotic treatment. Endod Dent Traumatol 1986; 2: 51–7

Comparative analysis of zirconia and lithium disilicate all-ceramic crowns manufactured using digital versus digital-conventional technique

Berar A.[1], Buduru S.[1,2], Breban C.[1], Gherman A.[3], Miţariu L.[4], Tăut M.[1,3], Buzatu R.[5]

[1]*Department of Prosthodontics, Faculty of Dental Medicine, UMF "Iuliu Haţieganu", Cluj-Napoca*
[2]*Stomestet Clinic, Cluj-Napoca, Romania*
[3]*Gident, Baia Mare, Romania*
[4]*Department of Dental Medicine and Nursing, Faculty of Medicine, "Lucian Blaga" University, Sibiu, Romania*
[5]*Department of Dento-Facial Esthetics, Faculty of Dental Medicine, UMF "Victor Babes", Timisoara, Romania*

Correspondence to:
Name: Manuela Tăut
Address: Department of Prosthodontics, Faculty of Dental Medicine, "Iuliu Hatieganu" University of Medicine and Pharmacy, Cluj-Napoca, Clinicilor Street, nr 32
Phone: +40741406230
E-mail address: tautmanuela@gmail.com

Abstract

Case presentation: This study aimed at presenting and evaluating two manufacturing technologies and two types of restorative materials (3rd generation zirconia oxide and lithium disilicate glass ceramic) for the rehabilitation of the upper anterior teeth. The outcomes were evaluated in terms of aesthetics, marginal adaptation, technologies and materials used, working protocol, time and costs.

Materials and method: A model with ideal preparations for the six upper anteriors was used in order to manufacture three zirconia oxide single units (Zirtooth Multi A2, Hass Corp) using the full digital protocol (1st hemiarch) and three lithium disilicate single units (Amber Press, LT, A2, *Hass Corp*) using the combined digital-analog protocol (2nd hemiarch). After fabrication, final layers of stains and glaze were applied for a better individualisation of the final restorations. The six restorations were evaluated on a printed model in order to asses the marginal fit, the final aesthetics, the optical characteristics and the elements of macro and microtexture.

Discussions/Conclusions: The two materials used together with the two different manufacturing techniques have produced very similar results, in accordance with the naturalness of teeth.

Keywords: zirconia, lithium disilicate, digital, analog

INTRODUCTION

In restorative dentistry, different types of dental materials had been constantly introduced for single or multiple fixed restorations with optical and mechanical properties that restore the morphology elements, the aesthetics and functionality of the natural dentition. In the last years, the all ceramic indirect restorations had become more and more popular due to improved biological, optical and mechanical properties such as biocompatibily with oral tissues, natural aspect and mechanical strength (1).

Zirconia (zirconium dioxide, ZrO2) is a ceramic restorative material used for the fabrication of crowns, bridges using CAD/CAM technology with ceramic stratification or simply with staining and glazing (2). Compared to other dental ceramics, zirconia exhibited good chemical and dimensional stability and high mechanical properties. This bioceramic material has monoclinic, cubic and tetragonal forms and is stabilised with oxides such as yttria (Y_2O_3), magnesia (MgO) and calcium oxide (CaO) (3).

Lithium disilicate glass ceramic is indicated for single tooth restorations such as veneers, partial and full crowns in anterior and posterior region and tooth replacement with 3-unit fixed dental prostheses, up to the second premolars. This material is considered an alternative to zirconia for the rehabilitation of the anterior teeth due to its improved optical properties and mechanical strength (4).

Aim and objectives

The aim of this study was to assess comparatively the technical procedures of two types of ceramic materials (full digital technique for zirconia monolithic and combined digital-analog technique for lithium disilicate) in case of six single units dental crowns for the upper anteriors in terms of aesthetic outcomes, marginal fit, workflows, working time and costs.

CASE PRESENTATION

Six monolithic ceramic restorations were fabricated for the rehabilitation of the six upper anterior teeth, of which three were 3rd generation zirconia crowns obtained through the full digital technique (1st hemiarch) and another three were lithium disilicate crowns manufactured through the combined digital and analog technique (2nd hemiarch).

In order to manufacture the six restorations, a maxillary model with ideal juxtagingival preparations from canine to canine was chosen and scanned using a laboratory scanner (3Shape E4, *3Shape*) (Fig. 1). After scanning, the 3D design of the future restorations was created using Exocad DentalCAD Plovdiv software (*Exocad GmbH*). The antagonist arch and the interocclusal relationships were not included so the functional outcomes had not been evaluated.

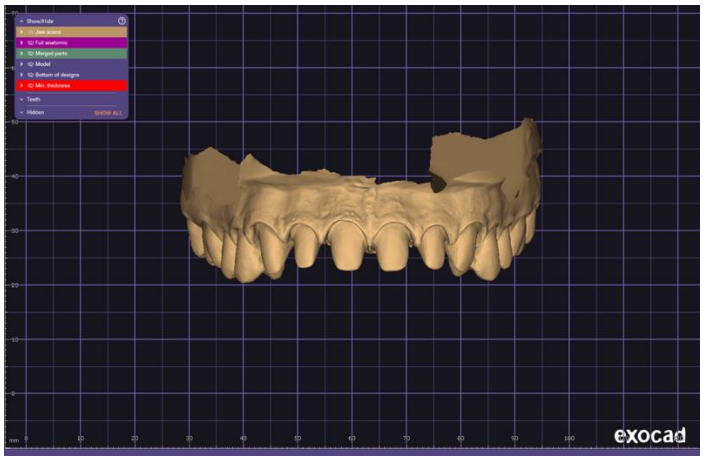


Figure 1. STL file of the working scanned model was imported in Exocad in order to design the future restorations

The 3D design begun with delimitation of the preparations and marginal fit of the future crowns and the selection of axis of insertion for each individual crown. The die space selected incisally and cervical for zirconia crowns was 0.02 mm in 1st hemiarch and 0 mm for lithium disilicate crowns in 2nd hemiarch.

The next step was to generate the teeth library which were applied individually on each die. Each crown was individualised using specific elements of morfology (Fig. 2.a.b).

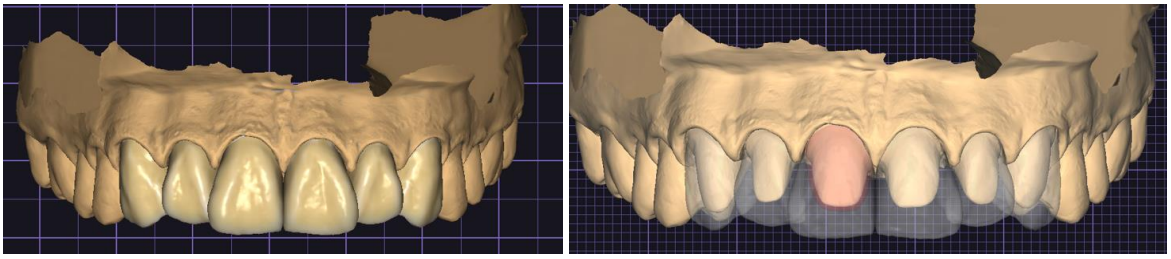


Figure 2. a. Teeth library with specific morfology elements; b. final aspect of design on the dies

Afterwards an alveolar printed model was fabricated by virtually sectioning the scanned model at the level of each preparation (Fig. 3). The future printed model was used as a control model and for a comparative analysis of the two types of restorations (marginal fit, proximal contacts and aesthetic outcomes).

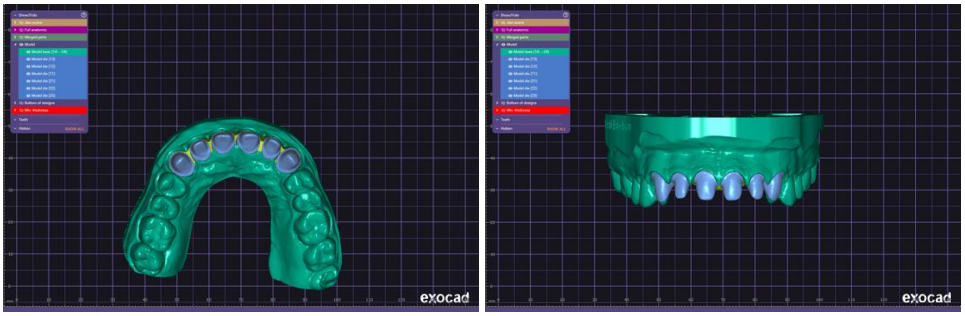


Figure 3. Virtual alveolar model with mobile dies a. occlusal view; b. frontal view

The alveolar model was printed using 3D printing machine (Asiga MAX 4K, *Asiga*) and dental resin for dental models (DentaModel, *Asiga*). After printing (Fig. 4.a), the model was washed for 5 minutes using isopropilic alcohol. Afterwards, it was rinsed and dried in order to be light cured (Sibari SR620, *Sirio*) to increase its resistance (Fig. 4.b).

