Medicine in Evolution

Printed at: WALDPRESS, Timisoara,
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Edited at: EUROSTAMPA, Timisoara
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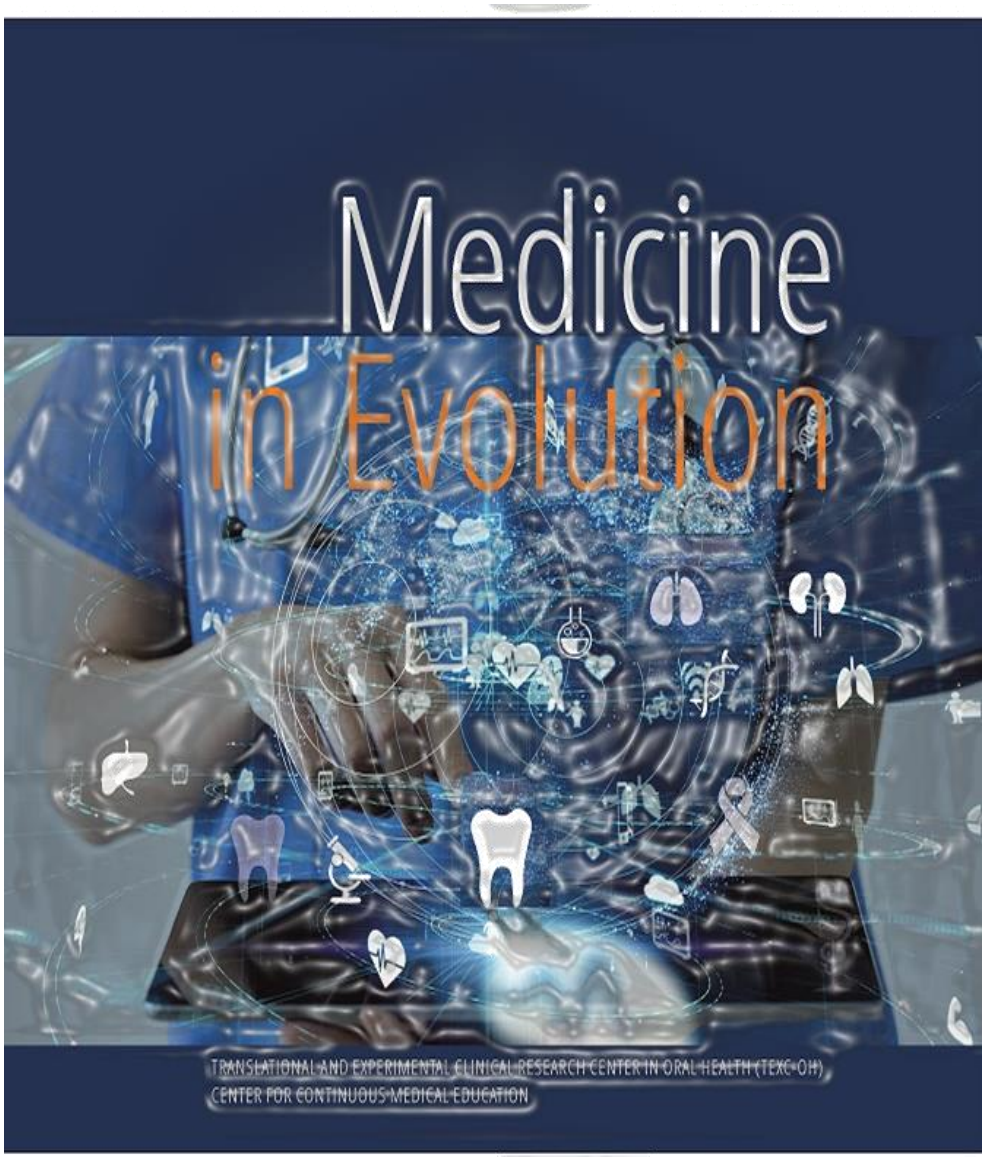
TRANSLATIONAL AND EXPERIMENTAL CLINICAL RESEARCH CENTER IN ORAL HEALTH (TEXC-OH)
CENTER FOR CONTINUOUS MEDICAL EDUCATION

ISSN 2065-376X medinevolution.umft.ro

Volume XXX, No. 2, 2024, Timişoara, Romania
ISSN 2065-376X

MEDICINE IN EVOLUTION



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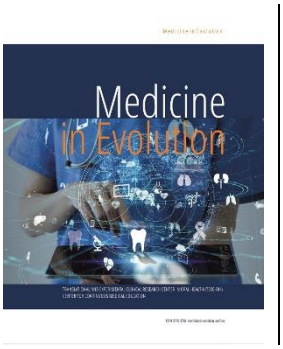

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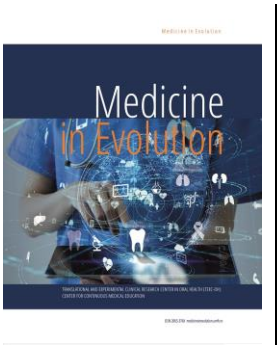
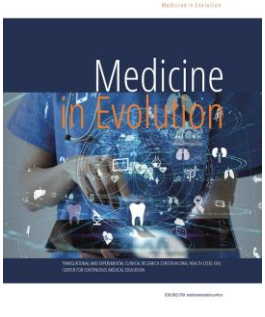


Influence of lifestyle in cardiovascular disease - regional characteristics



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Received: 12 April 2024; Accepted: 9 June 2024; Published: 30 June 2024

Abstract

With the investigation through epidemiological anamnesis of the cohort of patients with cardiovascular disease admitted for tertiary prevention hospital we retrospectively assessed their cardiovascular risk factors, taking into account the patient's area of origin as it can significantly influence their lifestyle. Specific to this research we consider the constitution of the study group from patients who have a long history of cardiovascular disease, patients on whom risk factors, respectively protective factors have had a long period of action, and the use for characterization of the population, not for their aggregation in tools to assess total cardiovascular risk (as is the trend in large cohort studies since Framingham).

Keywords: cardiovascular risk, cardiovascular diseases prevention, lifestyle influence

INTRODUCTION

For the present research, the ranking of risk factors for cardiovascular disease includes in the top 20 factors that negatively influence the occurrence and prognosis of the disease only 20% medical risk factors, a low percentage are genetic factors and the vast majority are factors attributable to lifestyle habits.

The most risk factors in line with the prevalence obtained are those related to lifestyle - diet, exercise, ingestion of toxic substances - tobacco, alcohol, excess sugar and salt, resting time, lifestyle. Their importance lies primarily in the fact that it is easier to intervene on them.

Conversely, the protective factors ranked in order of importance reveal that simple actions (such as salt restriction) are effective in preventing (at any level) cardiovascular disease. Here social factors play a primary role, followed by diet.

Aim and objectives

The present research, carried out in a group of chronic patients with pre-existing cardiovascular disease, aimed to rank the risk factors in order to identify those on which intervention is possible.

Given the results, i.e. that habits can represent both risk and protective factors for cardiovascular disease, highlighting and grouping according to the region where the subject comes from (generating in turn characteristics on the habits of the subjects) offers the possibility of action (all risk factors associated with lifestyle are modifiable) and allows the identification of distinct vulnerable groups with adapted prevention needs.

MATERIALS AND METHODS

Study sample

The study is a descriptive, observational, epidemiological study conducted on a group of 499 chronic cardiovascular patients from all over the country (nationally representative) admitted for tertiary prevention procedures between January and April 2022.

The selection of patients was made respecting the territorial distribution of the general population (starting from counties and grouped in regions) and the proportions of belonging to the environment of origin (urban/rural) and gender (male/female).

The epidemiological history data were obtained by direct examination by the epidemiologist MD. The medical history of the identified comorbidities was taken from the General Clinical Observation Sheets (GCOS) of the patients in the Cardiovascular Recovery Hospital Dr. Benedek Géza Covasna.

Inclusion criteria:

1.Inpatient, 2. Subject diagnosed with chronic cardiovascular disease prior to inclusion in the study, 3. Patient's agreement and willingness to provide information required for epidemiological investigation of viral vector exposure

Exclusion criteria:

1. Patient without a diagnosis of cardiovascular disease, 2. Acute patient, 3. Lack of consent to participate in the present research.

The selection of patients was done randomly, respecting only the criteria of belonging to the area, gender and environment of origin adjusted to those found in the general population of Romania.

The confidence interval (confidence) for patients selected for the study and the general population of the country is 99% for both gender and background.

For the current research we considered the division of the territory into the 8 current administrative regions that correspond to the historical regions of Romania, regions that **have** different characteristics and lifestyle habits and could provide data on cardiovascular risk factors.

Method

Data from the epidemiological survey were uploaded into a centralising Excel Worksheet for mathematical processing. The information was recorded numerically or later transformed into numerical values No= 0 and Yes=1 for interpretation.

Data analysis was done

- Through tables and graphs using Microsoft Excel
- Statistical mathematical processing using SPSS (Statistical Package for the Social Sciences).
- Discrete variables were presented as percentages, comparisons were made with chi-squared test
- Continuous variables were presented as mean or median by distribution, comparisons were made with t-student

RESULTS

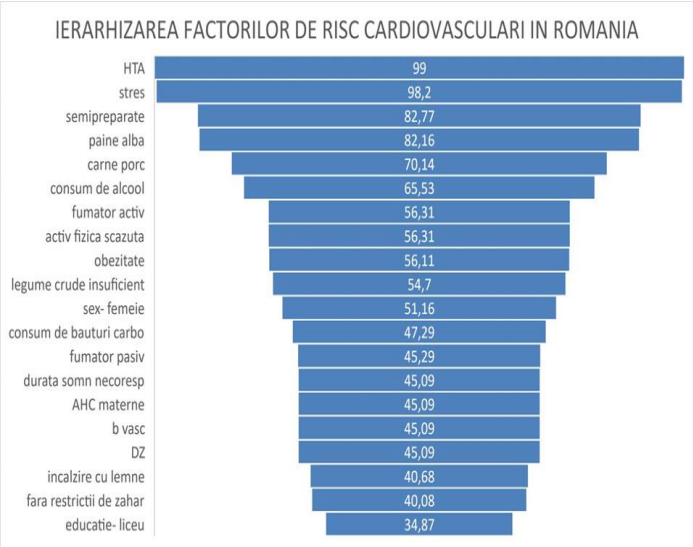

Figure 1. Ranking of cardiovascular risk factors in Romania

In the ranking of risk factors in the population studied, elements in line with the subjects' lifestyle habits are identified with significant weights:

- 56.31% of cardiovascular patients are active smokers and 45.29% are passive smokers. In the research group 56.31% of the subjects are smokers, while 17.43% are former smokers. Compared to the prevalence in the general population (44% of the adult population) the proportion is significantly higher. The period during which smokers have consumed toxic substances is impressive - the average duration is 45.65 years. Also for ex-smokers the data obtained in the present research support that they smoked on average 35.87 years before quitting, and the period without tobacco consumption in this category is 10.08 years, significantly shorter than the period of exposure. In terms of territorial distribution, the highest percentage of active smokers is found in Banat and Transylvania, while smoking prevalence (active and former smokers) is highest in Muntenia and Transylvania, with Muntenia also recording the highest percentage of quitting smoking (highest

percentage of former smokers). The average age of smoking initiation is low, at 21 years. At the same time there is a high percentage of subjects who are passive smokers

- 82.16% consume white bread. For bread consumption, most subjects consume white bread in Bucharest-Ilfov and Banat, while black bread is consumed by the majority of subjects in Bucharest-Ilfov and Banat while black bread is consumed mostly in Moldova and Crişana.
- 82.77% consume semi-prepared meat (highest percentage in Moldova, lowest in Bucharest-Ilfov) and 70.14% consume pork (highest percentage in Dobrogea, lowest in Transilvania region).
- 65.53% consume alcohol (most people consuming alcoholic beverages are found in the study in the Moldova region, and most people not consuming alcoholic beverages in the Banat region). Regarding the frequency of consumption for all types of alcoholic beverages, the habit of daily consumption is found with the highest frequency in Muntenia, weekly consumption of alcoholic beverages is most frequently found in Transylvania, and occasional consumption in Moldova. According to the type of alcoholic beverages consumed by the patients in the study group, in Transylvania they drink the most beer, in Moldova they are the most frequent consumers of wine, and in Bucharest-Ilfov they are the most frequent consumers of refined alcohol (spirits).
- 56.31% have low physical activity (less than 30 minutes daily). The highest proportion of sedentary people is identified among subjects in Muntenia, while the highest proportion of active people (who carry out physical activity over 60 min daily) is in Bucharest-Ilfov.
- 54.7% do not consume adequate amounts of raw vegetables
- 47.29% consume carbonated drinks. Carbonated drinks are consumed by a large proportion of the population with CVD in Bucharest Ilfov and Muntenia, while the highest proportions of people who do not consume carbonated drinks are found in Banat and Crişana.
- 45.09% have inadequate sleep duration. The region with inadequate sleep duration (less than 7 hours/day) is Moldova, while the highest percentage of patients suffering from sleep disorders are in Muntenia.
- 40.08% consume unrestricted sugar.

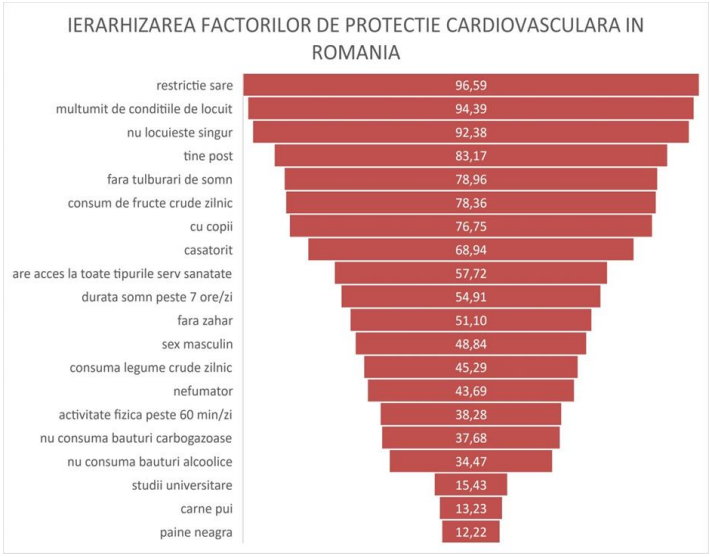

Figure 2. Ranking of cardiovascular protective factors in Romania

- 96.59% of patients with known cardiovascular disease restrict their salt intake, which is practically the protective factor present in this population. In the region of Moldova we find in the research the most patients who do not have a diet to restrict the amount of sodium (salt) ingested, in contrast in Dobrogea and Muntenia all the study population controls the amount of salt.

- 83.17% of the people included in the study practice animal protein restriction (fasting) - practiced in weekly stages, periodically and periods when no solid food is ingested. Most people following this pattern (rooted in religious customs) are in Transylvania for the cohorts studied.

- 43.69% of the subjects are non-smokers, which is an important protective factor (but it should be mentioned that in this percentage there are former smokers or passive smokers).

- Adequate sleep duration (more than 7 hours daily) and sleep quality are mentioned by 54.91% and 78.96% of the subjects respectively.

- eating habits with a cardiac protective profile are the consumption of fruits and vegetables daily, restriction of sugar intake, no alcohol consumption, no consumption of carbonated drinks, predominant consumption of white meat (chicken) mentioned by only 13.23% of the participants and black bread mentioned by only 12.22% of the participants

- 38.28% of patients have physical activity for more than 60 minutes daily

DISCUSSIONS

Limits of the study

1. Subjects with cardiovascular disease in the study are older than the general population averages (the cardiac population has undergone a degree of selection).

2. The patients are admitted to a hospital for tertiary prevention of the underlying disease, they are patients who attach importance to health status, this fact limiting the degree of representation for the population

3. Cases with long term chronic evolution are overrepresented in the group and there is a systematic error of selective survival

4. The same category of patients was not included in the study if they were admitted before 2022

5. As the study group has a uniform distribution we used in the data processing the mean (not the median which is characteristic for non-uniform distribution and is not sensitive to higher values)

6. The use of variable mean data are characteristic for populations, we do not attribute characteristics to members of a group that they do not possess as individuals. Pre-prevention measures will be addressed accordingly to the population in question.

The data processing was done to be able to develop prevention strategies in the interest of the specific individual, not to standardize population characteristics and translate them to the individual thus decreasing their appropriateness.

CONCLUSIONS

We can conclude that even in the case of patients with proven cardiac morbidity, the application of preventive measures is only a desideratum because in fact exposure continues consciously (or unconsciously). Preventive measures can change the quality of life without changing the individual.

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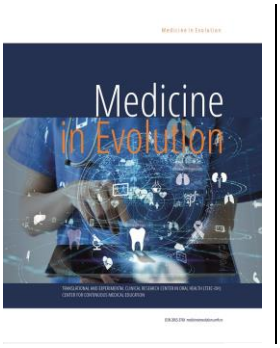
Multiple sclerosis in the context of rare diseases



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Received: 4 April 2024; Accepted: 20 June 2024; Published: 30 June 2024

Abstract

The study focuses on highlighting the causes that determine the appearance of multiple sclerosis (MS) and on describing the general characteristics of the disease such as pathophysiology or symptomatology, but also on identifying its treatment. An important component of the study refers to the needs and services of the person diagnosed with MS, respectively of their companion. Last but not least, a circumscription of the phenomenon in the Romanian space is considered here.

Keywords: multiple sclerosis, demyelination, axons, immunology, genetics

1. EPIDEMIOLOGY AND ETIOLOGY

Multiple sclerosis is thought to involve an interaction between genetic and environmental factors leading to an immunologically mediated inflammatory response in the central nervous system (CNS). Although immunologic abnormalities have been systematically reported, the relative role of each component of the immune response in mediating tissue destruction and the extent to which these changes are the cause or consequence of myelin damage remain to be established. There is compelling evidence for a genetic susceptibility to MS, and environmental influence on MS is suggested by variations in disease incidence and prevalence across geographic areas.

There is a clear pattern of latitudinal variation in MS prevalence. Epidemiological studies indicate that the prevalence of MS is high (> 30 per 100,000) among young adults in northern Europe, North America and Australasia, moderate (5-30 per 100,000) in southern Europe, southern USA and northern Australia, and is less prevalent in the East, Africa, South America and India. Combined data from epidemiological studies in the USA, UK, Australia and New Zealand show a strong association between latitude and MS prevalence.