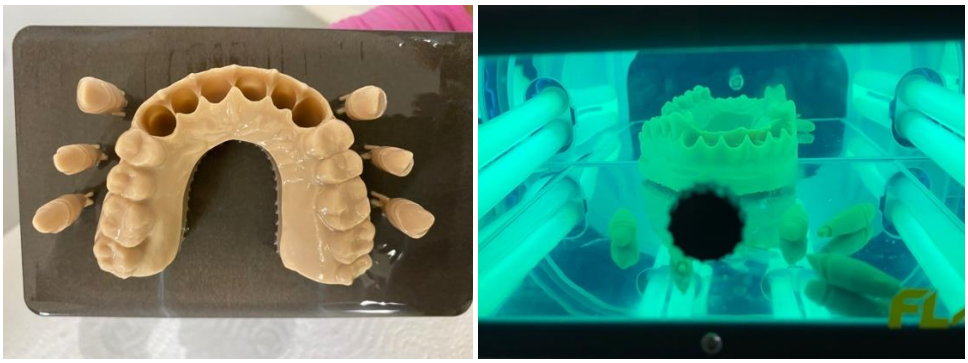


Figure 4. a. The printed alveolar model on the 3D printing machine platform; b. the alveolar model in photopolymerization environment

The manufacturing of the three Zirconia crowns

The.STL files from Exocad were sent to Dental CAM (*VHF*) software in order to mill the final restorations using a 5 axis milling machine (VHF S2, *VHF*). The characteristics of zirconia disk were set (thickness and scalling coeficient) (Zirtooth Multi NEO, multilayer, A2, *Hass Corp*). The three crowns were positioned in order to obtain the maximum number of milled elements from a single zirconia disk. The final restorations were milled using a specific dry milling strategy (Fig. 5).

Figure 5. The milled zirconia elements

Afterwards, the sintering process was performed using the sintering furnace (Z7, *Supertherm Electro*) thus obtaining the necessary mechanical strength and shade A2 for the final zirconia restorations. The sintering process was made in three steps: first, increasing the furnace temperature up to 1000°C with a rate of heating of 9°C/min and a waiting time of 10 minutes, second, increasing the furnace temperature up to 1500°C with a rate of heating of 3.5°C/min and a waiting time of 2 hours, third, decreasing the furnace temperature with a rate of cooling of 8°C/min). In the end, the final restorations were applied on the control model, finishing and polishing were performed and the interdental contact points were evaluated using a 8µ articulating paper (Bausch Arti-Check, *Bausch*) (Fig. 6).

Figure 6. Three zirconia crowns after sintering process on the control model

The manufacturing of three Lithium Disilicate crowns

The process started with the milling process of three wax crowns (WAX Disc 98/16 mm, *Sagemax*) according to initial design. After, the investing and pressing of ceramic ingot were performed using the combined analog and digital protocol. The same 5 axis milling machine was used to mill the wax crowns (Fig. 7).

Figure 7. The milled wax crowns

After the milling process the investing was performed using packaging mass (JP Vest, *Just Pressables*). The following steps were performed: attachment of the 2.5 mm diameter wax rod on each crown in a vestibular position, attachment of the 2.5 mm diameter wax rod on silicone pattern, pourring of the packaging mass (JpVest, Just Pressables) into the into the packaging cylinder (Fig. 8.a.b.c).

Figure 8. The attachment of rod wax on each milled wax crown; b. The attachment of rod wax on silicone pattern; c. the packaging cylinder

They are subsequently placed inside the STC 18.26 calcination furnace (Supertherm Electro) at a temperature of 850^0 C for 45 min, then transferred into the press furnace (Dekema Press Dent Austromat 3001, *Dekema Dental-Keramiköfen GmbH*), having applied the lithium disilicate ingot (Amber Press, LT, A2, *Hass Corp*).

Disassembling lithium disilicate crowns was performed using Effegi Brega Atlantis (*Effegi Brega*), the sandblaster (ESB 2, *Eurocem)* and 50-110m aluminium oxide particules at 2-4 barrs pressure (Fig. 9.a.b).

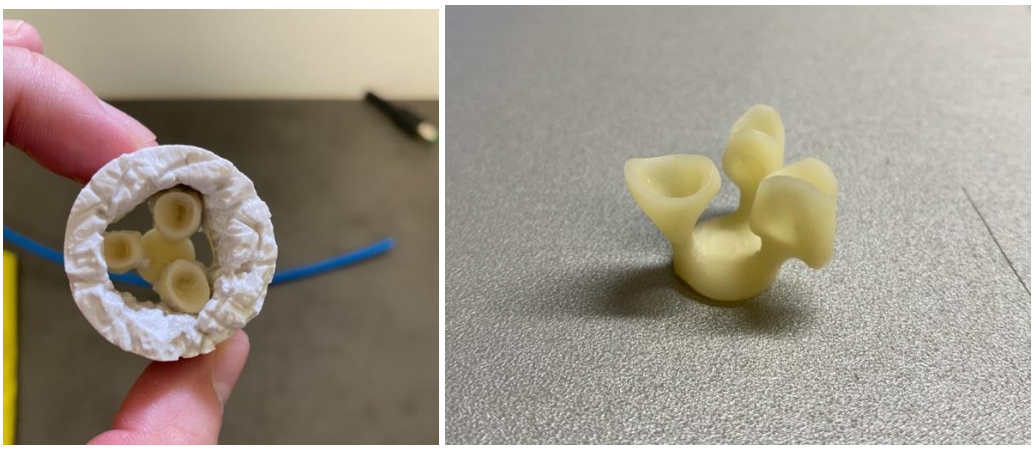


Figure 9. a: Disassembling lithium disilicate crowns; b. The final aspect of lithium disilicate crowns after sandblasting

The connecting rods are severed under water cooling with diamond drills and then polished, and the crowns are positioned onto the model, by checking the contact points with 8 µm Bauch articulating paper (Bausch Arti-Check, *Bausch*).

Both types of crowns were applied onto the printed model and the contacts between the two central incisors were adjusted (Fig. 10).

Figure 10. Final aspect after sandblasting and sintering of six upper anterior crowns on the model a. frontal view; b. incisal view

Staining and Glazing

Each final restoration was individualised using a first layer of staining (HeraCeram Stains, *Heraceram*) in different shades („ocean", „ivory", „white") to customise the colour and to obtain superior aesthetics (Fig. 11).

Figure 11. Final restorations after staining

The second layer was made up of transparent glazing and was applied to obtain a natural shiny finish (HeraCeram Glaze, *Heraceram*) (Fig. 12).

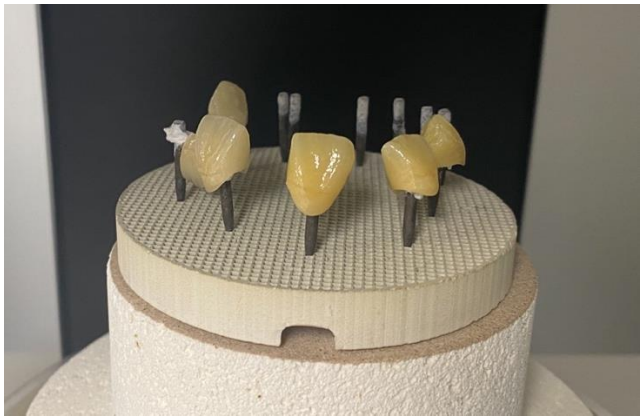


Figure 12. Final restorations after glazing

Polishing was performed with grinders, brushes and Zirkopol polishing paste (Zirkopol, *Feguramed*) (Fig. 13, Fig. 14).

Figure 13. Finishing using grinders

Figure 14. Final aspect: a. frontal view; b. lateral view

DISCUSSIONS

Due to the importance of the appearance and aesthetics of the teeth, especially in the case of the upper maxillary "the social six", this being the main reason why the patients voluntarily end up in a dental clinic, the evolution of dental materials is essential, from both mechanical and aesthetic perspectives.

The two materials used together with the two different manufacturing techniques have produced very similar results, in accordance with the naturalness of teeth, characteristics which have been described in Ziyad et al (5).

The tendency towards an aesthetic that is as natural as possible, in the shortest amount of time, using the same technical steps and with minimal human intervention is supported by the progress in the field. This, the 3rd generation zirconium oxide, in the multi-layer variant used in this case has proven itself to be satisfactory from an aesthetic standpoint even before the glazing procedure when it was compared with the LT lithium disilicate variant, used in this same case. Studies have shown that the translucency and transparency of multi-layer zirconium oxide, even if similar to the lithium disilicate glass ceramic, still produces inferior results (6).

Related to the macro texture and the shade of zirconium oxide, this had good optical properties and natural texture even before glazing. The lithium disilicate ceramic, after unpacking, has a faded aspect and only after glazing it presented the characteristics of transparency and translucency. The glazing has shown that for different materials, obtained through different procedures, in the end these have resulted in nearly the same shade and colour, both being close to natural teeth.

CONCLUSIONS

Prosthetic restorations made from third-generation multi-layer zirconium oxide with staining have presented optical characteristics and elements of micro- and macro-textures similar to disilicate lithium restorations in the upper anteriors.

Regarding the related costs for the necessary equipment and the materials needed, in addition to manufacturing time, the zirconia restorations required less working and processing time compared to the restorations made of disilicate lithium materials.

The marginal fit on the alveolar printed model of both types of restorations was excellent in an ideal work scenario (the visibility of preparation limits on the scanned model were properly evidenced and the delimitation of thresholds in the design stage was strictly enforced).

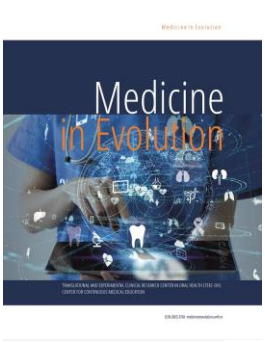
Lithium disilicate in the HT variant (high translucency) can be considered, at this current time, the best choice for the restoration of the upper anteriors due to its versatility and

optical similarities with natural dentition, respectively the aesthetic standards imposed in every clinical case.

REFERENCES

1. Gautam, C., Joyner, J., Gautam, A., Rao, J. and Vajtai, R., 2016. Zirconia based dental ceramics: structure, mechanical properties, biocompatibility and applications. Dalton transactions, 45(48), pp.19194-19215.
2. Della Bona, A., Pecho, O.E. and Alessandretti, R., 2015. Zirconia as a dental biomaterial. Materials, 8(8), pp.4978-4991.
3. Sekar, M., Sujatha, V., Babu, R. and Mohan, A.G., 2014. Zirconia as a bioceramic material. Indian J. Restor. Dentist, 3(1), pp.1-7.
4. Aging resistance, mechanical properties and translucency of different yttria-stabilized zirconia ceramics for monolithic dental crown applications
5. Ziyad T.A., Abu-Naba'a L.A., Almohammed S.N. Optical properties of CAD-CAM monolithic systems compared: three multi-layered zirconia and one lithium disilicate system. Heliyon 2021; 7(10):E08151.
6. Harianawala H.H., Kheur M.G., Apte S.K., Kale B.B., Sethi T.S., Kheur S.M. Comparative analysis of transmittance for different types of commercially available zirconia and lithium disilicate materials. J Adv Prosthodont 2014;6:456-61.

Extensive prosthetic rehabilitation in accordance with ceramic masses



Lolos D.[1], Mihali D.F.[2], Mihali S.G.[3], Oancea R.[4]

[1]Student, Faculty of Dentistry, "Vasile Goldis" Western University of Arad, 94 Revolutiei Blvd., 310025 Arad, Romania
[2]Student, Faculty of Dentistry, "Vasile Goldis" Western University of Arad, 94 Revolutiei Blvd., 310025 Arad, Romania
[3]Department of Prosthodontics, Faculty of Dentistry, "Vasile Goldis" Western University of Arad, 94 Revolutiei Blvd., 310025 Arad, Romania
[4]Preventive, Community Dentistry and Oral Health Department, "Victor Babeş" University of Medicine and Pharmacy, Timisoara, Romania

Correspondence to:
Name: Sorin Gheorghe Mihali
Address: 7 Circumvalaţiunii Street, 300013 Timişoara, Romania
Phone: +40 744 546 768
E-mail address: sorin@dentalconcept.org

Abstract

The purpose of this study was to demonstrate the fact that today the clinician will have to use ceramic masses according to their indications and contraindications. Nowadays the therapeutic decision when making a treatment plan is largely based on the socio-economic status of the patient. But even when this aspect does not represent a problem, clinicians will have to choose ceramic masses based on their advantages, minimizing or removing from the treatment plan ceramic masses that are not reliable in the long term. Respecting these aspects, patients will be able to benefit from minimally invasive treatments throughout their lives, conserving as much as possible of the remaining hard tissue over the years.

Keywords: ceramic masses, minimal invasive, treatment plan.

INTRODUCTION

As for fixed dental prosthetics, the materials and procedures used in this branch of dentistry have improved over the years. Along with its development, the options regarding the materials from which dental restorations are made have also increased in number. The aim of this paper is to provide a comparison between different restorative materials that have been developed over time and their application in restorative prosthetics.

When dentists have to deal with a situation where they have to restore a tooth or a group of teeth, the problem of choosing the restorative material always arises (1). Traditional metal-ceramic restorations have proven over time that they can have predictable strength (2), an aesthetically pleasing appearance, and long-lasting oral health (3). In the case of metal-ceramic restorations, fixation is based more on the geometry of the abutment than on the adhesion process itself (4). Even if the resistance of metal-ceramic restorations is enviable, some studies show that the cracks that appear most often are at the level of the coronal ceramic layers (5). Regarding the criteria for preparing the teeth, in order to facilitate the fixation stage, there must be a single axis of insertion, and the occlusal convergence must be brought to a close value between 6° and 8° (6,7,8).

Regarding all-ceramic restorations, due to the 100% adhesive fixation at the enamel level, these types of restorations offer a very low amount of microleakage that has a major impact on the resistance of the restorations over time. But this reduced amount is maintained in situations where the adhesion will be 100% at the level of enamel, because a greater amount of microleakage was observed in veneers with cervical edges placed at the level of dentine (9). A study carried out on 66 patients shows us that the success rate of veneers fixed on preparations made entirely at the level of the enamel is 99%, while in situations where the preparation was made marginally at the level of the enamel, the success rate reached the percentage of 94% (10). Other authors have discussed the fact that approaching the preparation strictly at the enamel level is an essential factor to be able to achieve an adhesive fixation and to have a much more durable result over time (11,12).

Although there are several types of materials from which feldspathic ceramic restorations are made and several techniques, the most commonly used technique is the refractory mass model with refractory abutment technique in which the technician loads the ceramic through an additive process applying successive layers (13). The major disadvantage of feldspathic ceramics is mechanical resistance. Depending on the conditioning of the restorations, the sequence and the materials used, the mechanical strength is approximately around 100-140 MPa (14).

Lithium disilicate is composed of very small needle-shaped crystals (3-6 μm x 0.80 μm) embedded in a glass matrix with a volume of 1% porosity (15). This situation occurs most often when the patient wants the new restorations to be lighter in color. In this situation the clinician will need to remove 0.2 mm to 0.3 mm of dental hard tissue for each shade (16). The difference between the colors is obtained by dispersing some ions (staining ions) in the glass matrix at different levels of translucency depending on the distribution of the clinical case (17). The success rate of these types of restorations can be classified as less than 10% failure at 10 years (18). Regarding the indications of zirconium oxide compared to restorations made of lithium disilicate and those made of feldspathic ceramics, its applicability has a wider spectrum taking into account the qualities of the material. The mechanical properties of zirconium oxide provide a flexural strength of 900 to 1200 MPa (19). All ceramic masses are used in the given conditions and for the preparation of dental hard tissues. These conditions are provided by the preparations that the dental clinician will have to perform. Depending on each type of ceramic table, there is a certain preparation that must be carried out, but this will

depend on the remaining hard dental substrate, the patient's complaints regarding color and the forces exerted in that area of the dental arch. Regarding the dental surfaces, the chosen material will have to be combined with a certain type of veneer preparation (20).

Aim and objectives

The purpose of this study was to demonstrate that in certain situations where clinicians do not take into account the indications and contraindications of restorative materials, they can have repercussions on the patient both in the short term and in the long term. The most common complications in the short term are represented by chipping, and in the long term a standard in this sense is represented by the preservation of the hard dental structures of the teeth.

MATERIAL AND METHODS

In the case of dental trauma, the training of clinicians in terms of therapeutic possibilities plays a very important role. This is based on thorough knowledge regarding the advantages and disadvantages of each individual ceramic mass. A patient presented with a trauma at the level of dental units 1.1 2.1 which causes an emergency in dentistry.