MS mainly affects the white race, although it is also known to affect black immigrants living in Europe and North America. In Australia and New Zealand, MS is rarely seen in Aboriginal or Maori people, but it does occur in white people. In South Africa the disease occurs more often among English-speaking whites than among Africans, and is not found among them. Incidence decreases in individuals of northern European descent as we approach the tropics, suggesting that certain environments may be relatively protective. For example, in Australians of Northern European descent and in English-speaking South Africans, the frequency of MS is only half that of Northern Europeans. Age is also a factor in immigrant populations. The risk of MS has been shown to be higher for white, English-speaking South Africans who migrated in adulthood rather than in childhood.

Other evidence supporting genetic susceptibility is provided by epidemiological studies conducted in that setting among ethnic groups. Results of a 1973 study of individuals with MS in Israel showed that the disease was common among immigrants from Europe, and rare among immigrants from Afro-Asian countries. Similarly, immigrants from areas with low MS risk arriving in areas with high MS risk retained the low risk of the area of origin. Familial aggregation studies have shown that approximately 15% of individuals with MS have an affected relative. This risk increases to 1:50 for children of affected individuals and to 1:20 for their siblings. MS is 20-40 times more common in first-degree relatives, decreasing rapidly with the degree of kinship.

Other potential environmental risk factors in MS include infections, vaccinations, stress, climate, and diet. Among these, infection is often considered a presumptive causative agent, especially childhood viral infections. It has been suggested that in countries where the disease is relatively rare, early contact with the causative agent, most likely a virus, protects the population by making it immune. On the other hand, there is some evidence that viral diseases such as measles, mumps, and rubella contracted relatively late in childhood may be a factor in those at risk of developing the disease. In the past decade, several studies have provided preliminary data indicating that environmental triggers that are perceived by the individual as stressful (ex: a broken relationship, job loss) are associated with MS relapses. Evidence for other risk factors such as climate and diet is less compelling [1].

It would therefore appear that MS does not have a single cause. New episodes of demyelination are more likely to follow viral infections or stressful events, but no single trigger may be involved, suggesting that in the context of genetic susceptibility/predisposition, environmental influence and priming immunologically,

demyelination is a physiological response to many pathogens. To summarize, the epidemiological evidence implicates environmental factors, including psychosocial triggers, acting in the context of a genetic predisposition or childhood resistance manifesting as an altered immune response.

2. DISEASE PROCESS

Review of large databases related to patients with MS has provided valuable information related to its natural history. The clinical signs and symptoms of MS are different and several patterns can be identified: benign; relapsing-remitting (RR); a secondary progressive form (SP) and a primary progressive form (PP). The clinical onset in 80 – 85% of MS patients is manifested by subclinical neurological symptoms, either multifocal or anatomically discrete, which may initially disappear completely. This manifestation is often known as clinically isolated syndrome (SCI). Among patients with SCI, approximately 20% had optic nerve lesions, 45% had long tract signs and symptoms, 10% had brainstem syndrome, and 25% had multifocal abnormalities. There are no differences in predictive value between unifocal and multifocal presentation but there is a longer time to second episode in optic neuritis presentation than in all other brainstem or spinal cord presentations. After the onset of SCI, 70% of patients experience new episodes in which MS symptoms worsen and then gradually decrease in severity until the next attack. Patients enter the RR phase. RR episodes usually occur with random frequency, and for unpredictable periods, involving the same or different regions of the CNS. Recovery from these relapses may be incomplete. Over time the symptoms can increase in severity and the disability becomes more pronounced. This RR phase lasts an average of 20 years, being shorter for men and for individuals with MS onset at an older age. The rate and severity of disease progression in the RR phase can vary considerably between patients, with 20–30% of patients continuing to work 20–25 years after disease onset and having minimal cognitive impairment. However, in cases with frequent relapses, the chronically progressive form of the disease may develop. The patient is in the SP phase. The age at which individuals enter the SP phase is independent of the initial course/trajectory of the disease [2].

A small percentage of MS patients (approximately 10%) experience a benign course of MS after SCI; i.e. subsequent episodes are delayed by 5 - 10 years where they have minimal signs and symptoms with each episode. A course of benign MS is significantly associated with female sex, younger ages of onset, and absence of motor symptoms at presentation. On the other hand, about 10% of patients experience a clinical course called primary progressive which is characterized by a progressive accumulation of neurological deficits from the onset without relapses or improvements. This group of patients generally has an older age at disease onset and a lower female predominance than in the general MS population.

In population studies, at any given time, about one-third of individuals are in a quiescent phase of the disease and without significant disability, another third are slowly deteriorating, and the remainder are stable but disabled because they have had the disease for many years. MS generally has a greater impact on the quality of life rather than its duration, with life expectancy decreasing very little in MS patients. However, severely disabled individuals are four times more likely to die than the general population [3].

3. CLINICAL SYMPTOMATOLOGY

3.1. Sensory-motor impairments

Weakness in MS can develop gradually in one or more limbs, increasing with use of that limb and often described as a feeling of heaviness or clumsiness. Depending on the

location of the lesion, signs of an upper motor neuron injury may be present, while involvement of the cerebellum and its connections produces ataxic symptoms that usually occur in combination with corticospinal damage. Spinal demyelination causes progressive weakness in both legs. In individuals with extensive demyelination adjacent to dorsal root entry areas, lower motor neuron signs may be present.

People with MS who experience loss of muscle activation and control often have difficulty taking part in activities of daily living and recreational activities. This fact, in turn, leads to a gradual decrease in physical activity. Physical limitations have been shown to be positively correlated with physiological changes in people with MS, a process similar to that which occurs in healthy people who have had prolonged periods of inactivity [4].

Spasticity (along with fatigue and weakness) is one of the three most common physical signs and symptoms experienced by MS patients. Epidemiological studies show that spasticity is a significant problem for approximately 60-80% of people with MS and is one of the major contributors to the disability of this population. The most widely used definition of spasticity is probably that of Lance (1980): a motor disorder characterized by a rate-dependent increase in stretch reflexes (muscle tone), with exaggerated tendon reflexes resulting from hyperexcitability of the stretch reflex as a component of upper motor neuron syndrome. Increasingly, a distinction is made between resistance to passive movement due to reflex hyperactivity, and resistance resulting from increased mechanical stiffness. The Ashworth scale is the instrument commonly used to measure spasticity, although this scale cannot differentiate between intrinsic muscle stiffness and reflex hyperactivity. The increased resistance to passive movement may be caused by an increase in passive soft tissue stiffness, an increase in stiffness mediated by the stretch reflex, or an increase in intrinsic stiffness that reflects the stiffness of the contractile properties of the involved bridges [5].

Furthermore, passive, intrinsic, and reflex-mediated stretch responses in the ankle extensors and flexors of MS and healthy subjects were measured. The results suggested that spastic muscles in individuals with MS have increased non-reflexive stiffness (passive and intrinsic) and that reflex-mediated stiffness in the ankle extensors during a sustained voluntary contraction did not differ significantly from that of healthy subjects. However, in this study the authors did not directly investigate the passive properties of the muscles because the stiffness measurements were obtained from electrically stimulated muscles – the muscles were not relaxed. Furthermore, the authors examined stiffness at the ankle joint. Ankle stiffness is partly due to stiffness in the muscles but also in other structures that cross the ankle, such as ligaments. A method has recently been developed that allows direct measurement of the passive properties of the relaxed human gastrocnemius muscle. Using this method, it was shown that the passive properties of the gastrocnemius in people with MS (patients are still ambulatory and have spasticity) are no different from those of healthy people [6].

Altered sensation occurs at one stage or another in all individuals with MS. Sensory symptoms such as paresthesia of a limb or face with numbness, tingling or burning sensation may be the first clinical signs. Due to the unpredictable nature of the disease, sensory impairments can affect one limb, one part of the body, or all four limbs. Involvement of the posterior columns of the spinal cord results in disturbances of position and sense of movement, sense of vibration and sense of touch. In MS, the sense of temperature can also be affected, causing the symptoms of sensitivity to heat or cold. Pain is also a common symptom in people with MS. Pain can be a direct result of demyelination and loss of axons (neurogenic pain) or a secondary consequence of other symptoms of MS (nociceptive pain). Several studies have determined that the incidence of pain in any one month period is between 60 – 80% of MS patients. Chronic pain, defined as pain lasting 3 months, is experienced by 65-70% of people with MS. Of these, 60% had chronic dysesthetic pain and 70% experienced episodic

pain. The prevalence of pain tends to increase with age and the number of years since the onset of the disease. Some studies have noted a higher prevalence of pain in women with MS and in people who have moderate to severe mobility restrictions as measured by the Expanded Disability Status Scale (EDSS). However, it is important to note that pain affects people with MS at all stages of the disease, including newly diagnosed people [7].

3.2. Cognitive and affective symptoms

The results of recent reviews suggest that the effect of MS on cognition is both general, all cognitive domains are affected, and specific, effects are greater for the domains of mood, motor functioning, memory or learning. It has been estimated that 40 – 60% of MS patients suffer from memory and learning deficits even in the early stages of the disease. Some clinical observations suggest that slowed mental processing makes it difficult for patients with attention deficits to understand all aspects of a verbal message, especially when it is long, complicated, and delivered quickly in a complex environment. When patients cannot remember what was said or what was happening around them, they and their families interpret this situation more as a memory problem rather than one of slowed information processing. Once patients, their families and professionals understand the nature of the problem, increased attention to how, when and where the information, message and organized activities are delivered can greatly improve patients' 'memory' [8].

3.3. Personality and psychosocial behaviour

In addition to cognitive and affective symptoms, MS can also be associated with a number of behavioral changes. For example, changes in personality, preferences and attitudes tend to accompany attention deficits and distractibility. Individuals with MS describe feelings of mental block, dissatisfaction with themselves, and diminished spontaneity in actions. Individuals with MS have been described as prone to 'euphoria'. Euphoria can be defined as a fixed state of well-being in which patients may express the belief that all is well and that they are physically fit and healthy despite the presence of considerable physical disability. The term euphoria is thus inappropriate when associated with individuals with MS who are trying to face the future with courage. Real euphoria is a relatively rare phenomenon, typically associated with advanced stages of the disease in forms involving the frontal lobes [9].

Depression is said to be more common in MS patients than in those with similar medical disorders. The lifetime risk of depression among people with MS has been estimated at 50%, compared to a risk of 10–15% in the general population. Although this fact is not surprising, and considering that depression is an appropriate reaction to what can be a devastating illness, the occurrence of depression does not appear to be related to the severity of the illness. Recent research suggests that depression develops after the onset of illness and is fairly stable longitudinally. Due to the stability of depression in MS and the fact that it is unlikely to go into remission without treatment, it can have devastating long-term consequences for the patient's daily functioning. Recent work has suggested that anxiety disorders are also common among MS patients, but are often overlooked and poorly treated. Risk factors include female sex, comorbidity of depression diagnosis and limited social support. Fortunately, anxiety disorders are a treatable cause of disability in MS [10].

On the other hand, stress can exacerbate symptoms and precipitate the onset. There is increasing evidence that stressful life events are associated with exacerbations in MS. A systematic meta-analysis of 14 studies identified consistent associations between stressful life events and subsequent exacerbations in MS but no link with specific stressors to exacerbations. From several clinical studies and animal models, it has been suggested that stress may be involved in the reduced sensitivity in glucocorticoid and beta-adrenergic modulation, which may exacerbate the overridden inflammation in MS. The roles of the two

major stress-response systems, the hypothalamic-pituitary-adrenal axis and the autonomic nervous system, are topics of interest in current stress research [11].

3.4. Special senses

Involvement of the visual pathway is very common. The episodic visual blurring so often described by patients early in the disease can worsen later, with some patients losing vision in one eye or experiencing double vision. Deafness is observed more often in patients in whom the disease is stabilized. Acute vestibular symptoms with acute positional vertigo (an illusion of movement in the interaction between the person and the environment), vomiting, ataxia, and headache are common in cases with acute brainstem demyelination. Other senses such as taste and smell may also be involved.

Fatigue is one of the most common symptoms reported in MS, yet the least understood. It can be more debilitating than any of the milder symptoms because it compromises a person's efficiency and sense of well-being. Individuals with MS report that fatigue generally occurs daily, negatively impacts social function, and worsens with temperature. Individuals with MS, their families, and friends may misjudge the impact of fatigue, mistaking it for laziness. Working individuals complain that they have no energy for recreational activities because they need to rest on weekends. Furthermore, fatigue is one of the two major causes of unemployment among individuals with MS. Recent data from an ongoing longitudinal study (Multiple Sclerosis Society of Australia, 1990) involving more than 3,000 patients in Australia show that fatigue and mobility deficits are the main reasons for patients missing work. Many patients are unable to engage actively for more than a few hours without fatigue, and they tend to limit their activity to avoid fatigue and overheating. This creates a vicious circle, with low physical and social activity having a detrimental effect [12].

Four types of fatigue have been described: fatigue following physical exertion, experienced by the general population and disappearing after a period of rest; nervous impulse fatigue following extreme activity which, again, disappears with rest; fatigue related to depression, and associated with sleep disturbances, low self-esteem and mood swings; and malaise, or an abnormal feeling of tiredness of unknown etiology. All four types described can contribute to the fatigue shown in MS. However, the feeling of fatigue or malaise is poorly understood and people with MS seem to be particularly vulnerable to it. However, an additional cause of fatigue is the slowing of nerve impulse transmission on partially demyelinated axons.

Krupp and colleagues designed the Fatigue Severity Scale (FSS), a nine-item questionnaire in which patients rate agreement with statements that distinguish between fatigue in MS and healthy controls. This scale has been shown to have acceptable internal consistency, stability over time, and to reflect the effects of fatigue on daily functioning. Interestingly, Krupp and co-workers found that fatigue severity did not significantly correlate with depression in individuals with MS, suggesting that depression and fatigue are separate, albeit overlapping, entities. Another scale used to measure fatigue in MS is the Modified Fatigue Impact Scale or MFIS. This is a list of 21 statements developed by the National MS Society of the United States, derived from the original 40-item Fatigue Impact Scale. It has been classified as a multidimensional scale and is intended to analyse different aspects of fatigue, measuring the impact on physical, cognitive and psychosocial functioning [10].

Heat, in the form of hot water, overheated rooms, immersion in hot water, and body temperature after strenuous physical activity, increases the level of fatigue and other symptoms of MS, tending to weaken the individual. Increased temperature sensitivity, with reduced safety factor for conduction in partially demyelinated axons, may explain the temporary increase in severity of sensory symptoms immediately after exercise, but is unlikely to cause changes in the sense of fatigue and functional impairment. On the other

hand, the cold might help improve performance. In laboratory models and in a few small studies in people with MS, cooling nerve fibers has been shown to improve the speed at which messages are transmitted along the nerves, and as a result improve symptoms [13].

3.5. Autonomous involvement

Autonomic involvement occurs in most patients with MS. Bladder symptoms are more common in women than in men. Impotence may be prevalent in men. Sphincter control may be lost or impaired. Disinhibition causes the urgency and frequency that lead to incontinence. Bowel incontinence may also be present. Cardiovascular autonomic dysfunction is usually of minor clinical importance. However, orthostatic intolerance may be present in approximately 50% of patients and may be easily detected by routine measurements of resting or standing heart rate and blood pressure [14].

4. MEDICAL MANAGEMENT

There is currently no single laboratory-supported diagnostic test for MS. The diagnosis of MS requires the use of both clinical and paraclinical criteria. The latter involves information obtained by MRI, motor evoked potentials (MEPs) and cerebrospinal fluid (CSF) analysis. Investigations such as MRI, CSF analysis in individuals with MS are used to document the position and extent of lesions, to confirm the presence of intrathecal inflammation, and to rule out conditions that could mimic demyelinating disease. MRI is believed to have increased the accuracy of diagnosing MS from 60% to 90% and appears to be a more sensitive indicator of disease activity than clinical course or neurological examination [15].

New criteria for the diagnosis of MS, integrating MRI assessment with other clinical and paraclinical methods (McDonald criteria), were introduced in 2001. Since then, these criteria have been evaluated and used extensively. The 2005 revisions of the McDonald diagnostic criteria for MS are aimed at simplification and faster diagnosis while maintaining adequate sensitivity and specificity, and are now widely accepted by the neurological community.

Medical treatments in MS can be divided into several categories. The first category involves the use of drug treatments that have an impact on the underlying disease (disease-modifying therapies) that target a certain aspect of the inflammatory process of MS in order to prevent the inflammation that causes relapses. The second category involves drugs that help decrease the severity and duration of MS relapses (steroids) that aim to eliminate inflammation. The third category involves drugs that help alleviate many of the symptoms associated with MS, such as fatigue, spasticity, and pain, to name a few.

A larger body of experimental evidence implicating immunologically mediated processes in the activation of MS progression has led to the search for immunotherapies that not only eliminate acute relapses but also modify disease progression. Consequently, many extensively clinically tested disease-modifying drugs (DMDs) or immunomodulatory treatments for MS have been developed. To date, there is sufficient data to support that the use of DMDs may have an effect in slowing the accumulation of disability over time. Some of these drugs are interferon beta-1a (Avonex or Rebif), interferon beta-1b (Betaseron), glatiramer acetate (Cepaxone), and most recently natalizumab (Tysabri). Each of these drugs works to block different inflammatory pathways, and comparative studies have shown that none is more effective than the others. However, treatment may not be an option for every person with MS. DMDs are most effective in people with RR type MS, while there is no treatment for PP type. Additionally, drug resistance is another concern when using DMDs for long periods of time.

A short course of intravenous methylprednisolone is often used to treat relapses in MS. But there is still no evidence that it influences the final outcomes of the disease, although

it might speed up a stage of remission when given during a relapse. In many cases, after a series of intravenous methylprednisolone, oral prednisone is prescribed and gradually withdrawn. Recent observations suggest that oral prednisone after intravenous methylprednisolone treatment for MS relapse does not lead to an improved neurological outcome compared to intravenous methylprednisolone alone after 12 months [15].

Medicines such as baclofen and diazepam may be helpful in reducing hyperactive reflexes (spasticity). When administered to individuals suffering from severe flexor and abductor spasms associated with spinal cord injury, these agents may reduce hyperactivity sufficiently to allow the individual to stand or sit more comfortably, or be cared for more easily. However, oral medications like these, especially in high doses, can cause severe side effects such as general muscle weakness. Studies of botulinum toxin to relieve abductor spasms report improvement in spasticity in the lower extremities and a significant increase in passive range of motion in the wrists, allowing for easier care and rehabilitation, with no signs of significant side effects from the toxin.

5. MULTIPLE SCLEROSIS IN ROMANIA

According to specialists from the Quality of Life Research Institute, the concept of quality of life refers to the well-being of people in society and indicates the extent to which life is good for them. Being a multidimensional concept, it includes aspects of life such as material living conditions, health, housing, workplace, family life, balance between private and professional life, subjective well-being. Although it is fundamentally focused on the person and the circumstances of his life, the quality of life is closely correlated with the relationship of the person and the community/society in which he lives (e.g. trust in people, institutions), as well as with some elements of society as a whole (eg the quality of public services). Practically, the study of the quality of life gives people "a voice" through which they can evaluate aspects of their lives in the institutionalized framework of science [16].

As Zamfir C appreciates, the quality of life is ensured by all the conditions that offer the person the possibility of a harmonious development, of achieving a full, satisfying life. Starting from this context, we must mention the fact that the research carried out by us takes into account a series of indicators defined by Zamfir C such as: the person himself (health, the ability to establish relationships.); family (health, relationships, free time); the habitat (dwelling, neighborhood, city, neighborhood); work (profession, organization, colleagues); free time, possibilities for personal development (possibilities to develop knowledge, talents, accessibility of education); tone of life (cheerfulness, interesting life); human environment (trust, respect); economic resources; the social environment (the quality of the organization of social life, fairness, equity, safety, the functioning of institutions); economic services (transport, food supply, quality of goods); social services (education, healthcare, administration); participation (the possibility to change things, to have a say) [17].

An important tool for the present research, which is the basis for the construction of the questionnaire and the interview guide, is the Quality of Life Index (World Health Organization Quality of Life WHOQOL) developed by the World Health Organization. It includes six dimensions of quality of life: the physical dimension, the psychological dimension, the level of independence, social relations, the environment and the spiritual dimension [18].

Multiple sclerosis is an autoimmune disease that predominantly affects young adults (20-50 years old), especially women, characterized by chronic inflammation, demyelination and gliosis. The fundamental characteristic is the dissemination of lesions in time and space [19].

In Romania, statistically speaking, multiple sclerosis causes the greatest disability among young adults, affecting more than 7,500 patients in 2016, of which 5,000 accessed the public health system entering the national program. The specialized literature shows a significant reduction in the life span of MS patients between 6-13 years compared to a healthy person. (The "Impact of multiple sclerosis in Romania" study, carried out by EY Romania for Roche Romania)" In our country, there are 13 functional medical units distributed in seven university cities that provide treatment for MS patients:

Bucharest:

- Bucharest University Emergency Hospital - Neurology Clinic;
- Central Military Emergency Hospital "Dr. Carol Davila" Bucharest - Neurology Clinic;
- Colentina Clinical Hospital - Neurology Clinic;
- Elias University Clinical Hospital - Neurology Clinic;
- Fundeni Clinical Institute - Neurology Clinic;
- Clinical Hospital of Psychiatry "Prof. Dr. Alexandru Obregia" Bucharest;
- "Prof. Agrippa Ionescu" Emergency Hospital - Neurology Clinic.

Târgu Mureş:

- Târgu Mureş County Emergency Clinical Hospital.

Iaşi:

- Iaşi Clinical Recovery Hospital

Timiş:

- Timiş County Emergency Clinical Hospital - Neurology Clinic.

Cluj:

- Cluj County Emergency Clinical Hospital - Neurology Clinic.

Oradea:

- Oradea County Emergency Clinical Hospital

Dolj, Craiova:

- Clinical Neuropsychiatry Hospital" [20].

The main problems encountered by MS patients in Romanian society would be: the label placed on them, lack of medication, poor communication between doctors and patients, insufficient treatment centers, bureaucracy in the public health system, lack of useful information about the management of the disease, high financial costs, the reduced number of private providers of social services. The direct costs for 2016 are approximately 272 million RON (60 million EUR) in total or 56,500 RON (12,500 EUR) / year / per patient. The most important cost category is drug treatment, which represents 88% of the total direct costs. Products settled through the national program for MS represent 5.7% of the budget for drugs for high-risk chronic diseases, used in national programs with a curative purpose, reported by CNAS in the reference year of the study [21].

In addition to early detection of the disease and administration of treatment, therapies play a fundamental role in the lives of patients diagnosed with MS. Diagnosed young adults have completed their studies and most are working. After diagnosis, many continue their work at work until the disease progresses and as it progresses, the physical disabilities also increase, thus forcing them to retire. Patients require professional rehabilitation therapies such as physical therapy or occupational therapy in order to maintain dexterity and autonomy. Patients need to develop certain occupations with which to occupy their free time in a pleasant and useful way [22].

Both MS patients and their family need support and specialized social services provided by public or private institutions that have specialized equipment and trained specialists. When the motor disability advances, the MS patient needs services such as physiotherapy and kinesitherapy. Through these services, motor skills are regained, mobility and elasticity are maintained, muscle tone is maintained, fatigue is reduced, memory is

cultivated. Many sufferers have a permanent disability which in countless cases is severe. In this regard, occupational therapy is recommended, which ensures the increase of functional skills, well-being, restoration and gaining independence from household activities such as dressing, feeding, toileting. Psychological counseling of the patient and the family is very important. The adaptation of the family and the patient to the conditions of the disease can be improved by a specialist through group therapies or individual therapies. In training and counseling on the rights and facilities that people with disabilities have from the state, on treatment, information on disease management, procurement of assistive equipment plays an important role to improve the quality of life of the patient [22].

It has been statistically proven that patients who live with their family adapt much more easily to the conditions of the disease and present fewer physical disabilities compared to those who live alone or are isolated from their family. The necessary costs are high for the maintenance of a patient diagnosed with MS, and the family becomes burdened and certain problems arise. These costs increase according to the degree of disability. The first expenses occur with diagnosis, later expenses occur with medical care and recovery. It is very important for the sufferer's family how they manage their financial resources, and they must take into account both the medical costs and the subsequent benefits and improvement in health that result from them. Another dysfunction at the family level is the sufferer's loss of autonomy and partial or total dependence on a family member. Family members go through a mental imbalance alongside the one diagnosed and through a period of accommodation [22].

For this purpose, the Multiple Sclerosis Society of Romania, a non-governmental federation, was founded in 1995. The mission of the federation is to coordinate the national MS movement in order to facilitate certain laws to improve the quality of life of patients through the active involvement of NGOs and the development of partnerships and public policies at the national and international level. To improve collaboration with public authorities; non-governmental organizations; medical and social providers for early disease detection; for the provision of quality social services in order to maintain autonomy and information about the management of the disease and the rights of persons with disabilities; providing support groups for both the patient and the relative. Following the steps taken and following the collaboration with the Ministry of Health and CNAS, the number of patients included in the national program has increased substantially. Within the federation, local organizations and SM day centers were established in counties such as: Alba, Bihor, Năsăud, Botoşani, Bistrița, Braşov, Constanta, Bucharest, Dolj, Ilfov, Hunedoara, Neamț, Sibiu, Suceava, Prahova, Timiş, Dâmbovița, Vâlcea [23].

"The causes of multiple sclerosis are unknown, but most experts agree that they are a combination of a person's genetic predisposition, an underactive immune system, and one or more environmental factors. Possible factors would be:

- Epstein-Barr virus, Chlamydia Pneumoniae;
- Infections in early childhood (measles, chicken pox, scarlet fever);
- Smoking;
- Low level of vitamin D early in life;
- Stress;
- Genetic background;
- Geographical area (the risk of developing MS is higher in regions further away from Ecuador - for example in northern USA, Canada and southern Australia).

A theory would be that individuals who grow up as close to the Equator as possible have more exposure to sunlight which stimulates the body to produce more vitamin D, which can had a protective effect'' [22].

Because MS can cause inflammation and demyelination in the central nervous system, the list of possible symptoms is very long. Fortunately, however, most people never experience all of these symptoms, with many exhibiting only a few. Possible symptoms, which can range from mild to severe, include fatigue, vision problems, difficulty walking (caused by balance problems, weakness, stiffness, numbness in the legs), bowel and bladder changes, sexual problems, pain and other sensory changes, tremors, problems with speaking and swallowing, depression and other mood disorders, and problems with thinking and memory. Any of these symptoms can be the first sign of MS, and the challenge for patients is that it is impossible to predict which symptoms will appear, how long they will last or how severe they will be [19].

After the onset of the disease, patients experience a series of changes in cognitive functions and behavior. In MS, disturbances occur in the following aspects of mental life: neurocognitive function; resistance to effort (fatigue); emotions; personality.

A very relevant aspect in the present study is the social life of people diagnosed with MS. We considered that the respondents' social relationships represent important indicators of their quality of life. Our opinion is based on the fact that "(...) social means different types of association, of life in common, even if we are talking about different social groups in terms of size and typology, institutions, organizations or social communities. Any social unit involves a special network between members, status networks, social groups and a certain ranking and structure of component elements" [24].

CONCLUSIONS

Finally, an important component of the study refers to the needs and services of the person diagnosed with MS, respectively of their companion. Education, vocational training and access to the labor market are some aspects captured in the research instruments. From a theoretical perspective, our point of view is based on the fact that "equal opportunities in education means, first of all, equal access to educational resources, a characteristic with a direct effect on school results. This is an important area under the attention of educational policies, considering the fact that school failure is one of the fundamental sources of social exclusion and compromising the social cohesion and human capital of a nation.

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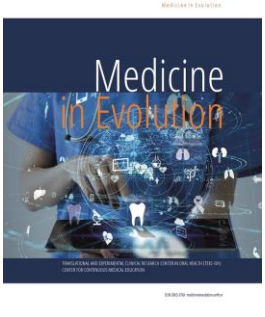
The impact of a rehabilitation program on static, locomotion, and balance impairments in COPD patients



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Received: 4 May 2024; Accepted: 18 June 2024; Published: 30 June 2024

Abstract

Aim and Objectives: Investigating balance impairments and developing a structured rehabilitation plan can significantly improve the safety and reduce the risk of falls in COPD patients.

Material and methods: The study included ten patients with severe to very severe COPD who comprised the intervention group, and ten mild COPD patients who comprised the control group, with similar demographic data. Tests were used to assess balance and gait.

Results: The intervention group was associated with worse outcomes in the initial evaluation of the balance tests, consisting of SLS, TUG, and 6MWT. However, at the end of the rehabilitation program, the intervention group registered an increase in SLS time and 6MWT distance and a decrease in TUG test time.

Conclusions: Following a 3-week rehabilitation program, patients with severe to very severe COPD decreased the risk of falls and showed a higher independence rate.

Keywords: COPD, balance impairment, abnormal gait, rehabilitation

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressively worsening and life-threatening condition that affects an estimated 251 million people worldwide, including more than 15 million people in the United States [1]. It ranks as the third leading cause of death in the US, contributing significantly to impaired mobility, disability, and reduced quality of life. People with COPD often experience decreased strength, endurance, and balance, along with changes in gait, all of which further diminish their quality of life [1].

In addition to these physical impairments, a significant percentage (57.6%) of people with COPD also live with considerable cognitive deficits. The presence of COPD is linked to a high risk of cognitive decline over time, even among adults with mild COPD [1].

Impairments in cognitive function are related to changes in gait quality, reduced balance, and increased incidence of falls and injuries. In people with cognitive impairment, there is a significant association between impaired cognitive function and reduced or slowed walking speed [2].

Aim and objectives

While the impact of COPD on lung function is well established, the interaction between statics, locomotion, and balance is still poorly studied. Further research may reveal how these factors influence each other, leading to a more comprehensive approach to patient management.

Current COPD management focuses mainly on respiratory symptoms. However, tackling static, locomotion, and balance problems require specific interventions. Research can pave the way for personalized training programs, assistive devices, and rehabilitation strategies tailored to individual patient needs and limitations.

Falls are a major concern for COPD patients, often leading to serious injury and reduced quality of life. Investigating balance deficiencies and developing a structured rehabilitation plan can improve safety and postural control. Early detection of problems with statics, locomotion, and balance can allow prompt intervention before functional limitations become severe.

Research into static, locomotion, and balance impairments in COPD patients has immense potential to improve their balance, reduce healthcare costs, and advance scientific and clinical understanding of the disease.

MATERIALS AND METHODS

The study included ten patients with severe to very severe COPD, who constituted the intervention group, and 10 patients with mild COPD, who constituted the control group. Both patients and control subjects were recruited from the "Doctor Victor Babeş" Clinical Hospital for Infectious Diseases and Pneumophthisiology Timisoara to participate in this study.

Criteria for inclusion of patients with COPD consisted of a primary diagnosis of COPD from severe to very severe, according to the norms and criteria defined by the Global Initiative for Chronic Obstructive Lung Disease (GOLD), which require inclusion of patients with a Peak Expiratory Volume per Second (FEV1) rate between 30-50% for severe COPD and below 30% for very severe COPD, reliance on non-invasive ventilation, cessation of tobacco use, and ability to remain unassisted in orthostatic and walking conditions.

Subjects in the control group consisted of patients with mild COPD with an FEV1 rate of 80% or above and were able to sustain body weight in orthostatic and walking conditions.

Patients in the intervention group followed a three-week, individualized rehabilitation program focused on muscle strengthening and improved respiratory function, coordination, balance, proprioception, and gait.

The rehabilitation program was conducted by a team of physiotherapists specialized in pulmonary rehabilitation, with a frequency of 2 training sessions per day, five days per week, for three weeks. For the physical training to be effective, the total training load surpassed the demands encountered in daily life to improve aerobic capacity and muscular strength, progressing as they improve.

The rehabilitation program included resistance training, which aimed to condition the muscles responsible for locomotion and increase cardiorespiratory capacity to allow an increase in physical activity, simultaneously with an improvement in dyspnoea and fatigue, with an intensity of 60% of maximum work rate, a duration of between 10 to 20 minutes initially, gradually increasing to 25-30 minutes, a frequency of 5 sessions per week and a limit of perceived exertion of 4 to 6 on the modified Borg scale.

Interval training has also been included in the rehabilitation program, with the advantage of performing repeated bouts of higher intensity exercise, but over a shorter period of time than resistance training, with an intensity of 70% of the maximum work rate, gradually added up to 90-100%, exercise intensity of 30 seconds with 30 seconds pause, or 20 seconds with 40 seconds of rest, depending on the patient's characteristics for a total of 10 minutes, gradually increased to 15-20 minutes for a total of 5 sessions per week.

The final component of the rehabilitation program consisted of strength training, also recommended by the American College of Sports Medicine, for increasing muscle strength in adults. It consisted of 1-2 sets with 8 to 12 repetitions at a frequency of 5 sessions per week, with an initial load of 60%-70% of individual maximal repetition potential gradually increased to 100% [3].

The BTS P-Walk sensory platform was used on the intervention and control groups to identify balance and gait disturbances and help prepare the rehabilitation plan. The BTS P-Walk facilitates assessing plantar pressure and force distribution in both static and dynamic stages, providing quantitative information about plantar support to identify plantar overloads, rotations, and postural asymmetries. This type of analysis allows for assessing the patient's level of balance by identifying the COG (center of gravity) position and quantifying the postural sway of the patient in an orthostatic position.

Patients performed both on the first day of training and at the end of the rehabilitation program a series of tests to assess aerobic capacity, static balance, and general mobility. The tests used were the 6-minute walk test (6MWT), Single-Leg Stance (SLS), and Timed Up-and-Go (TUG).

RESULTS

The analysis of data and statistical results was carried out using IBM SPSS Statistics software, which evaluated the results of the intervention group both at the beginning and at the end of the rehabilitation program, as opposed to the control group, which was only evaluated initially, as they did not undergo an intervention program.

Following the initial test of the distribution of stepping time and plantar area using the BTS P-Walk plate, the differences recorded between the groups were expressed in Table I:

Table 1. Results of initial testing of foot pressures and forces

Test	Intervention	Control
Left lower limb stepping time	1770,8 ms	1072,8 ms
Right lower limb stepping time	1438 ms	1086,7 ms

Difference in stepping time	327,8 ms	88,2 ms
Area covered by the left lower limb	233,9 cm^2	155,8 cm^2
Area covered by the right lower limb	188,7 cm^2	170,6 cm^2
Difference in area covered	48,2 cm^2	17,3 cm^2

Following the evaluation, the statistical differences of the recorded measurements in the Independent Sample T-test, were:

- Difference in left lower limb stepping time between groups*
- p=0.001
- Right lower limb stepping time*
- p= 0.05
- Difference in stepping time*
- p= 0,01

- Area covered by the left lower limb*
- p= 0,02
- Area covered by the right lower limb
- p= 0,43
- Difference in area covered*
- p= 0,05

*Statistically significant difference = $p < 0.05$

In the initial assessment of the SLS test, the intervention group had lower values of time spent maintaining an orthostatic position on the dominant lower limb (16.5 seconds) compared to the control group (55.2 seconds). The statistical difference was p=0.01, thus demonstrating a statistically significant difference between the two groups.

In the initial assessment of the TUG test, the intervention group had higher values of execution times (higher times correlated with greater difficulty in maintaining balance) compared to the control group (19 seconds vs. 8.9 seconds). The statistical difference being

p = 0.003, thus demonstrating a statistically significant difference between the two groups.

Also, in the initial assessment, the intervention group showed lower values of the distance covered in the 6MWT, expressed in meters (m), as well as the final percentage, with an average of 247 m and 58%, compared to the control group, which recorded an average of 440 m and 92%, the statistical difference being p = 0.01 and p = 0.03 in the percentage difference, respectively, demonstrating the existence of a statistically significant difference between the two groups.

At the end of the rehabilitation program, the intervention group repeated the tests to identify the program's impact on static and dynamic balance and aerobic capacity. Thus, compared to the baseline, the intervention group showed an increase in the time to maintain balance on the dominant lower limb in the SLS test, with an average of 22.7 seconds compared to the baseline of 16.5 seconds. The statistical difference between baseline and end-stage was p = 0.02.

At the second evaluation of the TUG test, the intervention group had lower execution time values, with an average of 15.4 seconds, compared to the initial 19 seconds. The statistical difference recorded p= 0.001 demonstrates a statistically significant difference between the two stages.

At the end of the rehabilitation program, the intervention group had a higher mean distance and percentage covered in the 6MWT, with an average of 284 m and 68%, compared to 247 m and 58% in the initial evaluation. The statistical difference was p = 0.03 and 0.02 in

percentage difference, respectively, demonstrating a statistically significant difference between the two evaluations.

DISCUSSIONS

The study aimed to demonstrate that people with severe to very severe COPD have impairments in both balance and gait compared to mild COPD patients. Furthermore, the objective was to demonstrate that a structured rehabilitation program significantly improves balance and gait among patients with severe to very severe COPD compared to those without such an intervention. Results suggest that interventions focused on skeletal and respiratory muscle groups offer potential benefits in postural control and dynamic balance, thus mitigating the risk of falls for people with COPD.

Initially, significant differences were observed in the TUG and SLS tests, with the intervention group showing a longer completion time for the TUG test and a shorter time for the SLS compared to the control group.

However, following the 3-week rehabilitation program, the intervention group demonstrated a decrease in TUG test completion time and an improvement in SLS test completion time. These results are consistent with previous investigations by other authors [4,5].