Figure 1. The initial aesthetic appearance of the teeth after their fracture

The only pre-prosthetic treatments that were performed in this case were sanitization and professional brushing. After sanitizing and professional brushing, I performed the aesthetic analysis of the case. In this case, we did not use a wax-up because the patient had to leave the country as soon as possible. With the help of the aesthetic analysis, we planned the future contours that should be incorporated into the final restorations. Regarding the all-ceramic systems from which the final restorations would be made, we had 2 possibilities. We could make the final restorations either from lithium disilicate-supported ceramics or from feldspathic ceramics. Due to the exclusive front area, we could not choose a restoration on a zirconium oxide support because this type of restoration compromised our aesthetics. Even if it compensates for the strength of the frontal area where the upper central incisors are part, they must not present very strong contacts. It is even contraindicated to reconstruct the frontal area with strong contacts. So the decision had to be made according to the 2 all-ceramic systems left, namely: lithium disilicate and feldspathic ceramic. We encounter a case

where aesthetics prevail. The material that can offer us the highest aesthetic qualities is feldspathic ceramics. And lithium disilicate-based ceramics have very good aesthetic properties, but in this regard, no other all-ceramic system can compare with feldspathic ceramics. So for this case, the option chosen for the restorative material was feldspathic ceramic. I chose feldspathic ceramic to be able to make some restorations that will not be noticeable. The properties of feldspathic ceramics can enable such achievements. It can be observed at the level of 1.1 and 2.1 the lack of dental hard substance. The strategy for this case was that after obtaining the feldspathic ceramic restorations, we would respect the principle of mutual protection, at the same time creating an inocclusion space at the level of the upper central incisors to stress them as little as possible during the act of mastication.

Figure 2. The intraoral aspect from the frontal norm

After the decision on the restorative material was made, we moved on to the next stages of the prosthetic treatment. Compared to the other cases where preparations were performed or a no-prep technique was approached this case was a little more special. Considering the type of ceramic table used, I had the opportunity to approach a different type of preparation. In this case (Figure 3), the purpose of the preparation was to smooth the hard dental surfaces. The smoothing was performed respecting the insertion axis of the future restorations.

Figure 3. Smoothing of remaining hard tooth surfaces

Smoothing was done with arkansas tools. The surfaces were smoothed to facilitate a 100% adhesive bond to the enamel. The patient was anesthetized to facilitate the insertion of

the gingival retraction wires. In this case, the 2-wire gingival retraction technique (Ultrapack, Ultradent) was used.

The impression was taken with silicone with addition reaction in two consistencies, namely medium consistency and light, lower consistency (3M ESPE).

In order for the dental technician to be able to make such a prosthetic restoration, the impression materials must necessarily be very faithful. This type of restoration includes surfaces where the thickness of the material reaches up to 0.2 mm. For the fixing stage I used the dike. The feldspathic ceramic veneers were fixed with Variolink Esthetic composite resin (Ivoclar/Vivadent). The type of fixation performed was the adhesive one. To condition the veneers, I started by washing them with water and air drying them. After that I switched to applying hydrofluoric acid for 60 seconds. (IPS Ceramic etching gel HF 3% to <7%-IPS Ceramic; Ivoclar/Vivadent) After the application of hydrofluoric acid, the veneers were placed for 60 seconds in a place protected from possible interference with other liquids or other bodies. After the 60 seconds, the veneers were also washed with water. Then the conditioning continued with orthophosphoric acid 37%-orthophosphoric acid (Total Etch; Ivoclar/Vivadent). After applying the orthophosphoric acid for 60 seconds the restorations were washed and dried and the next part of the conditioning was carried out. The veneers were then silanized with silane (Monobond Plus; Ivoclar Vivadent) for 60 seconds. After that I performed the conditioning of the teeth. The surface of the teeth was conditioned by sandblasting with aluminum oxide particles. After that, 37% orthophosphoric acid (Total Etch; Ivoclar/Vivadent) was applied for 45 seconds to the enamel surface of the teeth. I continued with bonding, namely with Adhesive Universal (Viva Pen, Ivoclar Vivadent). After brushing for 20 seconds, I let the surfaces dry and light-cured for 10 seconds on each individual tooth. Fixation of the restorations was performed with Variolink Esthetic (Ivoclar/Vivadent). With the help of a dry brush I removed the excess cement. Then we moved on to finishing the marginal closure. After finishing the marginal closure, we performed the occlusal echilibration.

Figure 4. Aesthetic appearance after fixation and occlusal echilibration

Unlike the other cases, this patient did not have time to be recalled. This happened because the patient called for an appointment. The patient claimed it was an emergency so she was scheduled as soon as possible. At the visit, the urgency could also be observed from a clinical point of view. As can be seen in Figure 4.9, dental unit 1.1 is fractured. From the image we can see that the fractured surface would be totally part of the structure of the

restoration, being 100% feldspathic ceramic. Even though the group of teeth 1.1 and 2.1 was taken out of occlusion through occlusal echilibration, it did not cope with certain incisal forces. The positioning and angulation of the teeth did not provide an advantage for a material like feldspathic ceramic in this situation. The chances of the other restoration fracturing were quite high so we had to rethink the treatment plan for this situation. The only remaining solution that would provide a suitable aesthetic was represented by lithium disilicate.

Figure 5. Aesthetic appearance after fracture of feldspathic ceramic

The restorative material that would follow the feldspathic ceramics was a ceramic crown on a lithium disilicate support. By changing the restorative material, we should also change the type of preparation performed. For the preparation in order to fix lithium disilicate crowns, we used modified chamfer diamond tools. Code green was used to make the guide grooves and to quantitatively remove dental hard tissue. For finishing I used code red along with rubber bands and arkansas tools.

Figure 6. Preparations obtained for lithium disilicate supported crowns

Figure 7. Insertion of the lithium disilicate restoration on the prosthetic field

After the new lithium disilicate ceramic restorations were made, the next steps were the conditioning of the abutments and the restoration, as well as the fixation that was done with the rubber dam.

During the recall all the restorations were intact. After inspecting the restorations we found that they did not show chipping, discoloration or other complications.

Figure 8. The patient's smile at the recall

RESULTS

The patients who participated in this study were between the ages of 16 and 51. The average age of the patients who participated in the study was 34.75 years. Regarding the survival rate of restorations from all 4 systems of which they are a part, namely 3 all-ceramic systems (feldspathic ceramic, lithium disilicate-supported ceramic and zirconium oxide-supported ceramic) and the metal-ceramic system obtained the following results. In total we had a number of: -16 fixed unidental restorations made of feldspathic ceramic (integral) -10 fixed unidental restorations made of ceramic on a lithium disilicate support -12 fixed restorations made on zirconium oxide support (which include unidental and multidental

restorations) -13 fixed restorations made of metal-ceramics (which include unidental and multidental restorations).

Of the total of 51 restorations including all the cases presented in the special part, only 2 restorations were considered a failure although only one of these restorations was fractured. The total number of restorations that can be considered a success from a prosthetic point of view is 49 restorations, which determines a survival rate of restorations from the 3 all-ceramic systems together with the metal-ceramic system of 96.07%. Regarding all-ceramic systems, failures have been recorded with feldspathic ceramic restorations. Out of a total of 16 feldspathic ceramic restorations, 2 of these were considered failures.

DISCUSSIONS

Following this study, it was found that the survival rate of restorations made of all-ceramic systems is very high (96.06%). Moreover, we demonstrated how an integration of several all-ceramic systems does not decrease the long-term success rate of restorations, even if we use all-ceramic systems that do not have a very high structural resistance, but which from an aesthetic point of view bring a plus that patients appreciate. Patients appreciated the quality of the materials even in the situation where the restorations had to be redone, as was the case with the 2 feldspathic ceramic veneers.