Beauchamp et al. identified an increase in lower limb musculature and gait speed, associating these results with improvement in TUG test scores within the same group before and after a rehabilitation program [4].

Similarly, Marques et al. observed a reduction in TUG completion time following a rehabilitation program in the intervention group, noting increased gait speed and improved proprioceptive coordination [5].

The SLS test results are also consistent with Mkacher et al. who recorded a significant difference in test completion time following an extended rehabilitation program, which correlated with a decreased risk of destabilization and falls [6].

Our results are in line with the findings of Kerti et al., who identified an increase in aerobic capacity in terms of distance covered in the 6-minute walk test between their intervention group (undergoing pulmonary rehabilitation and inspiratory muscle training) and the control group (undergoing pulmonary rehabilitation only) after a 4-week rehabilitation program.

Patients in the intervention group initially had a longer mean walking time (1604ms vs. 1079ms) and a larger base of support (211cm2 vs. 163cm2) compared to those in the control group, indicating a less flexible and adaptive movement pattern, factors often associated with a higher risk of falling.

The prolonged step time and increased size of the base of support observed among the severe to very severe COPD patients in this study suggests a possible mechanism that could explain, at least in part, why this population has a higher risk of falls.

The study had some limitations. Firstly, a restricted time frame for accessing and using the BTS P-Walk plates prevented us from evaluating plantar distributions after the rehabilitation program. Secondly, the rehabilitation program was conducted over only three weeks. It included a relatively small sample size, thus requiring further analysis to determine the lasting impact of muscle and balance training on patients with COPD. Finally, the inclusion criteria exclusively targeted COPD patients with severe to very severe airflow limitation, which constrained the overall generalizability of our findings. Further studies involving larger cohorts of COPD patients are warranted to validate these results.

CONCLUSIONS

Our results indicate that following a 3-week rehabilitation program incorporating aerobic, strength, and balance exercises effectively improves balance control in static and dynamic movements in patients with severe to very severe COPD, with a reduced risk of falls.

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Access to health assessment services for confirmed COVID-19 patients in Bihor County, Romania

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Received: 5 March 2024; Accepted: 25 June 2024; Published: 30 June 2024

Abstract

Aim and objective: This study presents the usefulness of a geographical information system to identify issues related to geographical access of COVID-19 confirmed individuals to established assessment services, in Bihor County, Romania. Material and method: Using the QGIS application, a geographic information system (GIS) was created with the following layers: the centroid of county localities, the assessment centres of confirmed cases, the corresponding 30-minute and 60-minute intervals for vehicle travel time from the localities to the assessment centre. Results: Determination of travel time (personal car or ambulance) from localities to an assessment centre was performed using isochrones for 30 minutes and 60 minutes. The ORS Tools plugin was used to plot the isochrones as a map. Conclusions: These analyses performed may provide key information for the development of health policies that promote safety and well-being in relation to the risks associated with COVID-19. Data are provided on areas with reduced access to healthcare resources.

Keywords: COVID-19, healthcare accessibility, isochrones

INTRODUCTION

Coronaviruses are a group of RNA viruses, named after the appearance of the outer surface, resembling a crown [1]. These viruses are a group that predominantly affect vertebrates. The novel SARS-CoV-2 coronavirus was first isolated in Wuhan from the lower respiratory tract of patients with unexplained pneumonia in 2019 [2]. There have been two new coronavirus outbreaks in the past. In 2002-2003, there was an outbreak of severe acute respiratory syndrome (SARS) caused by SARS-CoV. Another SARS outbreak occurred between 2012, which was named Middle East Respiratory Syndrome (MERS). MERS was caused by MERS-CoV. The current SARS very similar to SARS-CoV (in structure and pathogenicity) is called SARS-CoV-2 [3, 4]. Clinical manifestations are variable; clinical signs of influenza are present in about half of cases and lower respiratory tract infections occur in only 10-15%. Complications occurring in severe cases of SARS-CoV-2 infection are acute respiratory distress syndrome, disseminated intravascular coagulation and even death.

Since the beginning of the COVID-19 pandemic (March 11, 2020), all countries have been registered a large numbers of cases and they have faced problems related to the accessibility of the population to health services. A decisive factor in disease treatment is the distance to the healthcare provider.

Bihor County is located in the north-western part of Romania and has a population of 612,756 inhabitants. From the beginning of the pandemic until 31.01.2022, 67,272 cases of COVID-19 infection have been confirmed [5]. National health legislation has led to the establishment in January 2022 of nine health assessment centres for patients confirmed with SARS-CoV-2 [5].

Aim and objectives

Two objectives of this study were established. The first one is to present the usefullness of a geographical information system and to identify issues related to geographical access of COVID-19 confirmed individuals to established assessment services. The second purpose is to identify accessibility to health services assessment for COVID-19 by identifying the travel distance from the county localities to the nearest assessment center by setting time limits (30 minutes, 60 minutes) to count the number of localities in each category.

MATERIAL AND METHODS

Isochrones are timelines that are equally distant from a given geographical location [6]. Distance refers to travel time and not to physical distance [7]. Using the QGIS application (https://www.qgis.org/), a geographic information system (GIS) was created with the following layers: the Bihor County boundary, the centroid for the 454 county localities and georeferenced county addresses, 9 assessment centres. The determination of travel time by vehicle (personal, car, or ambulance) from localities to an assessment center was performed using isochrones for 30 minutes and 60 minutes. The ORS Tools plugin (https://openrouteservice.org/) was used to plot the isochrones. By performing vector operations to dissolve each isochron into a single layer (30 minutes and 60 minutes respectively) and using the tool to count points in a polygon, the number of localities for which the travel distance to an assessment center is less than 30 minutes, was obtained between 30 and 60 minutes and more than 60 minutes. In Bihor County, there are 101 administrative-territorial units with 454 localities (4 municipalities, 7 towns, and 91 communes with their villages).

RESULTS

From the determinations made it results that the population of 362 localities (79.74%) in Bihor County have access to specialized medical services for the evaluation of patients with COVID-19 in less than 30 minutes. A trip within the 30-60 minutes time interval is necessary for the population in 20% of the localities of the county. The time of more than 60 minutes is characteristic for the population in one locality (Table I).

Table I. Accessibility to health services according to travel time

Travel time	Locality Nr.	Percentage (%)
t < 30 min.	362	79,74
30<t<60 min	91	20,04
t >60 min	1	0,22

The isochrons corresponding to the travel time (30 minutes and 60 minutes) from Bihor County localities to an evaluation center are shown in Figure 1.

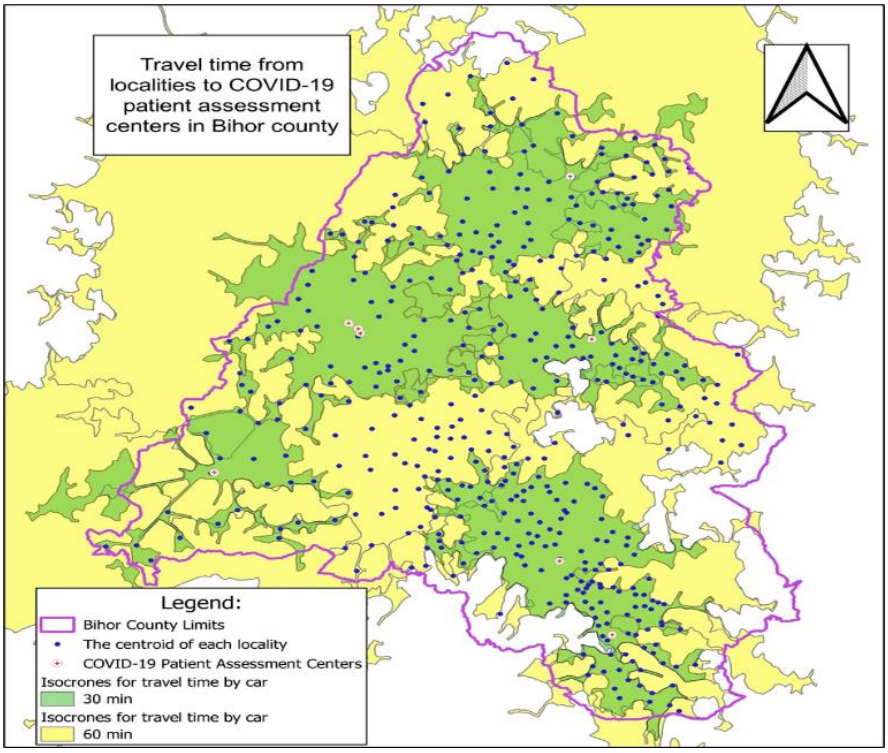

Figure 1. Isochrones corresponding to travel time to an assessment centre in Bihor County

Regarding the fatality rate, it has been found that there are 18 administrative-territorial units with a high fatality rate ranging between 9.98-16.1% (Figure 2).

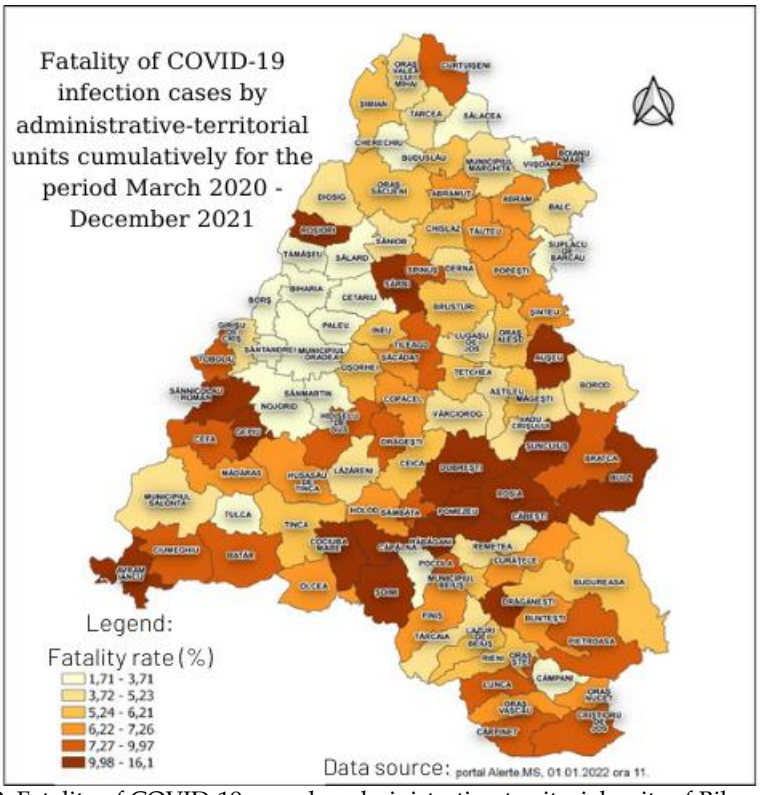

Figure 2. Fatality of COVID-19 cases by administrative-territorial units of Bihor County

DISCUSSIONS

In 10 of March 2020, 105 countries reported 114,253 cases of COVID-19 and 4,000 deaths. Since the start of the pandemic, declared on 11 March 2020 [8,9], all countries with a high number of cases have faced problems related to population access to healthcare. A decisive factor in the treatment of diseases is the distance to the healthcare provider. With the rapid increase in the number of the infections, COVID-19 has become considerably stressful for all healthcare institutions. According to a World Health Organization report (July 2020), globally there were 4534731 confirmed cases of COVID-19 along with 307537 deaths [8,9]. COVID-19 has now been reported from 216 countries [8,9]. Variations between countries and continents in the number of SARS CoV 2 cases are due to several factors: the timing of virus entry into the region and the length of time the virus circulated in the community until measures to stop the spread were applied, the demographic structure and health status of the population, and access to health care and the quality of the health system. Globally, the number of total cases remains on the rise. However, countries that experienced an explosion in the number of cases in the spring now seem to be experiencing a good, downward trend, while countries in the Americas and other countries with large populations are experiencing an alarming, rising rate of illness (Brazil, Peru, Chile, Mexico, India, Pakistan). Currently, the highest incidence is in the USA, India and Brazil with about 20,000, 17,000 and 11,000 new cases per 24 hours respectively [8,9]. The actual number of cases is not known, as many asymptomatic or minimally symptomatic infections go undiagnosed.

Bihor County, with a population of 612,754 inhabitants (by residence on 1 July 2021) is one of the 42 administrative-territorial units of Romania, located in the north-western part of the country [10]. From the beginning of the pandemic until 31 January 2022 (inclusive), 67,374 cases of COVID-19 infection have been diagnosed in Bihor county, of which 16,574 cases in January 2022 [5].

Both, national and county registration of COVID-19 cases are based on the population of county administrative units (communes, towns, municipalities). In Bihor county there are 101 administrative-territorial units. The population of each administrative-territorial unit, automatically updated in the Alerte.MS portal, is taken as a reference when calculating the cumulative incidence of cases per 1000 inhabitants per administrative-territorial unit. Cumulative data at the end of 2020 and 2021 were published in the annual activity report of the Bihor Public Health Department [5]. According to the data recorded in the database of Bihor Public Health Department the number of newly confirmed cases per month from March 2020 to January 2022 increased in the last trimester of 2021.

The extent of a public health problem is also evidenced by the fatality of illness. Fatality is expressed as the proportion of deaths in cases of disease from a given cause. For COVID-19 cases, based on data on illness cases and deaths registered in the Coronaforms and Alerte.MS portal by administrative-territorial units, it was possible to calculate the case fatality of COVID-19 cases by administrative-territorial units cumulatively for the period March 2020 - December 2021. Therefore, we observed that in some regions of Bihor County like Şuncuiuş, Bulz, Roşia, Căpâlna, and others the fatality rate of COVID-19 was up to 16%. According to national legislation [5], nine health assessment centers for newly confirmed COVID-19 cases have been operating in Bihor county since January. The assessment centers provide consultations for confirmed cases with associated diseases based on patient scheduling at these centers. Following the consultation in these centers it can be decided whether the patient has "indications/contraindications for antiviral medication and whether they require day or continuous hospitalization" [5]. For confirmed asymptomatic cases, monitoring during home isolation is carried out by the GP. Patients with moderate/severe COVID-19 benefit from continuous hospitalization in COVID-19 wards. Patient transport to the assessment center can be done by medical transport service (ambulance) or by individual transport without using public transport. A table with the locations of the nine assessment centers, the telephone number and the activity programme of each centre is posted on the website of the Bihor Public Health Directorate [10]. Access to health services refers to the extent to which a person can benefit from the services they need [6]. If health services are available, they can be obtained by those who need them, even so, sometimes there are limitations in the use of appropriate services due to geographical, organizational, financial barriers etc.

Current legislation does not provide recommendations for COVID-19 patients regarding geographic accessibility (e.g., optimal distance to a collection/assessment or treatment center). During the COVID-19 pandemic, public and some private health care facilities were fully or partially dedicated to the diagnosis and treatment of COVID-19 patients, with variations in the number of COVID-19 beds depending on the number of cases detected [11-13]. The study demonstrates the travel time required for referral to evaluation services of confirmed SARS-CoV-2 cases (mild and medium forms with associated pathology) for Bihor county localities. Subsequent studies, after a period of activity of the centres, will be able to assess the extent to which the population has benefited from these services, the territorial distribution of the cases evaluated per center and their origin from the localities of Bihor county. The uptake of telemedicine has accelerated rapidly since the onset of the COVID-19 pandemic. Telemedicine provides easy access to medical care, decreases the risk of disease transmission through physical distance, but allows professional assistance to mild and moderate forms [14, 15].

CONCLUSIONS

The study that we conducted may provide key information for the development of health policies that promote safety and well-being in relation to the risks associated with COVID-19. Data are provided on areas with reduced access to healthcare resources. Accessibility to health services is essential; even one neglected location can have adverse consequences. The paper is a starting point for future studies (after a period of operation of the centres) on addressability and accessibility to services for the assessment of patients confirmed with COVID-19.

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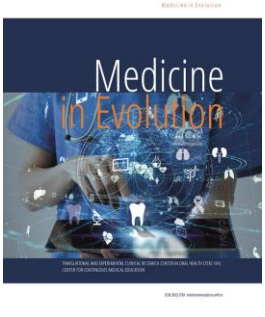
Case report of a patient with type 2 diabetes mellitus and severe Covid-19, successfully managed in Oradea Pelican Hospital



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Received: 26 April 2024; Accepted: 19 June 2024; Published: 30 June 2024

Abstract

The coronavirus disease 2019 (COVID-19) pandemic began in China with a cluster of severe cases of pneumonia later identified as severe acute respiratory syndrome coronavirus 2 in December 2019. Diabetes is one of the most common comorbidities in people with COVID-19 with a prevalence ranging from 7 to 30%. Diabetics infected with SARS-CoV-2 have a higher rate of hospitalization, severe pneumonia, and mortality compared to non-diabetic subjects. Chronic hyperglycemia can compromise innate and humoral immunity. Moreover, diabetes is associated with a chronic low-grade inflammatory state that favors the development of an exaggerated inflammatory response and therefore the onset of acute respiratory distress syndrome. Control of blood glucose and comorbidities should be individualized to reduce the incidence of complications and decrease the burden on health systems. A special management of diabetic patients with COVID-19 infection is the association of a chronic respiratory pathology that becomes complicated after covid, requiring a multidisciplinary team to save the patient. Pulmonary fibrosis post-COVID-19 in the field of atopic bronchial asthma, in a patient with obesity, may require attention and coordination of the case depending on the complications that may develop after the SARS-CoV-2 infection.

Keywords: COVID-19, Diabetes, pulmonary fibrosis, bullous dystrophy

INTRODUCTION

During the COVID-19 pandemic, it was observed that patients with diabetes, obesity and chronic lung diseases in personal history had much more serious forms of COVID-19, compared to the general population. The risk of death existing in conjunction with the development of post covid life threatening complications. The need to closely monitor these patients is justified and without the existence of a multidisciplinary team it can endanger their lives.

Aim and objectives

The development of a pulmonary complication of the pulmonary fibrosis type and the appearance of a bullous dystrophy in a patient with atopic asthma may require both the patient, through serial presentations for close monitoring, and the team to choose the optimal operative moment in order to solve a post COVID-19 complication. The following case that we propose for presentation is a revealing one for the particular case management of patients with chronic lung disease and diabetes mellitus which develop a pulmonary complication after hospital release.

MATERIAL AND METHODS

The reported clinical case was selected from the cases admitted in the Medical Department, Covid Section of the Pelican Hospital Oradea.

CASE STUDY

RESULTS

We present the case of a type 2 diabetic patient, age 46, admitted to the Pelican Hospital Oradea, with fever (38^0C), inspiratory dyspnea, asthenia, myalgias, adynamic, productive cough, headache, loss of appetite, SaO2 90-92 %, positive PCR (polymerase chain reaction) test, condition that started 3 days before presenting to the hospital. We mention that the patient underwent prior to admission to outpatient treatment protocol with, anti-inflammatory treatmment, antitussive, vitamins (C, D3, Zn) at the recommendation of the family doctor.