Regarding the feldspathic ceramic restorations, the calculation was made as follows:

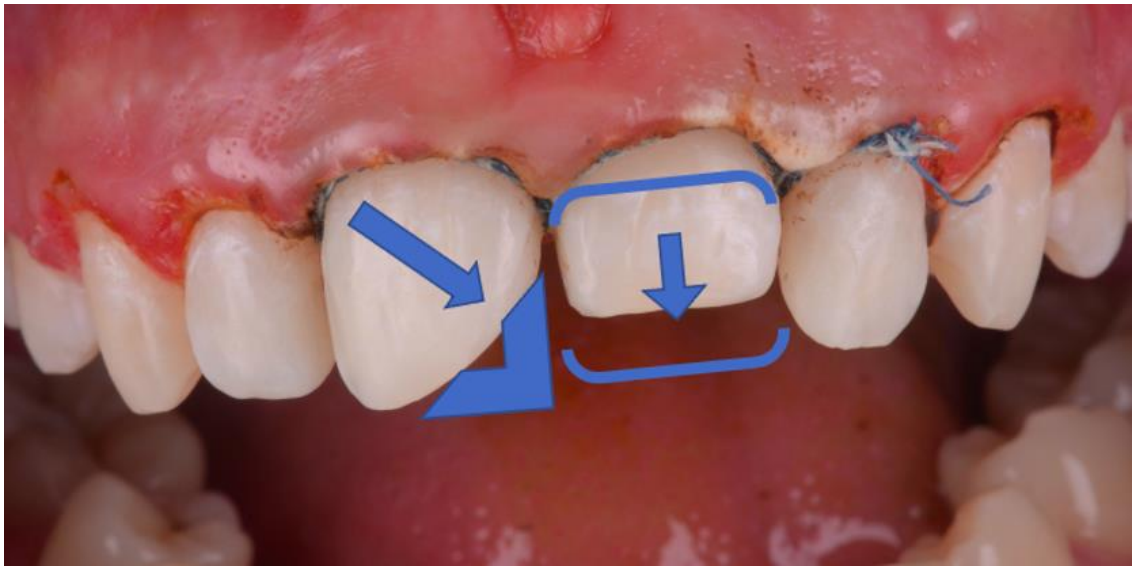


Figure 9. Planning the restorative material

The amount of dental hard tissue was approximately equally distributed across the restoration on tooth 2.1. However, a lack of hard dental tissue on the diagonal can be observed at 1.1. This lack of tissue results in an unsupported restoration surface. When there are larger portions of unsupported feldspathic ceramic in those areas, stress will be exerted and the higher stress will not be able to be distributed across the enamel. These forces will only exert pressure on the material. For this reason, feldspathic ceramic restorations are considered insufficiently strong when the ceramic has to be extended more than 2 mm from the tooth surface. When we look at the situation as a whole, we can say that the success of the restorations within these 4 systems depends on certain factors, among which the selection of the ceramic mass is also a part. In order for a clinician to be able to choose these ceramic masses correctly, sufficient information is needed about each type of material that the clinician must master very well. This will help him to choose the most suitable ceramic table

for each individual case. Once these concepts are mastered the relationship with the patient is much better due to his involvement and giving him the opportunity to have a point of view on the new restorations he will receive.

CONCLUSIONS

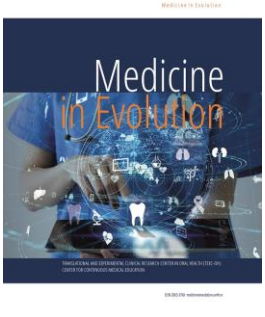
When clinicians know very well the properties of ceramic masses, the treatment options for different cases will have a much higher success rate compared to situations where these ceramic masses are made without respecting the indications and properties they possess. Once a clinician has a good grasp of the indications, contraindications and properties of each individual material, in addition to the fact that the percentage of success will increase, the benefits will also materialize in terms of patient satisfaction. Even if a clinician will have to prepare much more, both theoretically and practically, to know the ceramic masses and to make the preparations according to each individual ceramic mass, the clinical results and successes will mean much more to him.

REFERENCES

1. Bayne SC -"Dental restorations for oral rehabilitation - testing of laboratory properties versus clinical performance for clinical decision making. " J Oral Rehabil. 2007 Dec; 34(12):921-32.
2. Ayesha Aslam, Danish Azeem Khan, Syed Hammad Hassan and Bilal Ahmed Ceramic Fracture in Metal-Ceramic Restorations: The Aetiology Dental update 44(5):448-456 · May 2017
3. Heffernan MJ, Aquilino SA, Diaz-Arnold AM, Haselton DR, Stanford CM, Var- gas MA. Relative translucency of six all- ceramic systems. Part I: Core materials. J Prosthet Dent 2002;88:4–9.
4. Dorin Bratu, Robert Nussbaum - "Bazele clinice şi tehnice ale protezării fixe"-2011
5. D Castellani 1, T Baccetti, A Giovannoni, U D Bernardini- "Resistance to fracture of metal ceramic and all-ceramic crowns" Int J Prosthodont Mar-Apr 1994;7(2):149-54.
6. Nordlander J, Weir D, Stoffer W, Ochi S. The taper of clinical preparations for fixed prosthodontics.-J Prosthet Dent 1988;60:148-51.
7. Parker MH, Calverley MJ, Gardner FM, Gunderson RB. "New guidelines for preparation taper. J Prosthodont" 1993;2:61-6.
8. Jørgensen KD. "The relationship between retention and convergence angle in cemented veneer crowns." Acta Odontol Scand 1955;13:35-40.
9. A H Tjan, J R Dunn, I R Sanderson -"Microleakage patterns of porcelain and castable ceramic laminate veneers"- J Prosthet Dent. 1989 Mar;61(3):276-82.
10. Galip Gurel 1, Newton Sesma, Marcelo A Calamita, Christian Coachman, Susana Morimoto " Influence of enamel preservation on failure rates of porcelain laminate veneers"-Int J Periodontics Restorative Dent. Jan-Feb 2013;
11. Peumans M, et al. Porcelain veneers: a review of the literature. Journal of dentistry. 2000; 28(3):163-177.
12. Sheets CG, Taniguchi T. Advantages and limitations in the use of porcelain veneer restorations. The Journal of prosthetic dentistry. 1990; 64(4): 406-411.
13. Wildgoose DG1, Winstanley RB, van Noort R. The laboratory construction and teaching of ceramic veneers: a survey. J Dent. 1997 Mar;25(2):119-23.
14. Venturini AB, Prochnow C, May LG, Bottino MC, Felipe Valandro L. Influence of hydrofluoric acid concentration on the flexural strength of a feldspathic ceramic. J Mech Behav Biomed Mater. 2015 Aug;48:241-248
15. Zarone F, Ferrari M, Mangano FG, Leone R, Sorrentino R. - "Digitally oriented materials": focus on lithium disilicate ceramics. - Int J Dent. 2016;2016:9840594. doi: 10.1155/2016/9840594.
16. Galip Gürel - "Predictable, precise, and repeatable tooth preparation for porcelain laminate veneers" - Pract Proced Aesthet Dent. Jan-Feb 2003;15(1):17-24; quiz 26.

17. Vivadent I. IPS e. max lithium disilicate:- the future of all- ceramic dentistry material science, practical applications, keys to success. - Amherst, NY: Ivoclar Vivadent; 2009. p. 1e15.
18. Martin F Land et al. J Evid-"Survival rates of all-ceramic systems differ by clinical indication and fabrication method"-Dent Pract. 2010 Mar.
19. Tinschert J, Zwez D, Marx R, Anusavice KJ -"Structural reliability of alumina-, feldspar-, leucite-, mica- and zirconia-based ceramics. "- J Dent. 2000 Sep; 28(7):529-35.
20. Walls A, Steele J, Wassell R. Crowns and other extra-coronal restorations: porcelain laminate veneers. British dental journal. 2002;

Registration of intermaxillary relations using anterior Jig compared to the classical method



Mihali S.G.[1], Lolos D.[2], Bratu D.C.[3]

[1]*Department of Prosthodontics, Faculty of Dentistry, "Vasile Goldis" Western University of Arad, 94 Revolutiei Blvd., 310025 Arad, Romania*
[2]*Student, Faculty of Dentistry, "Vasile Goldis" Western University of Arad, 94 Revolutiei Blvd., 310025 Arad, Romania*
[3]*Department of Orthodontics and Dento-Facial Orthopedics, Orthodontic Research Center, Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, 2 Eftimie Murgu Square, 300041 Timisoara, Romania*

Correspondence to:
Name: Dan Lolos
Address: 7 Circumvalaţiunii Street, 300013 Timişoara, Romania
Phone: +40 730 034 780
E-mail address: lolosdan@yahoo.ro

Abstract

The purpose of this study was to record the intermaxillary relationships as accurately as possible by using the anterior Jig method as compared to the classical occlusion recording. The patients were divided into two groups. In the study group, the anterior Jig was used to record as accurately as possible the situation in the oral cavity in terms of intermaxillary relations, and in the control group, the classical method was used. With the help of indirect provisional restorations, the differences that appeared after recording the occlusion with the 2 methods were highlighted. In conclusion, the method of recording the intermaxillary relationships using the anterior Jig and the material of recording the bilateral occlusion proved to be the most accurate fitting of the models in the articulator, the difference being made by the anterior support.