Patient consent was obtained to report this case.

From the patient's pathological history, it is noted that he has several comorbidities: HTA (artreryal hypertension), atopic bronchial asthma, hyperuricemia, tipe 2 diabetes mellitus, obesity (BMI 30).

Immediately after admission to the covid department, blood samples were collected for evaluation and treatment was instituted in accordance with the protocol. A pulmonary CT scan was performed, which shows the appearance of frosted glass, characteristic of the average form of COVID-19 (figure 1).

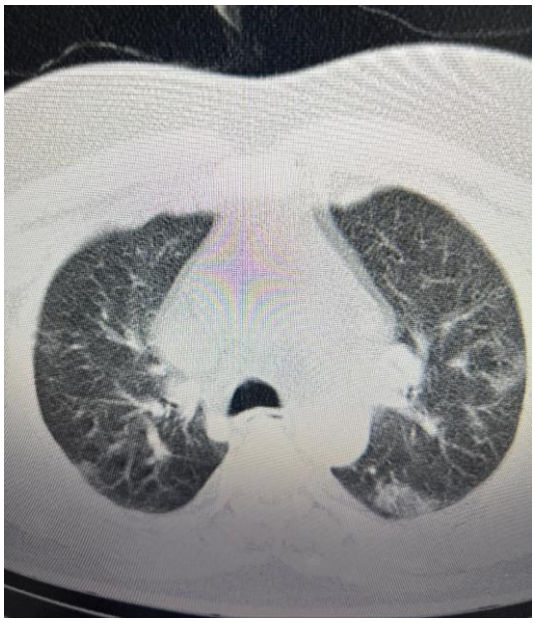

Figure 1. Pulmonary CT scan with frosted glass image

Oral antivirals and antibiotics were administered due to the fact that he had a fever with a productive cough in order to prevent the onset of bacterial pneumonia. The oxygen saturations, with all the medication administered, did not improve, the doses of oxygen on the facial mask were progressively increased, the blood sugars began to rise from 140 mg/dl at admission, to 300-400 mg/dl in the fourth day after admittance, when it was decided to institute the treatment with insulin. After 6 days of hospitalization in the Covid ward, the patient's condition worsen, SaO2 (oxygen saturation) drops to 40%, at which time he is transferred to the Intensive Care Unit, and requires emergency orotracheal intubation and mechanical ventilation on SIMV (synchronized intermittent mandatory ventilation) with FiO2 (fraction of inspired oxygen) of 0.8%

In these critical moments, the team decide to administer intravenous antibotics, antiviral therapy, interleukin 6 inhibitors, convalescent plasma according to COVID-19 treatment protocol, the patient has been in the ICU (Intensive Care Unit) for 5 days, thus ensuring the necessary hydric and caloric supplies.

After 5 days of IOT (orotracheal intubation) and VM (mechanical ventilation), the patient is extubated and put on a CPAP-NIN mask after 5 days. The patient's nutritional status is precarious, reaching muscle hypotonia and the inability to get out of bed and walk. Food consisting of pureed preparations and protein solutions were administrated.

Daily physiotherapy sessions and breathing exercises begin.

The patient is kept on the CPAP mask for 15 days, physical therapy is intensified within the limits of the patient's possibilities, during this period a slight improvement of movements was observed within the limit of the physical effort allowed.

After 15 days of the CPAP mask, the patient is put on an oxygen mask, thus having saturations of up to 98%, the insulin treatment continues, blood sugar levels begin to regulate, physical therapy and breathing exercises are continued.

The patient is later discharged after 45 days of hospitalization (from 29.11.2020-15.01.2021) in an improved general condition with an oxygen mask at home, using it very rarely.

In the outpatient clinic, physiotherapy exercises follow, the general condition improving from one day to the next.

From March 2021, he presents himself monthly for evaluation to a pneumology, where a lung CT is repeated in March 2021, on which the appearance of pulmonary fibrosis is observed accompanied by bronchial dilatations of emphysema bubbles (figure 2).

Figure 2. Emphysematous image on pulmonary CT scan

Biological samples collected at hospital admittance, in the day of intubation and in the day of patient release from the hospital are presented in the following table (Table 1).

Table 1. Biological samples collected in the first day, in the 7 th day and at the release day from hospital; abbreviation used CRP- C reactive protein, ALT-alanine transaminase, AST-aspartate aminotransferase, FBG-fasting blood glucose

	DAY 1 (admitance)	DAY 7 (intubation)	DAY 48 (release)
CRP	21.17mg/mL	68.23mg/dl	16.2 mg/dl
FERITINE	458.9 ng/ml	966.6ng/ml	452ng/ml
ALT	32U/L	43.4 U/L	31U/L
AST	28U/L	33.7 U/L	35 U/L
LYPHOCYTES	1.47 $\cdot 10^3/\mu L$	0.57 $\cdot 10^3/\mu L$	1.07 $\cdot 10^3/\mu L$
LEUKOCYTES	5.27 $\cdot 10^3/\mu L$	6.19 $\cdot 10^3/\mu L$	5.45 $\cdot 10^3/\mu L$
FBG	312 mg/dl	450 mg/dl	312 mg/dl
SERUM CREATININE	0.91 mg/dl	0.81 mg/dl	0.9 mg/dl
SERUM GLUCOSE	140mg/dl	440 mg/dl	180 mg/dl

In the period 18.01.2022-25.01.2022, the patient is admitted to undergo surgery for bullous emphysema.

The recommendations at discharge are to avoid physical efforts and exposure to noxes and the cold weather, to continue physiotherapy and respiratory gymnastics.

DISCUSSIONS

The patient presented above is with long history of diabetes mellitus tested before admission by RT-PCR test for SARS-CoV-2; his severe case rapidly progressed to respiratory distress syndrome. Our patient belongs to the category with risk factors with a demonstrated higher risk of developing a severe form of disease, as well as a higher risk of mortality (1).

We will summarize a special situation of SARS-CoV-2 infection in diabetic patient and the impact of pandemic on the life of a patient with chronic pulmonary disease as comorbidity, knowing that the second most common comorbidity in the disease of COVID-19 is diabetes (2).

Potential mechanisms that may increase the susceptibility of diabetic patients to COVID-19 include: 1) higher affinity cellular binding and efficient entry of virus, 2) decreased viral clearance, 3) decreased T cell function, 4) increased sensitivity to hyperinflammation and"cytokine storm" syndrome and 5) the presence of CVD(cardiovascular disease), mechanisms, which our patient presented during hospitalization, the cytokine storm occurring on day 10 after hospitalization, when he required IOT [3].

According to the length of hospitalization and the treatment administered, the patient's condition improves, so that upon discharge from the hospital, oral antidiabetic treatment with SLGT2 (Sodium-glucose Cotransporter-2) inhibitors is resumed, having beneficial effects on cardiovascular and renal risk.

After discharge from the hospital, the patient became aware of the risk of the disease he went through, as well as the risks of comorbidities, and therefore started a new lifestyle in terms of nutrition, physical and respiratory exercises. After approximately 1 year (2022) the BMI (body mass index) has gradually decreased from 30 to 27, the blood sugars levels are on target, and he regularly presents himself for cardiological, metabolic and respiratory evaluation.

Context-specific strategies show the capacity of health systems to sustain essential health services during the pandemic. The link between pandemic responses and health care utilization can inform purposeful strategies to ensure communities have access to care and provide lessons for promoting high health service utilization [5]

The patient continued to receive prescribed medication and received high-quality medical care from staff specially trained to treat patients with COVID-19. These included chest physiotherapy maneuvers including deep breathing exercises (wearing a mask to reduce aerosols) and encouraging self-reclining according to the UK Intensive Care Society Guidelines [6].

CONCLUSIONS

We present this case report as an example of successful management using standardized, evidence-based treatment guidelines according to WHO guidelines [4]. Successful management of severe hypoxic disease COVID-19 includes oxygen titrated to SaO2, prone position to improve pulmonary perfusion, dexamethasone (if not contraindicated), and effective multidisciplinary teamwork.

At the current moment 2024, the patient in question, as a result of the efforts made by an interdisciplinary team makes physical effort limited to a sports basis.

After discharge from the hospital, the patient became aware of the risk of the disease he went through, as well as the risks of comorbidities, as a result he started a new lifestyle in terms of nutrition, physical and respiratory exercises. After approximately 1 year (2022), it can be said that the BMI (body mass index) has gradually decreased from 30 to 27, the blood sugars are on target, as well as FBG and he regularly presents himself for cardiological, metabolic and respiratory evaluation.

In the year 2024, the patient is in good health, maintains his weight, has gained muscle mass as a result of physical exercises, respects the food strategy and blood glucose monitoring.

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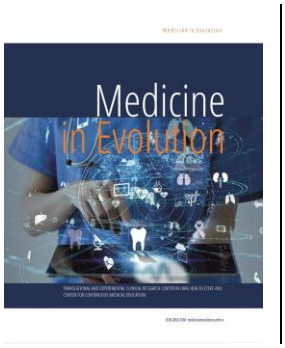
Genetic testing approach in cardiomyopathies comparing NGS panels, WES and WGS



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Received: 17 April 2024; Accepted: 15 June 2024; Published: 30 June 2024

Abstract

Background: Genetic testing in cardiomyopathies has a great impact on diagnosis and further management. Considering novel technologies developed for DNA sequencing, it is important to understand the indication and limits of genetic testing available, while taking cost-efficiency into account. Aim: The focus of this review is to summarize the current genetic testing approach in cardiomyopathies in order to determine the best patient pathway in reaching a genetic diagnosis. Methods: For this narrative review, we performed a search of several electronic databases, selected and evaluated relevant manuscripts. Results: Each method of genetic testing in cardiomyopathies was assessed in terms of the diagnosis yield, benefits, limitations and turnaround time. Conclusion: Whether the use of whole exome or genome sequencing can improve the performance of genetic diagnosis in cardiomyopathies over standard custom panels is challenging and needs to be determined in future researches.

Keywords: cardiomyopathy, whole genome sequencing, genetic testing, next generation sequencing

INTRODUCTION

Cardiomyopathies are a group of diseases determined by dysfunction of the myocardium leading to heart failure and sudden cardiac death (SCD) [1]. They can be classified into primary (genetic) and secondary (acquired) forms based on etiology. When referring to morpho- functional phenotypes, they can be classified into: hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (DCM), restrictive cardiomyopathy (RCM), and arrhythmogenic cardiomyopathy (ACM) [2]. The genetic background should be investigated in order to find a potential inherited type of cardiomyopathy even in presence of a potentially acquired cause or environmental factors [3]. Increasing progress and extensive use of genetic testing has brought more and more evidence of new inherited cardiac gene variants and their impact in disease manifestation and progression [4]. Polygenic risk score (PRS) also named genomic risk score is another variant of genetic testing that may be of importance in the future in the diagnosis work-up of cardiomyopathies. Multiple genetic variants are analyzed in the whole genome, each one being associated to a small risk for the disease. Instead of trying to identify a unique variant responsible the cardiomyopathy, all the identified variants are analyzed and the aggregate risk for the disease is appreciated [2]. Furthermore, genetic investigation for a cardiomyopathy implies not only genetic testing. It ideally involves: documenting a detailed at least 3 generations family pedigree, one on one patient counseling, molecular genetic testing using next generation sequencing (NGS), interpreting the variants according to phenotype and cascade family screening when appropriated for risk stratification in family members. There is a high variability of genes sequences in general population. The probabilistic chance of a genetic result, the yield of testing is higher when testing is realized in an individual with a clear phenotype and the challenge in interpreting the implication of the identified gene variant is easier. However, the yield of genetic diagnosis as well as the difficulty of interpreting the numerous variants of unknown significance in also enhanced by the complexity of the panel used for testing.

Aim and objectives

The aim of this narrative review is to provide a broad comparison between different genetic testing approach in adult patients with primary cardiomyopathies who underwent genetic testing using NGS custom panels, WES or WGS. We analyzed for each method of genetic sequencing: the diagnosis yield, benefits, risks, turnaround time and limitations.

MATERIAL AND METHODS

We performed a search on the following electronic scientific database: PubMed, Google Scholar, Web of Science, and Science Direct. Relevant open access articles employing the association between primary cardiomyopathies and genetic testing were identified. Key words used for the search included: “cardiomyopathy”, “genetic testing”, “next generation sequencing”, “whole genome sequencing”, “whole exome sequencing”. We selected 37 articles, based on a database search published between 2011 and 2024. Manually, we analyzed the reference lists of the selected literature in order to validate the inclusion of genetic cardiomyopathies and the molecular characterization of the cardiac disease based on the genetic testing.

RESULTS AND DISCUSSIONS

The initial literature search yielded 813 records. Of these 273 were excluded based on unavailbility of full content. 512 papers were considered irrelevant and withdrawn, based on the abstract title and/or content. From references review of the 28 articles that remained, 15 additional studies were identified, making the total number of 42 articles. Of these, 34 articles were excluded, based on the criteria detailed in figure 1. After all these exclusions, a total of eight articles remained, from which genetic testing data was extracted.

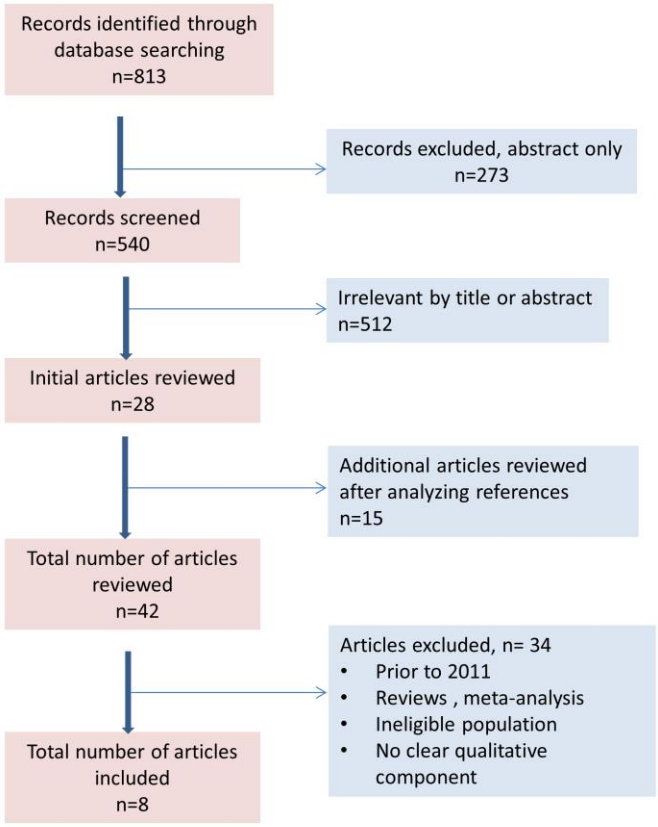

Figure 1. Flowchart describing the systematic literature review

Genetic Testing Strategies

Availability and diversity has increased in the past decades for genetic sequencing. In addition, the turn-around periods are shorter and the costs are lower. Options for genetic analysis vary from sequencing of one gene, a targeted panel of genes related to a specific phenotype, or in some cases, whole exome sequencing (WES) or the whole genome sequencing (WGS). Disease focused panels include genes that are proved to have a moderate to high association to the specific disease [5]. Some examples are: HCM specific panel or DCM specific panel. More complex cardiac panels may include genes with a low gene-disease association. WES sequences the whole Deoxyribonucleic acid (DNA) exons (protein-coding regions) and WGS sequences also the DNA's introns (noncoding regions) and the mitochondrial DNA beside DNA's exons. Testing is usually performed using blood, saliva, or oral swab sample. The DNA is extracted, purified, multiplied and fragmented, then isolated and attached to labeled beads for short-read sequencing. Sequence obtained information are compared with a human genome sequence of reference, and the identified variants in the patient probe are interpreted to determine the correlation with the disease of interest. The process of variant interpretation involves variant type classification. For instance, variants

that imply protein loss-of-function such as frameshift mutations are considered damaging for most genes, yet not all. Genome Aggregation Database, a complex and wide available database of healthy control genome and exome is interrogated for establishing allele prevalence in general population and ethnic groups. Also, the properties of the amino acid are analyzed to determine whether it's change will be tolerated without damaging the protein. The American College of Medical Genetics and Genomics (ACMG) and the Association for Molecular Pathology (AMP) have proposed a guideline in order to standardize variant interpretation and facilitate and this complex process [6]. When a causative variant is identified in the index patient, grade one relatives, including those phenotype negative should be tested for identifying presence of that specific variant within the gene using Sanger sequencing. A major challenge in the management of genetic testing in cardiomyopathies is choosing the most cost-efficient method, yet also considering turnaround time of results. Due to the genetically heterogeneous background of cardiomyopathies and the development and availability of Next-generation sequencing (NGS) NGS techniques in the clinical practice, a multi gene panel is desirable. However the disease focused panels may miss important genes with prognostic implication. For instance, TruSightCardio panel (Illumina, San Diego, CA) currently used for genetic testing in cardiomyopathies in the Regional Center of Medical Genetics Timis does not include the FLNC gene, which has clearly proved to determine DCM with high arrhythmogenic risk. Moreover, recently, deep intronic variants have linked to cardiomyopathy phenotypes in previously unexplained or negative genetic cases [7,8]. On the other hand, with higher number of genes analyzed also increases the costs of testing and the probability of identifying variants of uncertain significance (VUS) increasing the difficulty of interpretation. It is therefore evident that the ordering physician should be aware of the benefits and limitations of specific test types in order to select the most appropriate technique [9].