Keywords: Anterior jig, intermaxillary registration, CO, bimanual manipulation CR technique

INTRODUCTION

In case of dental patients who require extensive fixed prosthodontic and oral rehabilitation, recording an accurate centric relation is often a difficult procedure (1,2). Due to the preparation of the hard dental tissues, the occlusal stops are affected and the occlusion is no longer stable. As for the centric relation, there are many definitions that it has, at the moment none of them is considered to be official (3,4,5,6,7). Due to the multitude of definitions, its understanding that can be confusing because besides the fact that this definition can be changed it will also evolve constantly in the future (8). Some disagreements may be explained due to the different training areas, but a consensus was not found even in the situations where the clinicians were from the same country (9,10) which means that there will still be a controversial problem in prosthodontics (11). Even though there are some considerations about a range of normal positions of the condyle in the glenoid fossa (12,13) of all the patient's jaw relationships, the one that must be registered is the centric relation because is the only clinically comfortable, repeatable and logical jaw relationship and so the most important and critical (14,15,16). To include as many definitions in our study, we consider the centric relation (CR) as a classic reference position of the relationship between the maxillary and mandibular arches at the closure of the oral cavity where the condyles occupy the highest position in the glenoid cavity for occlusal, temporomandibular joint (TMJ) examination and prosthetic treatment. The purpose of this study was to record the intermaxillary relation as accurately as possible by using the anterior Jig method as compared to the classical occlusion recording. Regarding the methods of recording the centric relation described in the literature (17,18,19,20,21) there is no consensus on which one is the best (22). When clinicians perform full mouth rehabilitation, one very important thing is that they must be sure that they have correctly recorded their patient's centric relation. Regarding this, a technique is described for registering centric relation in dentate patients using an anterior deprogrammer Jig (23,24,25,26,). This technique is simplifying the setting up of models and the programming of articulators (26,27), thus visual verification is possible when the assembling is made with the correct orientation of the casts (28) by confirming the precise position of the anterior Jig with the help of impressions of maxillary and mandibular incisors left on it. Properly executed, the patient is able to close into an unassisted centric relation, eliminating the adaptive mandibular closure patterns (29) and the possibility of operator-induced error associated with commonly accepted manipulative techniques. There are several techniques described for registration of centric relation in dentate patients that use a anterior deprogrammer, and all these techniques have in common the muscular deprogramming. In order to obtain this muscular deprogramming (30,31,32) and to record the correct centric relation in the dentate patients the anterior Jig will have to be performed properly. Introduction presentation of general aspects, in the context of the approached theme.

Aim and objectives

In this study, the differences in registration of the intermaxillary relations were evaluated in a number of 49 patients. The differences that appeared from the records of intermaxillary relations both within the study group and within the control group were marked by the use of a new technique proposed in this study. This refers to the registration of intermaxillary relations by using the anterior Jig.

MATERIAL AND METHODS

In the study group, the first phase was to perform the anterior Jig. The clinician used a composite material (Gaenial A Chord) which he placed at the level of the lower central incisors. The amount of composite material can be adapted for each patient without influencing the study from the point of view of the contact space between the two dental arches.

Figure 1. Positioning the composite material at the level of the lower central incisors

Figure 2. Guiding the patient in the central relationship position using bimanual guidance

Figure 3. Photopolymerization of the anterior Jig

After obtaining the anterior Jig, the impression material will be injected. (Oclufast Rock Zhermack)

Figure 4. The actual injection of the recording material of the occlusion

Figure 5. The Guidance in centric relation

After the registration of the occlusion performed using the anterior Jig method, the registration with the facebow will take place next. Then the impressions will be made and the entire clinical situation will be transferred to the dental laboratory. With the help of these elements, the models will be mounted in the articulator.

Figure 6. Mounting the models in the articulator within the study group

In the control group, the occlusion was recorded differently compared to the occlusion recorded in the study group. The anterior Jig in this situation was no longer created. Through the method used in the control group, we tried through this study to highlight the fact that this method is one of the most used in current practice, and this greatly influences the prosthetic results. Since this is one of the most used methods of recording intermaxillary relations a comparison of it with another method which has been proven to be much more effective would change the perspective of intermaxillary relation records. The procedures and techniques used by the technicians in the dental laboratory were identical. The exception in this situation is the steps that could not be executed due to the absence of the anterior Jig.

In the control group, the unimanual technique of guiding the patient in centric relation was used, because this is the most used by the majority of clinicians who record the intermaxillary relations in this way. For the injection of the occlusion recording material, the exact same device and material (Oclufast Rock Zhermack) was used as in the case of the study group in order not to influence from this point of view the results of the recordings made in both groups.

RESULTS

In order to be able to compare the results as accurately as possible, we chose to use both methods of recording the intermaxillary relations in the following way. Each patient was recorded both by the anterior Jig method and by the classical method. The first comparison made was in the realization of indirect provisional prosthetic restorations after recording the occlusion by the classical method, and then using the anterior Jig method. After recording the occlusions, the models were mounted in a randomized articulator.

Figure 7. The difference between the classic method and the anterior Jig method highlighted by indirect provisional restorations

Figure 8. In the left side, the classic method was used and in the right side the anterior Jig method

Regarding the results within the study group the registration provided 100% success. On the other hand, in the control group, in the case of 6 patients, the provisional restorations fit to the same extent as in the study group after the occlusal adjustments were made. The indirect restorations of the patients in the control group, i.e. a percentage of 87.75%, could not be considered acceptable after the occlusal adaptation was performed at their level.

DISCUSSIONS

In the moment of positioning the anterior Jig by placing the composite at the level of the lower central incisors, the patient is asked to open and close the oral cavity multiple times, at the same time adding the composite to perform the Jig. At the moment of the gradual application of the composite, the patient is asked to close and open the oral cavity, and at that moment the anterior Jig performs a muscle deprogramming. This muscle deprogramming is determined by the muscle relaxation that allows centric relation to be recorded by whatever method use (27). Muscle deprogramming leads to the elimination of the engram and allows lateral pterygoids to relax (33) so that at the neuromuscular level (34) both the interference

made in the dynamic occlusion and the premature contacts made in the static occlusion that the patient had since then will disappear. Thus the recorded centric relation will be correct both from the point of view of the temporal-mandibular articulation as well as regarding the new restorations. By performing this muscle deprogramming the anterior Jig, even in situations where manipulating the mandible to obtain the centric relation may be more difficult (35), will allow the clinician to determine as accurately as possible the centric relation so that he can be sure that was recorded correctly. Although in some situations to guide the patient correctly the methods commonly used are chin point guidance or bimanual manipulation (36,37) in some clinical situations the manipulation with anterior Jig guidance has been shown to be very efficient and accurate (38,39). In order to be sure of a correct recording in this study besides these guides (bimanual manipulation, the chin point guidance, anterior Jig guidance) the verification was also performed by positioning the tongue tip to soft palates which were performed by the patient to observe the accuracy of the method used. The correct mounting of casts on articulators is a fundamental step in obtaining good clinical results and reducing the time spent in adjusting the prosthetic restorations. (40). The proper recording of the centric relation leads to the correct fitting of the opposing casts in the articulator, minimizing orientation errors that can cause malocclusions. The correct fitting already made will decrease the degree of intraoral adjustment from the new restorations (41), after fixing them, but also will generate a smaller surface amount removed of the restorations. A careful analysis of occlusal contacts should be performed, in order to avoid the creation of iatrogenic interferences that can produce the signs and symptoms of temporomandibular and postural disorders (42,43) because of the disharmony between the occlusion of the teeth and the centric relation position of the temporomandibular joints (44). Although some aspects have been highlighted such as the sensitivity, reliability, and efficiency of occlusal indicators, there is no data regarding whether the presence of occlusal indicators affects muscle function during occlusion (45). Even when adjusting restorations, there are some aspects that need to be considered in order for the prosthetic treatment to be functionally correct. The indicators of occlusion can affect the functional occlusal contacts if a very thick articulating paper is used because its thickness can significantly influence neuromuscular function during occlusion by not providing a valid tooth contact information and affecting the validity of the measurements they provide (45). Therefore the method of the anterior Jig by its ability to provide a very good, accurate and precision recording of the centric relation aims to perform extensive prosthetic interference-free occlusion type restoration (46). But this will greatly depend on the clinician's ability to perform the restorative procedures correctly from start to finish because if they are performed incorrectly they will cause interference and disharmonic relation between the arches (47,48,49,50,51). With a correct recording of the intermaxillary relationships, a functional anterior guidance is provided that can reduce the parafunctional activity and this anterior guidance can determine a harmonious functionality of the temporomandibular complex (52). In order to perform functional prosthetic restorations, the clinician must start from the beginning with a correct treatment plan that respects the concept of mutually protected occlusion (53) and tends to achieve both occlusal and articular stability in order to achieve orthopedic stability (54).