Advantages and disadvantages of NGS targeted gene panels

Approaches to genetic testing based on Next-generation sequencing (NGS) enables the diagnostic of a causative genetic variant including more than two hundred genes involved in the etiology of cardiomyopathies or channelopathies. Custom panels provide this precision without driving up sequencing costs to achieve the required depth of target regions. Multiple reports have published the outcome of genetic testing using different panels with genes ranged from 19 to 173, in a single test. [10,11] Usually, in clinical practice, it is feasible to choose a specific focused gene panel according to the suspected cardiomyopathy subtype. The correlation between genotype and phenotype in cardiomyopathies vary a lot as variants in certain gene can determine different phenotypes. [12,13] Variants in lamin A *LMNA* gene can determine DCM or arrhythmogenic cardiomyopathy (ACM), while variants in the MYH7 gene can linked to DCM, HCM and left ventricular non-compaction cardiomyopathy (LVNC). In this context, genetic testing using 2 or more disease targeted panels may become useful and provide better diagnosis yield, especially when phenotype in not well defined. The responsible variant detection rate is usually higher in familial vs. sporadic cases. Multiple studies have reported different diagnostic yield, slightly depending on the type of cardiomyopathy tested. For instance, a research performed by Gómez et al. [14] published a diagnostic yield of 25% using a panel of 9 genes in 76 patients with hypertrophic cardiomyopathy. In a study ruled by Cuenca et al. [15] that used an NGS panel with 126 genes, identified a DCM-causing variant in 73% of cases with familial DCM who were ongoing heart transplant. On the other hand, a study conducted in our Genomic Center of Timisoara, which included patients with familial and sporadic non ischemic DCM from 5 universitary centers of Romania, resulted in a diagnosis yield of 50.8%. [16] The difference in the diagnostic rate can be explained by the complexity of panel design, the number of genes but also the specific selected genes and, of course, by the selection of patients. Although

panel-based NGS techniques are appealing based of the fact they are cost-effective, easy fast, NGS based on ampliseq has some weaknesses. Only 94% from the targeted regions is covered at the panel design stage. Furthermore, recently identified variants may not be included in the panels used currently in clinical practice. For example, mutations in *FLNC* gene has been reported to be involved in the etiology of HCM and DCM cases but it is not included in the TruSight Cardio Illumina Panel that we use in our Genomic Center. Ouellette et al. stated that larger panels for cardiomyopathies had a higher rate of detecting variants of uncertain significance (VUS) in comparison to a disease specific focused panel (87% vs. 30%). In the study we performed on 122 patients with DCM, we have identified a rate of VUS of 30% [17]. Detecting VUS may produce confusion for the physician, the patient and his family, an unwanted consequence of extensive gene panels testing. Another limitation would be the amplification accuracy at the level of polymerase chain reaction (PCR) stage due to content high in GC (guanine-cytosine). As a consequence, a part of the coding regions will remain unsequenced. Despite the fact that targeted custom panels maximize sequencing economy, they are not suitable for broad discovery research.

Advantages and Disadvantages of WES

Whole-exome sequencing focuses on the genomic protein coding regions (exons) that represent around 2% of the genome. This is where most of the genetic variants related to the disease are found. WES requires supplementary reagents (probes) and an extra step: hybridization but it is a cost-effective method compared to WGS. WES has proved to achieve a comprehensive coverage of coding variants such as single nucleotide variants (SNVs) and insertions-deletions. Retter et al. analyzed an extensive cohort of 3040 clinical cases and resulted that WES provided an overall diagnostic rate of 28.8%. More specifically, for proband only cohorts, the diagnostic yield was 23.6%, increased to 31% when 3 family members were investigated [18]. Other papers have reported a diagnostic yield ranging between 22% - 57%, depending on the patient's phenotype and design of study. A study conducted by et al. shows that WES was able to detect likely pathogenic or pathogenic variants for almost half of HCM patients. However, according to a study published by Mak TSH et al, the use of WES did not increase the diagnostic yield versus the 4 commercial panels [19]. One of the limitation of WES is that it can miss valuable information by not detection variants that are localized outside the exome. Particularly variants located in regulatory regions are important for gene regulation and expression. Moreover, WES cannot identify structural variants, large insertions or deletions.

Advantages and Disadvantages of WGS

One of the major advantages of WGS is that it provides a more comprehensive view of an individual's genetic makeup. It can determine the order of the nucleotides in a patient's DNA and can uncover variation in any part of the human genome, including coding-noncoding and mitochondrial DNA (mtDNA) regions. In some instances, WGS is the better option because DNA variations outside protein-coding regions can affect gene activity and protein production, potentially leading to genetic disorders. This can be useful especially for determining rare or new variants that have been missed by WES. WGS provides detection of deep intronic gene variants that have demonstrated to have pathogenic significance [20]. Findings about the good results and improved diagnosis yield of WGS-based testing in hypertrophic cardiomyopathy [21] and DCM have emerged [22]. A powerful criteria that favors WGS as a testing method is the potential for identifying the genetic background of unclear or negative cases but phenotype-positive. Bagnall et al. found that WGS was able to identify deep intronic splice variants in the MYBPC3 gene in 4 out of 46 patients who had previously a negative HCM genetic testing on NGS custom panel [23]. However, one of the biggest limitations of WGS is that it is most expensive, due to the larger amount of data analyzed. WGS also requires more computational resources and sophisticated bioinformatics

expertise to decipher, increasing the time required for analysis. Moreover, WGS can determine false positive results, especially in less frequent genetic variants and make the interpretation of results more challenging.

Comparison between advantages and disadvantages of targeted gene panels, WES and short read WGS are presented in table I.

Table I. Comparison between different genetic testing techniques

Method	**NGS targeted panels**	**WES**	**Short read WGS**
Diagnosis yield	20-61% [14,15,16]	22- 73% [21,22,23]	50-57% [25,26]
Advantages	-High coverage -First step method when specific cardiomyopathy is suspected -Custom design of panel content -Detection of copy number variations (cnv) -Focused analysis -Cost efficient -Low storage and computational burden -Short turnaround time	-Convenient prescreening method -Quick sequencing and data analysis - Detection of copy number variations (CNV) -Exome wide analysis, allows virtual (dynamic) panel analysis -Medium cost -Medium storage and computational burden	-Uniform coverage -Less sequencing bias, stable, no PCR -Extensive method -Detection of non-coding variants -Accurate detection of copy number variants -Useful in difficult to target regions -could identify repeat expansions (low accuracy)
Limitations	-Limited detection based on gene panel content -Not suitable for broad discovery research -Does not identify repeat expansions	-Does not identify repeat expansions	- Lower coverage - More expensive - High computational and storage burden -Longer turnaround time compared to panels and WES

WESs and WGSs techniques are still mostly used in the research field over clinical practice when evaluating patients for inherited cardiomyopathies. WES and WGS have proved a potential of providing incidental gene variants related to cardiac disease, when testing patients without positive familial history [25]. In a study that involved 2628 individuals who underwent testing using WES, 11 were determined to have pathogenic variants linked to cardiomyopathies. However, on 25 years of follow-up, only 2 of these 11 people developed cardiac dysfunction [26]. The literature and database of genetic variants are constantly improved, thus variants are likely to be reclassified over time and VUS may become likely pathogenic or pathogenic variants. However, due to increased amount of uncertainty regarding cardiovascular genetics, there is still debate within about how to order and interpret these tests. Cardiologists should work in a cardio-genetics team together with the genetician in order to provide best management for the patient and his family. New technologies and tools are developing in order to provide continuous update and knowledge about variants, such as the CardioClassifier tool [27,28] or ClinGen [29]. Long-read sequencing, or third-generation sequencing, offers a number of advantages over short-read sequencing, yet it is currently more expensive compared to short read [30]. Thus, long read DNA sequencing approach will not be the focus of this future research.

Genetic variant's impact on clinical management

Genetic testing is not only providing the definite etiological diagnosing but also influences treatment and further management. In HCM patients, genetic testing provides

definite differentiation between genetic cardiomyopathies and phenocopies, for example, transthyretin (TTR)-cardiac amyloidosis, Fabry disease or other glycogen storage disorders [31]. By detecting the etiology of the disease earlier, targeted therapies are started sooner with impact on preventing disease progression and cascade family screening for the variant identified in the proband is initiated. The importance of determining the genetic basis of a cardiomyopathy arises also, from the impact of specific variant, among other risk factors, in stratifying the risk of life-threatening ventricular arrhythmias. Among patients with LMNA pathogenic variants, Wahbi et al. generated a risk score (https://lmna-risk-vta.fr/) that estimates the 5-year risk of malignant ventricular arrhythmia in these patients [32]. Other gene that has proved to induce a high risk for life threatening ventricular tachyarrhythmias is Phospholamban (PLN). PLN p. Arg14del variant along with other risk factors: left ventricular (LV) ejection fraction, inverted T waves, low voltaged ECG, the amount of PVC's over 24 hours are variables used in the 5-year risk SCD calculator in these patients [33]. These risk stratification tools are of great importance since they are capable of rising the indication for ICD implantation in primary SCD prevention. All these emphasize the important impact of genetic testing in personalized disease specific management.

CONCLUSIONS

Determining the genetic background of a cardiomyopathy is indispensable in the era of precise, personalized medicine and arises from the impact on patient's clinical management and family screening. Finding the right balance between the diagnostic yield, costs and the rate of incidental findings remains one of the major challenges in the field of genetic testing. Whether the use of whole exome or genome sequencing can improve the performance of genetic diagnosis in cardiomyopathies over standard custom panels is yet to be determined in future studies.

The authors declare that they have no competing interests.

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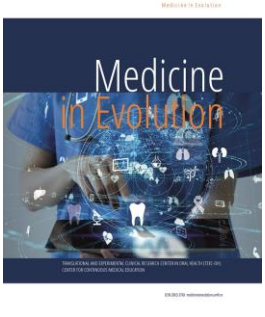
A bibliometric analysis of digitalization challenges in healthcare systems of the European Union



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Received: 14 May 2024; Accepted: 22 June 2024; Published: 30 June 2024

Abstract

This study aims to analyze the challenges in health systems at the level of the European Union in terms of digitization, with the help of bibliometric analysis. The proposed empirical analysis aims to select the most relevant scientific articles from the Web of Science Core Collection, a highly trusted scientific literature database, due to its comprehensive coverage of high-impact journals across the world, including open access journals, conference proceedings and books. Bibliometric analysis is a methodical approach to quantifying the state of knowledge in the field of digitization of health systems in the EU, involving several steps, each designed to provide insights into publication patterns, citation patterns and the overall landscape of academic research. Two concepts were considered, respectively "e-health" and"digital," following that the type of articles included was only"Article", and as the last condition for the search was the analysis period that was between the years 2010-2022. The visual results of the investigation undertaken indicate a significant increase in interest in the topic investigated in our study, observable not only among the member countries of the European Union, but also internationally. This trend reflects the relevance and novelty of the topic in the global scientific community.

Keywords: digitalization, bibliometric analysis, EU, e-health

INTRODUCTION

Digitalization aims to facilitate the work of both patients and healthcare professionals by providing high-quality services, prompt and accurate responses, and safety. Living in a period of continuous development, certain challenges may arise regarding implementation and the quality of services offered because despite all the available technology, we are only at the beginning, and continuous testing is being done to improve the current healthcare system. On the other hand, other challenges regarding the digitalization of healthcare systems can be the percentage of expenditure allocated to healthcare systems, with all countries allocating a different percentage for this purpose, thus creating a discrepancy among the countries of the European Union [1].

Data confidentiality and security are also obstacles because the information within the healthcare system contains sensitive data and must be protected so that unauthorized individuals cannot access it or misuse it. Given that digitalization is continuously evolving, and cyber security risks are increasing, trust in a digitized system is becoming more difficult to accept [2].

Another challenge regarding the digitalization of healthcare systems in the EU relates to its adoption and acceptance by both medical professionals and patients. Digitalization changes the way a doctor would collaborate with a patient, which must be done with adequate training and the benefits of such a doctor-patient relationship must be highlighted.

Aim and objectives

This study aims to identify the challenges in healthcare systems in the EU, and this was made possible with the help of methodology, hierarchical clustering of EU member states, using a bibliometric analysis. The proposed empirical analysis aims to select the most relevant scientific articles from the Web of Science Core Collection, a highly trusted scientific literature database, due to its comprehensive coverage of high-impact journals across the world, including open access journals, conference proceedings and books.

Since e-health consists of vast and complex literature, as well as the need for citizens to benefit from quality and efficient health services, prioritizing patient protection, we have decided to investigate the state of knowledge in the field, followed by conducting a comprehensive analysis.

MATERIAL AND METHODS

Since e-health consists of vast and complex literature, as well as the need for citizens to benefit from quality and efficient health services, prioritizing patient protection, it was decided to investigate the state of knowledge in the field. Facilitated by VOSviewer software, all articles produced in this research domain were organized, revealing the most used keywords, the most important authors, as well as the collaborations between certain countries.

In the Web of Science database, the following two concepts were used:”e-health” and”digital,” with the type of articles included being only”Article,” and the last condition for the search was the analysis period, which was between 2010-2022, the first year from which articles published on this topic began to appear being 2010. Web of Science found 296 results, which were then downloaded into a.txt file that was input into the VOSviewer software for analysis.

RESULTS

(1) The analysis of "key words"

Through the analysis of keywords, we can observe the trend of the most frequently used words in this theme. Essentially, we report on the fact that these words appear most often in the analyzed articles. The main purpose is to observe the most common words used in the field of e-health by authors addressing this subject. In our initial search, we used terms such as "e-health" and "digital," and the network facilitated by VOSviewer shows other important words in this field that appear predominantly in the analyzed articles: "telemedicine" (with 77 occurrences), "technology" (with 75 occurrences), "care" (with 52 occurrences), and "internet" (with 36 occurrences) (Fig.1).

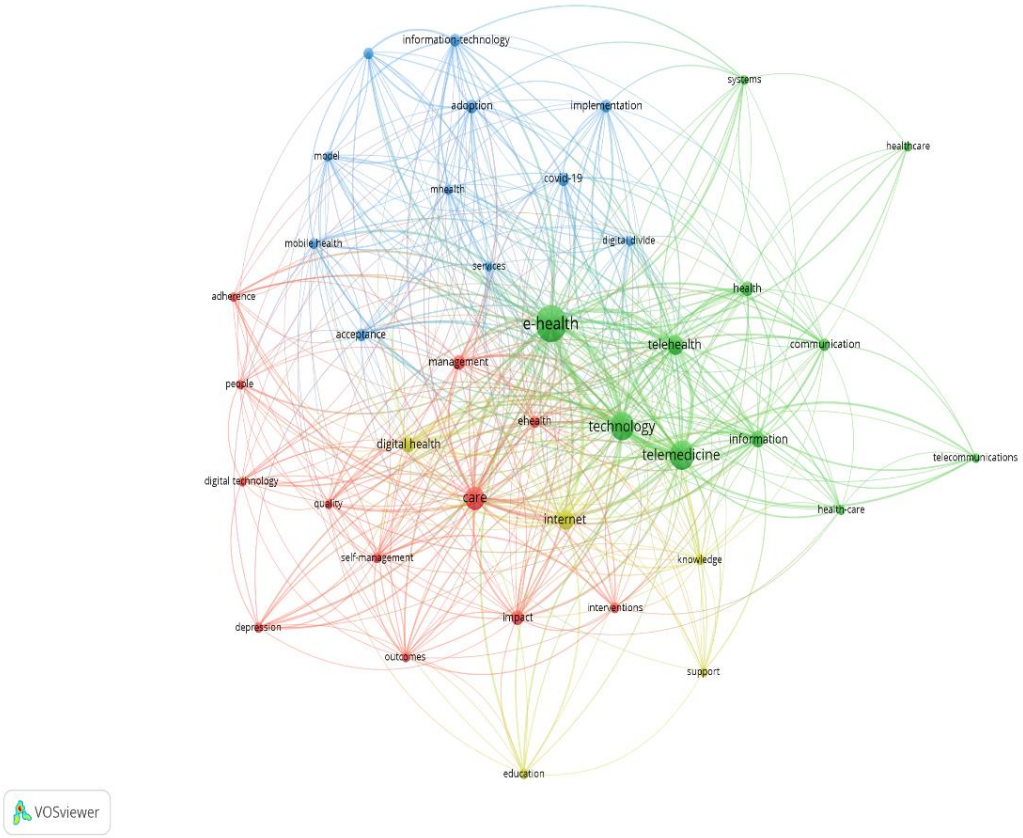

Figure 1. The Key Word Network.
Source: Processed by the author using VOSviewer

Figure No. 1 provides an overview of the most important keywords and the connections between them: the larger the size of the nodes and the words, the higher the frequency of occurrence of these keywords in the analyzed articles. On the other hand, a greater distance between nodes signifies a weaker connection between them. Thicker lines represent more frequent coincidences. A group of keywords or a series of related words is represented by the same colour. Figure No. 1 presents the most frequent keywords used in the field of e-health (applying a threshold of 9 coincidences). The largest group is the green one, which includes words such as "e-health", which is also one of the keywords chosen by me, as well as associated words like "technology", "telemedicine", and "information". The second group is the red one, where the most frequent words are "care", "management", "impact", and "inventions". The third group is yellow, containing predominant words such as "internet", "education", and "digital health". The last group, the blue one, includes terms

like "implementation", "covid-19", and "acceptance". The complete groups are detailed and can be viewed in Table No. 1.

Table 1. Groups of the keywords

Number of words	Group 1 (Green)	Group 2 (Red)	Group 3 (Yellow)	Group 4 (Blue)
1	(communication)	(adherence)	(digital health)	(acceptance)
2	(e-health)	(care)	(education)	(adoption)
3	(health)	(depression)	(internet)	(covid-19)
4	(health-care)	(digital technology)	(knowledge)	(digital divide)
5	(healthcare)	(ehealth)	(support)	(implementation)
6	(information)	(impact)		(information-technology)
7	(systems)	(interventions)		(mhealth)
8	(technology)	(management)		(mobile health)
9	(telecommunications)	(outcomes)		(model)
10	(telehealth)	(people)		(services)
11	(telemedicine)	(quality)		(user acceptance)
12		(self-management)		

The bibliometric analysis reveals that "e-health", the most frequently used keyword it is associated with information and technology. The green group focuses on health information and new medical technologies. The second group pertains to patient issues and the technology's impact on them. The yellow group emphasizes knowledge and education's role in e-health implementation. Lastly, the blue group addresses e-health adoption and implementation, showing widespread acceptance of such systems.

(2) Analysis of "scientific co-authorship" regarding the number of documents and citations of authors.

In this section, the analysis focuses on the research area of the main authors' network. This initial citation network focused on the two selected analysis concepts, namely "e-health" and"digital," with authors included being those who have published at least two articles indexed in Web of Science and have at least twenty-four citations. Figure 2 highlights this network of authors, grouped into 9 clusters. According to VOSviewer, the most cited authors are: with 2 documents, we have Ebert David D. (137 citations) belonging to group 5 (Purple) and Mcalearney, Ann S. (114 citations) belonging to group 9 (Pink), with the remaining authors also having 2 documents but fewer than 100 citations. Details regarding the number of documents and citations are included in Table 2.