CONCLUSIONS

Mounting the models in the articulator using the method of registration of intermaxillary relations using the anterior Jig provides superior fidelity in terms of the final results from a prosthetic point of view. In situations where we have to perform extensive prosthetic restorations, the anterior Jig registration method can be considered the choice due to the most accurate reproducibility of the intermaxillary relationships. Compared to the

conventional method, this method avoids a lot of errors such as: mounting models tipped to the front, vertical inocclusions and sagittal inocclusions.

REFERENCES

1. Türp JC1, Greene CS, Strub JR. Dental occlusion: a critical reflection on past, present and future concepts. J Oral Rehabil. 2008 Jun;35(6):446-53.
2. Goto Y1, Shor A, Chigurupati K, Rubenstein JE. A light-polymerized resin support tray as an aid for recording centric relation. J Prosthet Dent. 2002 May;87(5):578-80.
3. Dennis B. Gilboe, D.D.S., M.S. Centric relation as the treatment position November 1983Volume 50
4. Jayant N. Palaskar, corresponding author R. Murali, and Sanjay Bansal Centric Relation Definition: A Historical and Contemporary Prosthodontic Perspective J Indian Prosthodont Soc. 2013 Sep; 13
5. Jasinevicus TR, Yellowitz JA, Vaughan GG, Brooks ES, Bughan LW, Cline N, et al. Centric relation definitions taught in 7 dental schools results of faculty and student surveys. J Prosthodont. 2000;9:87–94.
6. Palaskar, Murali, Bansal Centric relation definition: a historical and contemporary prosthodontic perspective. Journal of Indian Prosthodontic Society, 31 Oct 2012,
7. Hothi GS. Technique tips--the ABC of the ESIPC jig: the 'elegantly simple incisal platform, customized' (ESIPC) jig for capturing/recording centric relation. Dent Update. 2015 Mar;42(2):195-7.
8. Gonzalez B. The not-so-controversial issue of condylar position. Int J Orthod Milwaukee. 2007;18:17–26.
9. T Roma Jasinevicius, Janet A. Yellowitz, Gregory Gawayne Vaughan, Ernestine S Brooks, Linda W Baughan, N Cline, Lynn Theiss Centric relation definitions taught in 7 dental schools: results of faculty and student surveys. Journal of prosthodontics 05 August 2004
10. Goldstein G1, Andrawis M2, Choi M3, Wiens J4, Janal MN5. A survey to determine agreement regarding the definition of centric relation. J Prosthet Dent. 2017 Mar;117
11. A. Keshvad R. B. Winstanley An appraisal of the literature on centric relation. Part I Journal of Oral rehabilitation 07 July 2008
12. Sujaik LA, Ajanovic M. Position of mandibular joint surface in centric relation. Bosn J Basic Med Sci. 2006;6:89–92.
13. Turp JC, Schindler HJ, Rodiger O, Smeekens S, Marinello CP. Vertical and horizontal jaw relations in reconstructive dentistry. A critical review. Schweiz Monatsschr Zahnmed. 2006;116:403–417.
14. Hickey JA (1964) Centric relation, a must for complete dentures. Dent Clin North Am 8:587–600
15. Becker CM1, Kaiser DA, Schwalm C. Mandibular centricity: centric relation. J Prosthet Dent. 2000 Feb;83(2):158-60.
16. Shildkraut M1, Wood DP, Hunter WS. The CR-CO discrepancy and its effect on cephalometric measurements. Angle Orthod. 1994;64(5):333-42.
17. Bansal S, Palaskar J. Centric jaw relation-a critical evaluation of its various methods. Germany: Lambert academic publishing; 2010.
18. Martin E.KantorD.M.D., M.S.D. Sidney I.SilvermanD.D.S. Lawrence Garfinkel M.A.Centric-relation recording techniques—a comparative investigation The Journal of Prosthetic Dentistry Volume 28, Issue 6, December 1972
19. McKee JR. Comparing condylar position repeatability for standardized versus nonstandardized methods of achieving centric relation. J Prosthet Dent. 1997 Mar;77(3):280
20. Bansal S, Palaskar J. Critical evaluation of various methods of recording centric jaw relation. J Indian Prosthodont Soc. 2008;
21. Bansal S, Palaskar J. Critical evaluation of methods to record centric jaw relation. J Indian Prosthodont Soc. 2009

22. K.-H. Utz F. Müller W. Lückerath E. Fuß B. Koeck Accuracy of check-bite registration and centric condylar position Journal of Oral Rehabilitation 21 May 2002
23. Benjamin D. Hunter II DDS Richard W. Toth DDS, MS Centric Relation Registration Using an Anterior Deprogrammer in Dentate Patients First published: 08 March 2005
24. Victor O. Lucia, D.D.S,1 A technique for recording centric relation May–June, 1964Volume 14, Issue 3, Pages 492–505
25. Martin FLandDDS, MSDaAlejandroPeregrinaDDS, MSDb Anterior deprogramming device fabrication using a thermoplastic material The Journal of Prosthetic Dentistry Volume 90, Issue 6, December 2003
26. P.H.DupasD.C.D., Ph.D.*B.PicartD.C.D.C.LefevreD.C.D. F.GrauxD.C.D. Centric relation and programming semiadjustable articulators with the universal jig. Part II: Experiments The Journal of Prosthetic Dentistry Volume 65, Issue 1, January 1991
27. P.H.DupasD.C.D., Ph.D.B.PicartD.C.D. C.LefevreD.C.D.F.GrauxD.C.D. Centric relation and programming semiadjustable articulators with the universal jig. Part I: TechniqueThe Journal of Prosthetic Dentistry Volume 64, Issue 2
28. Lawrence A.WeinbergD.D.S., M.S.*1 An evaluation of basic articulators and their concepts: Part I. Basic concepts Author links open overlay panel The Journal of Prosthetic Dentistry Volume 13, Issue 4, July–August 1963
29. Carroll WJ1, Woelfel JB, Huffman RW. Simple application of anterior jig or leaf gauge in routine clinical practice. J Prosthet Dent. 1988 May;59(5):611-7.
30. Martin FLandDDS, MSDaAlejandroPeregrinaDDS, MSDb Anterior deprogramming device fabrication using a thermoplastic material The Journal of Prosthetic Dentistry Volume 90, Issue 6, December 2003
31. Hunter BD 2nd1, Toth RW. Centric relation registration using an anterior deprogrammer in dentate patients. J Prosthodont. 1999 Mar;8(1):59-61.
32. Land MF1, Peregrina A. Anterior deprogramming device fabrication using a thermoplastic material. J Prosthet Dent. 2003 Dec;90(6):608-10.
33. Amit M. Gaikwad, BDS, MDS Shraddha Tamore, BDS, MDSb Fabricating an inexpensive leaf gauge deprogrammer from panoramic radiographic film September 2019Volume 122
34. Mariangela Salles Pereira NassarI; Marcelo PalinkasI; Simone Cecilio Hallak RegaloII; Luiz Gustavo de SousaII; Selma SiéssereII; Marisa SempriniII; Cristiane BataglionII; César BataglionI The effect of a Lucia jig for 30 minutes on neuromuscular re-programming, in normal subjects Bra
35. Karl PJ, Foley TF The use of a deprogramming appliance to obtain centric relation records. The Angle Orthodontist, 01 Apr 1999
36. Keshvad A1, Winstanley RB. Comparison of the replicability of routinely used centric relation registration techniques. J Prosthodont. 2003 Jun;12(2):90-101.
37. Alvarez MC1, Turbino ML, Barros Cd, Pagnano VO, Bezzon OL. Comparative study of intermaxillary relationships of manual and swallowing methods. Braz Dent J. 2009;20(1):78-83.
38. Carwell ML, McFall WT Jr. Centric relation determinations: clinical and radiographic comparisons. J Periodontol. 1981 Jul;52(7):347-53.
39. Mark L. Carwell Walter T. McFall Jr. Centric Relation Determinations: Clinical and Radiographic Comparisons† Journal of Periodontology 01 July 1981
40. Bezzon OL1, Orsi IA. An interocclusal record made of a combination of wax and acrylic resin. J Prosthet Dent. 1994 Sep;72(3):334-6.
41. Freilich MA1, Altieri JV, Wahle JJ. Principles for selecting interocclusal records for articulation of dentate and partially dentate casts. J Prosthet Dent. 1992 Aug
42. Seligman DA, Pullinger AG. The role of intercuspal occlusal relationships in temporomandibular disorders: A review. J Craniomandib Disord Facial Oral Pain. 1991;5:96–106.
43. Lima AF, Cavalcanti AN, Martins LR, Marchi Occlusal Interferences: How Can This Concept Influence The Clinical Practice? Eur J Dent. 2010;4:487–9.
44. Pokorny PH, Wiens JP, Litvak H. Occlusion for fixed prosthodontics: a historical perspective of the gnathological influence. J Prosthet Dent. 2008;99:299–313. doi: 10.1016/S0022-3913(08)60066-9.