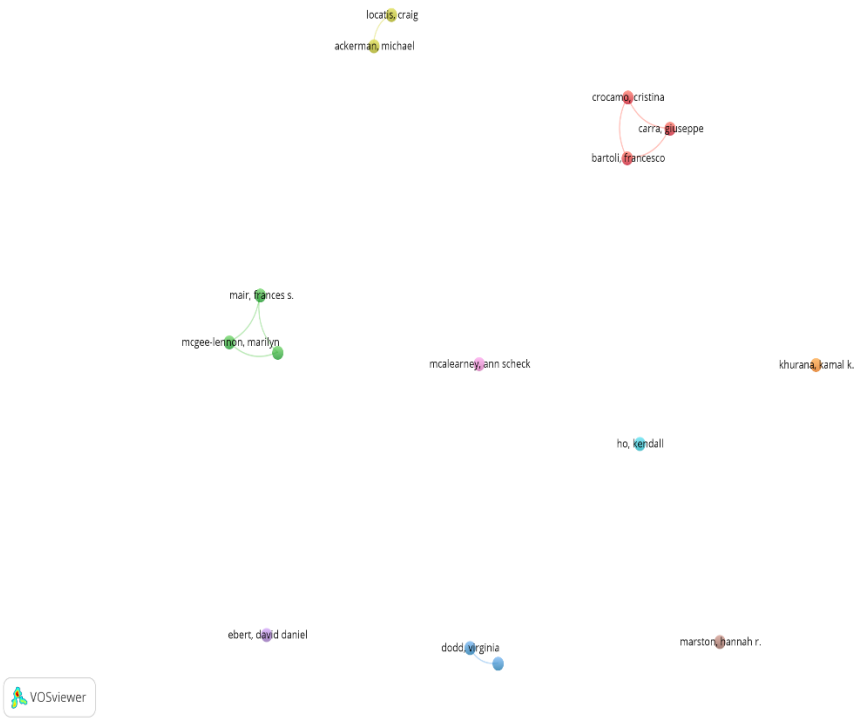

Figure 2. Co-authorship network based on the number of publications per author.
Source: Processed using VOSviewer

Table 2. Groups of publications and citations per author

Group	Authors	Documents	Link Strength
Group 1 (Red)	bartoli, francesco, carra, giuseppe, crocamo, cristina	2\29 2\29 2\29	4 4 4
Group 2 (Green)	mair, frances s. wyke, sally mcgee-lennon, marilyn	2\56 2\56 2\56	4 4 4
Group 3 (Blue)	dodd, virginia hall, amanda k.	2\84 2\84	2 2
Group 4 (Yellow)	ackerman, michael locatis, craig	2\24 2\24	2 2
Group 5 (Purple)	ebert, david daniel	2\137	0
Group 6 (Cyan)	ho, kendall	2\27	0
Group 7 (Orange)	khurana, kamal k.	2\29	0
Group 8 (Brown)	marston, hannah r.	2\52	0
Group 9 (Pink)	mcalearney, ann scheck	2\114	0

Group 5, the purple one, contains the author with the highest number of citations, specifically 137. This makes this group the main one due to its high citation count. The next impactful group in terms of citation count is group 9, the pink one, with 114 citations. Following that is group 3, the blue one, consisting of 2 authors who didn't reach the threshold of over 100 citations, each having only 84 citations. The subsequent groups obtained below the threshold of 56 citations, with the minimum being in group 4, the yellow one, which has only 24 citations.

(3) Analysis of "scientific co-authorship" in terms of the number of documents and citations reported by country.

The final segment of the study focuses on analyzing scientific co-authorship based on the countries contributing articles. Using the dataset of 296 articles, were identified countries with at least 7 publications in VOSviewer. The resulting map reveals collaboration links between authors from various countries, highlighting communication and influence (Table 3). In Figure 3, four color-coded groups are depicted, with red representing the most influential countries in e-health, including England, India, Norway, China, the United Arab Emirates, and the United States. Thicker connections, such as between England and the USA, signify closer ties. The presence of non-European countries underscores international interest in the thesis topic.

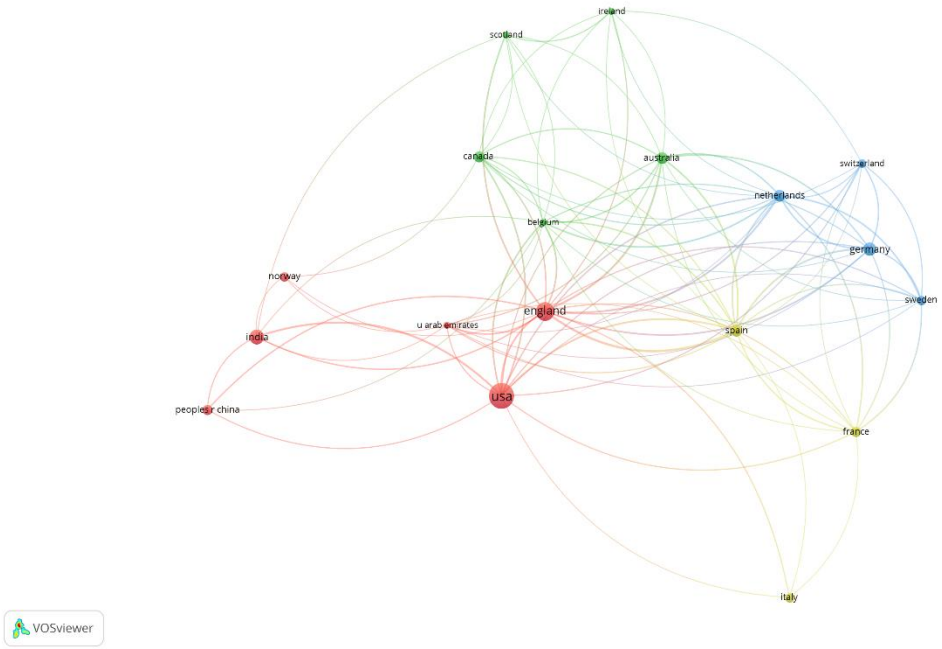

Figure 3. Scientific Co-authorship Network based on Countries of Publication.
Source: Processed by author using VOSviewer

Table 3. Groups of countries of publication and number of documents

Group	Countries	Documents	Link Strength
Group 1 (Red)	England	42/953	60
	USA	78/1372	41
	India	26/236	15
	Norway	11/147	4
	Peoples r China	13/81	8
	United Arab Emirates	7/6	17
Group 2 (Green)	Australia	17/246	29
	Belgium	7/132	29
	Canada	16/301	20
	Ireland	7/82	10
	Scotland	7/131	12
Group 3 (Blue)	Germany	21/491	30
	Netherlands	17/369	37
	Sweden	11/157	20
	Switzerland	9/205	15

Group 4 (Yellow)	France	13/193	20
	Italy	11/106	5
	Spain	17/387	42

DISCUSSIONS

The role of e-health is to provide patients with added safety and confidence in the quality of their treatment. However, its impact varies between developed and developing countries. Experts suggest that for implementation in developing countries, cultural and educational factors are crucial, followed by economic resources and long-term policies [3].

E-health implementation has led to a wealth of health information today. Technologies like online social networks, personalized health education, mobile health devices, and telemedicine aim to improve access to health information and enhance healthcare quality while reducing errors and promoting healthier lifestyles [4].

The European Commission supports e-health implementation, seeing it as crucial for healthcare system reforms to ensure sustainability and universal access to healthcare. Despite increasing adoption, challenges remain, including slow implementation of electronic health records (EHR) and electronic prescribing systems, along with financial, legal, social, and ethical barriers [5].

In Italy, e-health is recognized in national legislation, but regional efforts have led to uneven development in service quality. Nevertheless, the Italian Council supports healthcare digitalization, aiming to enhance health protection through solutions like electronic medical records, telemedicine, and electronic prescriptions, widely used among citizens [6].

CONCLUSIONS

The bibliometric analysis aimed to obtain the most important keywords, scientific collaborations among authors, and countries with the greatest influence on health and digitalization articles. Moreover, scientific co-authorship showed countries with the most publications on our topic, namely the USA, UK, India, and Germany, with only one of them being a current EU member.

In conclusion, when it comes to digitalizing healthcare systems in the European Union, there are both positive aspects and significant challenges. The use of digital technology in healthcare can bring numerous benefits, facilitating access to medical services, promoting health care, and prevention, and improving diagnosis and treatment. However, challenges include disparities between developed and developing countries and ensuring data security and patient confidentiality. Overcoming these challenges requires a collaborative approach among EU member states, exchanging best practices, and experiences, along with appropriate policies and regulations to protect data and ensure patient privacy. Ultimately, digitalization offers opportunities for substantial improvements in healthcare quality and access, contributing to the well-being of European citizens.

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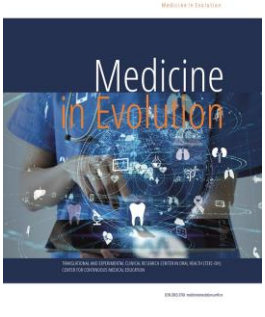
Dental treatment of sensitive tooth



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Received: 10 April 2024; Accepted: 10 June 2024; Published: 30 June 2024

Abstract

Introduction: Dentine hypersensitivity (DH) is a significant dental health concern characterized by sharp pain in response to stimuli on exposed dentine. It poses a diagnostic challenge due to its similarity to pain caused by other dental conditions. This condition predominantly affects adults, with canine and premolar teeth being the most commonly involved. **Aim of the Study:** The study aims to elucidate the management strategies for dentin hypersensitivity (DHS), focusing on various therapeutic options tailored to specific patient groups, including those with gingival recession, tooth wear lesions, and undergoing periodontal treatment. **Material and Methods:** For this study twelve patients (8 males and 4 females, aged 23-47 years) were selected after providing informed consent. Sensitivity testing involved exposure to thermal changes in the oral environment. The study design categorized teeth into groups receiving treatments like fluoride varnish, bonding agents to cover root surfaces after periodontal treatment, and a combination of periodontal and endodontic treatments with home care instructions. The effectiveness of these treatments was assessed through clinical examination and patient feedback. **Results and Discussions:** Treatment with fluoride varnish showed significant reductions in discomfort immediately and sustained improvement up to six weeks post-treatment, though effectiveness began to wane towards the end. No significant difference was observed between fluoride varnish and dental bonding in reducing DH. Interestingly, treatments combining periodontal and endodontic care with composite restoration were effective, underscoring the need for a multifaceted approach to DH management. **Conclusions:** The study concludes that various desensitizing agents, including fluoride varnish and dental bonding, are effective in managing dentin hypersensitivity to different extents. The management of DH necessitates a comprehensive understanding of its pathology and a tailored approach to treatment, considering individual patient needs and the specific causes of sensitivity.

Keywords: dentine hypersensitivity, screening procedure, pain management strategies, exposed root surface, gingival recession

INTRODUCTION

Dentine sensitivity (DS) or dentinal hypersensitivity (DH) is recognized as the most prevalent painful disorder affecting teeth. This condition arises in response to stimuli that reach the exposed dentine. Clinically, it is characterized by an excessive reaction to stimuli that are typically not harmful [1] [2].

The phrases "dentine sensitivity" and "dentinal hypersensitivity" are often utilized interchangeably to refer to this identical clinical phenomenon [3].

A significant portion of the research focused on this condition recommends the use of the term "dentine sensitivity", acknowledging that the acute pain experienced is, in fact, a normal reaction of the dental pulp to exposed dentine [4] [5].

However, it is acknowledged that not all exposed dentine is sensitive, and for many years, clinicians have preferred the term "dentinal hypersensitivity". Consequently, both terms are acceptable for describing this clinical situation [6] [7].

The mechanism of dentine hypersensitivity is explained by 3 theories:

1) Neural theory
2) Odontoblastic transduction theory
3) Hydrodynamic theory

The Neural Theory posits that unmediated nerve fibres in the outer layer of root dentine and the presence of potential neurogenic polypeptides reinforce this concept. However, despite its theoretical framework, the lack of substantial evidence to support it remains a challenge. This is particularly evident in the heightened sensitivity of outer dentin compared to inner dentin, and the absence of nerve endings in newly erupted teeth despite their sensitivity [8].

The Odontoblastic Transduction Theory posits that peripheral odontoblasts act as receptor cells, transmitting impulses through synaptic junctions to nerve terminals, thereby causing the sensation of pain from nerve endings located at the pulp dentine border [9]. However, a recent study by Thomas (1984) suggests that odontoblastic processes are limited to the inner third of the dentinal tubules. Consequently, it appears that the outer portion of the dentinal tubules lacks cellular elements and is filled only with dentinal fluid [10,11].

The Hydrodynamic Theory is the most widely accepted explanation for dentin hypersensitivity. It was initially proposed by Gysi in 1900 and later validated by Brannstrom. According to Brannstrom (1963), changes in temperature or physical osmotic conditions cause movement in the fluids within dentinal tubules, stimulating nerve receptors sensitive to pressure. This stimulation results in the transmission of stimuli, leading to the sensation of hypersensitivity [12,13].

In the ethology of dentin hypersensitivity, pathological conditions such as gingival recession, coronal destruction, attrition, abrasion, erosion, and abfraction are implicated, as well as periodontal issues. Furthermore, techniques such as dental bleaching can lead to the onset of dentin sensitivity [14].

The treatment of dentin hypersensitivity can be categorized as follows [15]:

A. Patient counselling

Education on oral hygiene practices

Addressing dietary factors

Removing risk factors through education about root caries

B. Interventional treatment

-At-home treatment options:

- Use of anti-sensitivity toothpaste

- Application of fluoride-based gels
- Use of specialized rinses

-In-office treatment options:

(i) Non-invasive:

- Surface applications in-office such as chemical (oxalates) or fluoride treatments
- Utilization of physical agents
- Class V restorations
- Laser therapy
- Iontophoresis

(ii) Invasive:

- Endodontic (root canal) treatment
- Gingival graft surgery
- Tooth extraction

Aim and objectives

The objective of the study was to outline management strategies for dentin hypersensitivity (DHS) and explore various therapeutic options. This study details DHS management strategies tailored to three distinct patient groups:

1) Patients with gingival recession
2) Patients with tooth wear lesions
3) Patients with periodontal disease and those undergoing periodontal treatment

MATERIAL AND METHODS

Patient inclusion

The study was carried out in the prosthodontics department, School of Dentistry at Victor Babeş University of Medicine and Pharmacy in Timişoara, Romania. All participants were verbally briefed, and written consent was obtained for their involvement in the research.

Study group

Twelve patients, consisting of 8 males and 4 females aged between 23 and 47 years (with a mean age of 30±2), were recruited and consented to participate (Fig.1.). Sensitivity testing was performed by exposing them to thermal changes in the oral environment. Each patient had at least two quadrants of their mouth selected, resulting in a total of 73 teeth being included in the study.

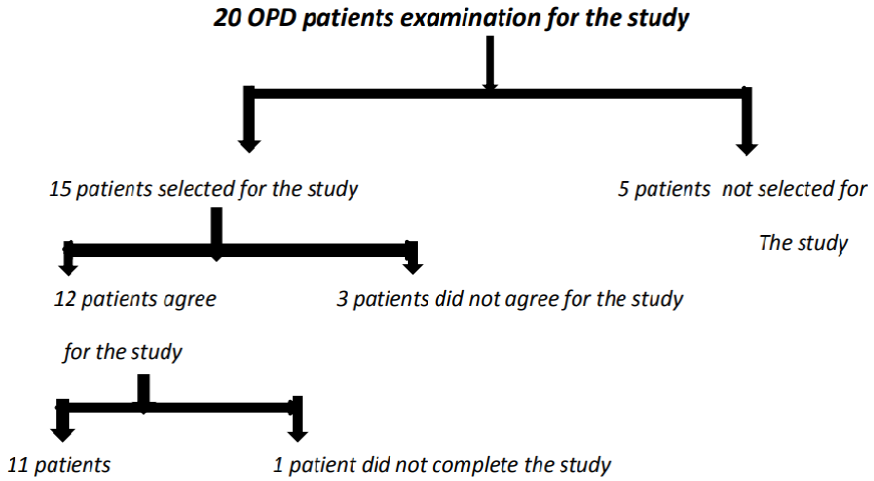

Figure 1. Chart with the recruited patients

Screening procedure

The participants underwent clinical examination and assessment to confirm the presence of dentin hypersensitivity (DH) and were once again screened for inclusion and exclusion criteria. The procedure involved isolating the test and control teeth with cotton rolls and thermally stimulating them with a burst of air from a dental syringe for one second, positioned 10 mm from the buccal tooth surface, to induce a brief, intense pain lasting no more than 30 seconds. After a 10-minute interval, thermal stimulation was halted by placing a small cotton pellet on the buccal tooth surface for one second. To confirm the vitality of the test and control teeth, an electric pulp tester was used with conducting paste, following isolation and drying of the teeth with cotton rolls and air. Assessment of response to various pain stimuli was conducted on both the test and control teeth, as well as adjacent teeth for safety. A thorough screening of medical and dental history, including medical conditions, medications affecting the oral cavity, dietary habits, oral hygiene practices, and substance use, was performed. The included teeth (n=73) were then divided into groups.

Study design

Teeth were categorized into groups as follows:

Group 1 (NaF): Received application of dentin adhesive sealers (fluoride varnish), specifically 5% NaF varnish.

Group 2 (Covering Root Surfaces): After periodontal treatment, received application of a bonding agent to seal the surfaces, thereby preventing exposure.

Group 3: Received periodontal and endodontic treatments, dentin sealer (composite restoration), and home care with dentifrices.

RESULTS

Three patient groups with clinically diagnosed cervical dentin hypersensitive teeth were enrolled and randomly assigned to receive either dentin adhesive sealers (fluoride varnish), a bonding agent, and restoration (endodontic and composite restoration). Pain and discomfort were assessed following an air blast at baseline, immediately after treatment, and during patient visits at weeks 2, 4, and 6.

Treatment with fluoride varnish led to significant reductions in discomfort immediately after treatment and after 1 week. Discomfort decreased by approximately 70% to 85% of baseline scores, followed by a gradual decline. Pain at the 4-week examination was notably lower in the fluoride group compared to other types of treatment. Multiple applications may be required for enhanced efficacy. The benefits stem from the physical blockage of the tubules, although the effectiveness of fluoride varnish began to wane by the end of the sixth week.

The sensitivity level was assessed according to predefined criteria. No statistically significant difference was found between fluoride varnish and dental bonding (dental sealant). When analysed separately, there was no significant difference observed for fluoride varnish across the three examination periods. However, for dental bonding (dental sealant) therapy, a significant difference was noted only between the values obtained before treatment and those recorded weeks after the first application. It can be inferred that both treatments may effectively reduce cervical dentinal hypersensitivity, with improved outcomes observed for teeth with a higher sensitivity level.

Additionally, while treatment in group 3 with endodontic and composite restoration may seem drastic, it proves to be a suitable method for successfully reducing dentinal hypersensitivity (Table.1).