45. Forrester SE, Presswood RG, Toy AC, Pain MT. Occlusal measurement method can affect SEMG activity during occlusion. J Oral Rehabil. 2011;38:655–60.
46. Dawson PE. Functional Occlusion: From TMJ to Smile Design. St. Louis, MO: Mosby Elsevier; 2007
47. Le Bell Y, Niemi PM, Jamsa T, Kylmala M, Alanen P. Subjective reactions to intervention with artificial interferences in subjects with and without a history of temporomandibular disorders. Acta Odontol Scand. 2006;64:59–63.
48. Tsukiyama Y, Baba K, Clark GT. An evidence-based assessment of occlusal adjustment as a treatment for temporomandibular disorders. J Prosthet Dent. 2001;86:57–66.
49. Niemi PM, Le Bell Y, Kylmala M, Jamsa T, Alanen P. Psychological factors and responses to artificial interferences in subjects with and without a history of temporomandibular disorders. Acta Odontol Scand. 2006;64:300–5.
50. Barbosa GAS, Badaró Filho CR, Fonseca RB, Soares CJ, Neves FD, Fernandes Neto AJ. The role of occlusion and occlusal adjustment on temporomandibular dysfunction. Braz J Oral Sci. 2004;3:589–94.
51. Kirveskari P, Alanen P. Occlusal variables are only moderately useful in the diagnosis of temporomandibular disorder. J Prosthet Dent. 2000;84:114–5.
52. Brose MO, Tanquist RA The influence of anterior coupling on mandibular movement. The Journal of Prosthetic Dentistry, 01 Mar 1987
53. Rick K. Biethman,1, Stephen Raney,1 and John Marincel2 Diagnostic Occlusal Adjustment: Case Presentation for Dental Students MedEdPORTAL. 2016; 12: 10465.
54. Jeffrey P. Okeson Evolution of occlusion and temporomandibular disorder in orthodontics: Past, present, and future May 2015Volume 147, Issue 5, Supplement, Pages

Meine Zukunft in Deutschland.

Der Start als Zahnarzt in Deutschland beginnt mit uns.

Ob eigene Praxis oder angestellter Zahnarzt
Mit unseren Kenntnissen und Erfahrungen stehen wir Ihnen in allen Fragen zur Verfügung. Wir helfen Ihnen beim Umgang mit Behörden, dem Erlangen einer Kassenzulassung, der Standort- und Praxissuche, der Beschaffung des Startkapitals und Finanzierungen jeglicher Art.

Als führendes Dental-Labor in Deutschland in den Bereichen **CNC-Fräsung**, **digitale Fertigung**, **3D-Druck** und **Intraoral-Scannen** bieten wir ein großes und hoch- modernes Portfolio an dentalen Leistungen an. Nehmen Sie Kontakt zu uns auf. **Wir kümmern uns um Ihre Formalitäten.**

HARTL GmbH
DENTALE TECHNOLOGIEN

Renthof 1
34117 Kassel
Deutschland

Fon: +49 561 - 560 24
+49 561 - 570 390
Email: hartl@web.de

INSTRUCTIONS FOR AUTHORS

The journal publishes general reviews, studies and clinical, epidemiological, experimental and laboratory research, clinical case presentation, papers from the history of medicine, reviews, scientific and technical state-of-the-art articles, medical informations and opinions. Only papers which have not been published or sent for publishing in other journals are accepted. The authors are responsable for the opinions expressed in the papers. ***The paper must be edited both in Romanian and in English; the English version will be supervised by our collaborator Dana Brehar-Cioflec, MD, PhD; typed on white A_4 paper and on CD, DVD or Memory Stick***.

Manuscripts will not exceed:

- general reviews: 6-8 pages
- studies and researches: 5-7 pages
- case presentations: 2-4 pages
- reviews, scientific and technical state-of-the-art articles, medical informations and opinions: 1-2 pages.

The paper will be edited according to international editing rules for manuscripts. The title will be written in capital characters and it will be followed by the name and surname of the author (authors), followed by their place of work (place where the paper has been elaborated). Studies and researches will be followed by a brief abstract, followed by 3-4 key-words.

The body of the paper will be structured on the following chapters: introduction, aim, objectives, material and method, results and discussions, conclusions. The references will be presented alphabetically and in conformity to the Vancouver Convention, including:

- for articles: name of the authors and surname initials, title of the article in the original language, title of the journal according to the international abreviation system, year of issue, volume, number, pages;
- for books: name of the authors and surname initials, volume, publisher (editors), city of publishing, year of issue.

Citation of references inside the body of the paper will be put between brackets, Harward style (author, year) or Vancouver style (number in square brackets or superscript). Cited reference titles will be selected, maximum 6 for studies and case presentations and 12 for general reviews. Acceptance, rejection or the need of alterations in sent materials, or in inconography, will be comunicated to the authors in due time. For this, the authors will indicate the person and address for corespondence (phone number, e-mail address). Given the less pleasant experience of the editorial board with some articles being rejected because they did not meet publishing criteria, we decided to support those who intend to publish in this journal by detailing the way such a paper should be elaborated, as well as our requirements.

Except some particular aspects concerning this journal, the following details are general requirements asked or imposed by other journals as well. Conditions to be met in order to propose a paper for publishing. The main author has the responsability to make sure the article has been approved by all the other authors. The journal will have copyright

for papers accepted for publishing. The editorial board reservs the right to change the style and dimensions of an article (major changes will be discussed with the main author) and to decide the date of issue.

2. FIRST PUBLICATION

The editorial board will not consider a paper already reported in a published general review or described in a paper proposed to or accepted by another journal. This does not exclude papers which have been rejected by other journals. Also, papers which have been presented at a scientific meeting will be accepted for discussion if they have not been entirely or partially published in a similar publication. „Multiple" publishing of the same study is seldom justified. One of the possible justifications is publishing in a second language but only if the following conditions are met:

- Editors of both journals involved are fully informed;
- Priority of the initial publication will be respected by a minimum publishing interval of two weeks;
- For the second publication, a shortened version will suffice;
- The second version strictly reflects data and interpretations in the first;
- A footnote may state: „This article is based upon a study initially published in [title of the journal]".

3. PATERNITY

Paternity must reflect the common decision of the coauthors. Each author must have participated enough to take public responsability for the content. A paper with collective paternity must have a key person responsable for the article.

4. COPYRIGHT

In order to reproduce materials from other sources, written agreement from the copyright owner must be obtained:

- photographer – for unpublished photographs;
- hospital where the photographer (physician) is employed – for unpublished photographs performed during the employment period;
- 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.

- Books - Standard format - #. Author of Part, AA. Title of chapter or part. In: Editor A, Editor B, editors. Title: subtitle of Book. Edition(if not the first). Place of publication: Publisher; Year. p. page numbers.
- Journal Articles - Standard format - #. Author of article AA, Author of article BB, Author of article CC. Title of article. Abbreviated Title of Journal. year; vol(issue): page number(s).
- E-Books - Standard format - #. Author A, Author B. Title of e-book [format]. Place: Publisher; Date of original publication [cited year abbreviated month day]. Available from: Source. URL.
- E-Journals - Standard format - #. Author A, Author B. Title of article. Abbreviated Title of Journal [format]. year [cited year abbreviated month day]; vol(no): page numbers [estimated if necessary]. Available from: Database Name (if appropriate). URL.

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.

Papers submitted for publishing will be addressed to:

Prof. Angela Codruta Podariu, DMD, PhD
Journal Medicine in evolution
Department of Preventive, Community Dental Medicine and Oral Health
Splaiul Tudor Vladimirescu no. 14 A
300041, Timişoara
Email: proiectetim@gmail.com

Dana Brehar-Cioflec, MD, PhD
Institute of Public Health *"Prof. Dr. Leonida Georgescu"* Timişoara
Bd. Victor Babeş no. 16
300226, Timişoara
Phone: 0256-492101
Email: danabreharcioflec@yahoo.com

Descoperiți elmex®.
Specialistul de încredere în îngrijire orală.

*Sondaj telefonic reprezentativ privind recomandările de pastă de dinți, organizat de Ipsos pe un eșantion de 300 de stomatologi, în ian-feb 2018.

elmex®
Healthy teeth for life.

Acest număr a apărut cu suportul COLGATE-PALMOLIVE