Table 1. Percentage of hypersensitivity reduction for the treatment groups after receiving treatment

Treatment	**Period of treatment**			
group	material	2 weeks	4 weeks	6 weeks
1	fluoride varnish	70-85%	65%	53%
2	Bounding agent	65%	50%	39%
3	Endodontic and Composites restoration	98%	98%	98%

DISCUSSIONS

Dentin hypersensitivity is an exaggerated response to sensory stimuli, typically manifesting as a rapid onset of sharp pain of short duration when exposed dentin is stimulated by various factors such as thermal, evaporative, tactile, osmotic, or chemical stimuli. This response cannot be attributed to any other dental defect or pathology. Various methods and materials are employed for treating dentin hypersensitivity, taking into account the degree of pain, discomfort, and functional complications both before and after treatment.

Treatments aimed at reducing dentin permeability should effectively alleviate dentin sensitivity by occluding dentinal tubules, thereby decreasing the degree of hypersensitivity.

All patients underwent scaling and polishing and received education on the modified Stillman technique. They were instructed to use desensitizing toothpaste and soft-bristle toothbrushes.

After conducting a pre-treatment assessment of hypersensitivity using the cold air blast test following calculus removal (due to improper tooth brushing, scaling, and root planning), it was observed that root planning on sensitive dentin may lead to significant discomfort.

All patients underwent scaling and polishing, along with education on the modified Stillman technique. They were instructed to use desensitizing toothpaste and soft-bristle toothbrushes.

The initial therapy involved the use of fluoride varnishes, which resulted in a significant reduction in dentinal hypersensitivity and a gradual decrease after air stimulation at 2, 4, and 6 weeks. This can be explained by the mechanism of action of fluoride deposition on the tooth surface, leading to the formation of Fluor-apatite. Fluor-apatite has the ability to completely seal dental tubules and promote the formation of secondary dentin surfaces. It can also form stable crystals that are deposited deep inside the dentinal tubules. However, a single application of varnish may not effectively occlude the dentinal tubules and may require multiple applications, as the effects diminish from 2 to 6 weeks during tooth brushing.

Furthermore, fluoride varnish provides additional protection against tooth decay and treatment of dentine hypersensitivity when used in conjunction with brushing.

CONCLUSIONS

Based on the findings of this study, we conclude that all desensitizing agents are capable of reducing dentin hypersensitivity, with varying degrees of effectiveness showing a decrease in dentin hypersensitivity from the first to the second week.

Treatment for dentin hypersensitivity requires a thorough understanding of the condition's complexity and available treatment options.

Management of dental hypersensitivity should involve regular treatment, starting with at-home therapy and then complementing with additional treatments as needed.

Patients who undergo periodontal therapy are more prone to developing hypersensitivity due to gingival recession and exposed root surfaces resulting from the disease and its associated therapy. This exposes dentin tubules to the oral environment.

Reducing the frequency of consumption of acidic foods and drinks and, in some cases, modifying toothbrushing practices may also be advisable.

Patients should be encouraged to seek medical advice if the primary cause of tooth wear is environmental or medical.

However, it is evident that a single strategy may not be suitable for all patients.

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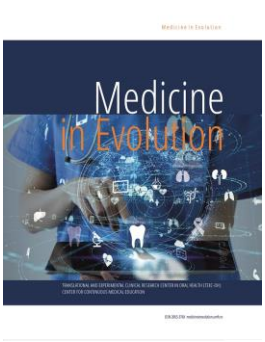
Using children's drawings to understand their emotions and expectations in the dental clinic



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Received: 21 April 2024; Accepted: 21 May 2024; Published: 30 June 2024

Abstract

Pediatric dentistry requires a specialized approach to managing children's anxiety and fear during dental visits. The use of drawings as a method of communication can be highly effective in understanding children's emotions and expectations in the dental office. This literature review analyzes relevant studies published in the last 10 years regarding the use of children's drawings in the context of dental medicine, highlighting the benefits of this approach and providing guidance for future research.

Keywords: child drawings, dentistry, pediatric dental anxiety, communication

INTRODUCTION

In pediatric dentistry, knowledge of both preventive measures and restorative skills is necessary, as well as understanding the children psychological development. This understanding enables the dentist to manage stressful situations in the dental office and identify dental anxiety and fear. The use of drawings as a means of expression and communication can facilitate the understanding and management of these emotions, contributing to a positive experience during the dental visit [1,2].

Dental fear typically refers to a normal unpleasant emotional reaction to specific threatening that occur in situations associated with dental treatment, while dental anxiety is an excessive, nonspecific negative emotional state. Emotional reactions are similar in both situations. Fear can be subjective (emotions and thoughts) or objective (behavior and physiological reactions). Children have difficulty describing subjective experiences using verbal language but fare better matching internal states with representations through drawings of emotions [3].

Currently, there is increasing interest in using art as a means of facilitating communication with children. Several authors have suggested that an appropriate way to gather information about children's perceptions and experiences is through projective self-report techniques, such as drawings. Children's drawings can provide a unique window into their inner experiences, especially when they have experienced stress and anxiety [3]. Drawing, as a graphic representation of thoughts and feelings, is one of the most primitive forms of human communication [4].

Considering Piaget's theory, Di-Leo established criteria for understanding the process of evolution of drawings in the cognitive development stages of children. In the Sensorimotor Stage (0-4 years), scratches appear, and by the age of 2, drawing is initially a reflexive reaction and part of motor activity. From the age of 2, the child draws circles as signs of symbolic communication, which becomes evident at the age of 3-4. In the Pre-Operational Stage (4-7 years), there is intellectual realism, and the child draws from an internal model, highlighting transparency and the presence of expressionism and subjectivism. In the Concrete Operations Stage (7-12 years), subjectivity is reduced, and the child begins to draw visible reality. Human figures become more proportional without transparency, and colors become more conventional due to visual realism. In the Formal Operations Stage (12 years and older), drawings are subject to self-criticism, and as a result, drawing activity decreases; however, children with drawing skills maintain this activity [4].

Aim and objectives

The aim of this study is to explore the effectiveness of utilizing children's drawings as a tool for understanding their emotions and expectations during dental visits. The objectives include:

1. Assessing the emotional themes depicted in children's drawings related to dental experiences.
2. Investigating the correlation between children's drawings and their reported emotional states during dental visits.
3. Exploring the developmental progression of children's drawings and its implications for understanding their emotional experiences in the dental setting.

MATERIAL AND METHODS

This literature review is focused on relevant studies investigating the use of children's drawings in the dental clinic. Articles were searched in academic databases such as PubMed, Google Scholar and Web of Science, using relevant search terms such as "child drawings", "dentistry", "pediatric dental anxiety", and "communication".

Inclusion criteria:

-parental consent for study participation;

-patients aged 3-14 years;

-clinically healthy patients.

Exclusion criteria:

-patients with a history of general pathological medical conditions.

In accordance with the aforementioned inclusion and exclusion criteria, only articles relevant to the study were selected. Thus, information regarding the participants' age for each study, the evaluation method, and the results and conclusions reached after conducting these studies were analyzed.

RESULTS

Table 1. Article analysis

Method	Age	Results	Conclusions
The methods used in this research included observation and analysis of drawings using Vygotskian method [1].	6 - 9	Personal relationships were represented by including the child in drawings and by what the children said during the activity, highlighting a strong relationship established with the dentist. Dental anxiety was expressed by children through their drawings, depicting them as "immobilized" or tense in the face of situations perceived as threatening. Additionally, a lack of representation of oral hygiene tools was observed.	The study underscores the need for a more careful approach in the dental education of children and in managing their anxiety during dental visits. It also highlights the importance of involving children in the dental care process and the necessity of effective communication between the dentist and the pediatric patient.
Data analysis was conducted using Riley's (1996) technique of data coding using colored fluorescent highlighter pens to identify common themes [5].	7 - 14	The writing and drawing technique used revealed that fear of the white coat and fear of needles were observed among children, and they also expect a play area within the dental office. Additionally, children showed greater trust in procedures and exhibited improved cooperation after using this technique.	The writing and drawing technique can be successfully applied as a tool to identify children's opinions regarding pediatric dentistry and the dental office.
The drawings were evaluated using the Drawing Scale Manual (CD: H) and correlated with FLACC, FPS-R, and Frankl using Pearson correlation test [6].	4 - 13	A positive correlation, although statistically nonsignificant, was observed between the CD: H scores and all other parameters considered (Frankl, FPS-R, and FLACC) in the present study.	The drawings could not act as a measure to substitute the child's pain; however, they acted as a recounting of experiences and reflection of internal emotions. Therefore, drawings can be used as an

			additional tool in the dental arsenal.
The drawings were evaluated using the CD:H scoring sheet, and the findings were compared with SEM and Frankl scores [3].	4 - 11	A significant positive linear correlation was observed between SEM scores and CD:H (P < 0.001, correlation coefficient = +0.483). Furthermore, a significant negative linear correlation was found between Frankl scores and CD:H (P < 0.001, correlation coefficient = -0.550). The correlation coefficient between SEM scale and Frankl scale was -0.905 (the evaluation system in Frankl is inverse to SEM and CD:H scales).	Drawing can be a statistically valid indicator of the child's emotional state compared to SEM and Frankl scales. This method is reliable enough to be recommended for all age groups.
The Sound, Eye, and Motor (SEM) and Frankl scales were used as objective assessments of behavior during treatment. Children's drawings were evaluated using the Child Drawing: Hospital (CD: H) scale and the Emotional Indicators of Human Figure Drawings (HFD). The findings were compared with Frankl and SEM scores [7].	6 - 12	A significant negative correlation was identified between Frankl scores and CD: H (P =.017), and likewise, a significant negative correlation was found between HFD scores and Frankl (P =.048).	Drawings can reveal a considerable amount of information about the emotional state of children, and children's drawings can be a useful non-verbal self-report measure to assess anxiety in a pediatric dental setting.
The drawings were collaboratively analyzed by the two dental authors of this study, using theoretical support from books and articles on child psychology, human developmental psychology, and drawing interpretation studies, in addition to articles on children's perceptions of dentists through drawings available in the scientific literature, as a basis for interpreting children's drawings in the dental office [4].	5 - 12	The results showed that boys (521 volunteers - 51.3%) were more prevalent than girls (494 volunteers, 48.6%), 688 (67.7%) of the children had experience with dental care, and the need for treatment was the reason for seeking dental care for 306 (30.1%) of them. In describing the profession using a single word, positive words totaled 805 (79.1%) responses, negative words represented 24 (2.2%), and 186 (18.3%) participants could not answer. The drawing category with the highest number of volunteers was"Procedures", with 238 (23.4%) drawings, followed by:"Dental Consultation" with 228 (22.4%),"Other Professionals" with 174 (17.1%),"Dentist" with 115 (11.3%),"Oral Health" with 71 (6.9%),"Miscellaneous" with 71	The drawings were effective in representing the individual vision and showed a plurality and complexity of concepts and ideas related to dentistry. In addition to procedures and consultations, professional behavior, knowledge conveyed to patients, the physical environment, and experienced sensations, factors related to the origin of the main idea about the profession were also relevant. The volunteers' perception was positive both in the drawings and in the semi-structured interview responses.

		(6.9%),"Dental Office" with 55 (5.4%),"Mouth" with 36 (3.5%), and"Pain/Fear" with 27 (2.6%).	
The drawings were evaluated and scored using graphological method [8].	5 - 10	Significant reductions in stress levels were observed in the drawings made after play therapy.	Play therapy is an effective behavior modification technique in pediatric dentistry, which can be used in routine dental practice.
The three coloring and drawing sections were correlated with the Frankl Behavior Rating Scale [9].	3 - 14	Out of the 178 patients, 60 exhibited a definitely positive behavior, 73 displayed a positive behavior, 37 had a negative behavior, and 8 were totally negative on the Frankl Behavior Rating Scale; 133 children showed no stress markers or had one, while 45 presented 2 or 3 stress markers in their drawings.	The presence of stress markers in their drawings can help identify children who require specialized behavioral techniques. This nonverbal activity itself can have an overall positive effect on the behavior exhibited in the dental office.

DISCUSSIONS

The analyzed studies have highlighted numerous benefits of using children's drawings in the dental office. Among these, they are facilitating communication and expression of emotions, reducing anxiety and stress associated with dental visits, increasing children's cooperation and trust in medical staff, as well as improving the quality of their experience in the dental office.

Some studies have indicated that the success of using drawings in the dental office may depend on factors such as the child's age, level of development, previous experiences in a medical context, and linguistic abilities. Additionally, methodological limitations of some studies, such as small sample sizes or lack of appropriate comparison groups, may influence the interpretation of results.

Torriani (2014) has shown that children's drawings can reflect their perceptions of dental care and oral health. Most of the analyzed drawings presented positive and neutral scenes about dental visits, with few representations of pain or anxiety associated with dental treatments. The results suggest that children's drawings could be used as useful tools to assess their perceptions of dental care and identify potential issues or concerns. This approach could improve communication between children and medical staff, facilitating anxiety management, and providing more personalized care [1].

Rupak Kumar Dasarraju (2017) demonstrated that the write and draw technique could be effective in reducing anxiety and stress in children during dental treatments. The results indicate that this technique could be a promising way to manage children's anxiety and fear in the dental office. This approach could be integrated into pediatric dental practice to improve children's experience and ensure a more comfortable and safer environment [5].

Pala SP, Nuvvula S, and Kamatham R (2016) found that drawings made by children during dental extraction procedures reflected varying levels of pain and discomfort. Children used the drawings to express their emotions and communicate their feelings to the medical staff. The children's drawings served as a useful tool for assessing the level of pain and discomfort associated with dental procedures. Using drawings as a projective measure could be beneficial in obtaining information about the emotional state of children and adapting medical approaches accordingly [6].

Naser Asl Aminabadi demonstrated that drawings made by children during the visits to the dentist reflected significant levels of stress and anxiety. Children's drawings could be considered as useful tools for assessing stress and anxiety in pediatric dentistry. Integrating these drawings into clinical evaluation could improve understanding of individual needs and concerns, and could guide treatment plans and psychological interventions [3].

Guner Onur S (2020) found a positive correlation between the emotional content of children's drawings and their level of anxiety before dental procedures. Children with more negative drawings exhibited higher levels of anxiety during treatment. Children's drawings could be used as indicators of anxiety and fear in pediatric dentistry. Identifying and interpreting the meaning of these drawings could guide medical staff interventions to reduce anxiety and improve children's experiences in the dental clinic. Additionally, the Human Figure Test aids in evaluating cognitive level and identifying unconscious and expressive aspects, personality traits, and the child's experiences with others and the environment. It also serves as an indicator of internalized disorders, gender identity, and eating behavior. The human figure, mostly representing either the child themselves or important people around them. The presence of exaggerated or highlighted body parts, such as hands, shoulders, prominent nose, eyebrows, double or prominent ears, and the presence of teeth, are often associated with hostility and aggression. Details such as shaded eyes and the absence of arms and hands are associated with feelings such as helplessness, shame, fear, and social anxiety. These drawings should be interpreted with care and in context, considering the child's life history and developmental stage [7].

Magalhães Costa (2015) highlighted that drawings made by children could reflect their perceptions of the dentist. Analysis of these drawings revealed various feelings and perceptions, including fear, anxiety, or trust in dental professionals. Integrating these drawings into clinical evaluation could help improve communication and the relationship between children and medical staff [4].

Kiran SDP (2018) has shown that play therapy can be effective in reducing anxiety and stress in children during dental procedures. Analysis of drawings made by children revealed a more positive attitude and open communication after participating in play therapy. The results suggest that play therapy can be an efficient and non-invasive way to manage children's anxiety and fear during dental visits. Using drawings as an assessment tool can provide an additional perspective on the effectiveness of this approach [8].

Mathur J (2017) found that children's drawings can reflect the level of anxiety associated with dental visits and treatments. Analysis of the drawings revealed that certain characteristics of the drawings were associated with behavior scores according to the Frankl scale. Integrating these drawings into clinical practice could facilitate the identification and efficient management of anxiety in pediatric dentistry [9].

These discussions and results highlight the various ways in which children's drawings can be used in pediatric dentistry to understand and manage their emotions and expectations during dental visits. Integrating these techniques into clinical practice could improve the quality of dental care for children and contribute in reducing anxiety and fear associated with dental treatments.

CONCLUSIONS

The use of children's drawings in the dental office represents a promising approach for understanding their emotions and expectations during dental visits. However, further research is needed to investigate the effectiveness of this method in various clinical contexts and populations of children. Future research directions should explore the impact of using

drawings on clinical outcomes and identify optimal strategies for integrating this approach into pediatric dental practice.

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Alcohol consumption and oral health

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Received: 11 April 2024; Accepted: 13 June 2024; Published: 30 June 2024

Abstract

Alcohol consumption poses a significant global public health issue. Substantial evidence associates alcohol intake with mouth, throat, voice box, esophagus, colon (by men), and breast (by women) cancer. Additionally, there is plausible evidence that alcohol increases the likelihood of colon cancer in women and liver cancer. An observed correlation shows that increased alcohol consumption is associated with a higher risk of developing these cancers.

Poor oral health is a significant problem among people who drink alcohol regularly (chronic alcoholics), but little is known about their oral health care needs and whether interventions and guidelines are implemented within alcohol-dependent treatment services. alcohol.

Thus, the present study primarily proposes the identification of frequent oral pathology in chronic alcohol users, the assessment of existing oral health care needs, the assessment of oral health problems in relation to alcohol consumption as well as the assessment of the need for an oral health education program specially intended for people who consume alcohol chronically.

Keywords: alcohol, oral health, addiction, intoxication, dental health services, oral pathology, etiology

INTRODUCTION

Alcohol significantly contributes to the global disease burden and is a major factor in injury and violence [1]. Its consumption imposes substantial social and economic costs worldwide. The World Health Organization identifies alcohol abuse as the third leading risk factor for poor health and a major risk factor for disability and premature death, accounting for 5.1% of disability-adjusted life years. About 5.9% of all deaths (3.3 million people) in 2012 were attributed to alcohol [1]. Estimated costs attributable to alcohol range from 1.3 to 3.3% of gross domestic product in high- and middle-income countries [2]. However, some evidence has suggested that people who consume alcohol may tend to undermine its negative effect in order to justify their behaviour [3] and minimize their uncomfortable experience of Cognitive Dissonance. The latter refers to the effect caused by the inconsistency between the knowledge of the dangerous effect of alcohol consumption and the contradictory desire to drink [4, 5].

Drinking patterns are typically established during adolescence and early adulthood [6,7]. Early initiation of alcohol consumption, particularly between the ages of 11 and 14, is a significant risk factor for poorer health outcomes later in life [8]. Although adolescent alcohol consumption has declined in Australia over the past decade [9], as well as in Europe and the USA [10, 11], alcohol remains one of the most used substances among school students. Notably, while the number of current drinkers has decreased, the rate of consuming more than four drinks at once in the past week has not declined among current drinkers [9]. In 2011, research indicated that 50.7% of Australian high school students had consumed alcohol in the past year, with rates increasing from 5.1% at age 12 to 36.7% at age 17 [12].

Recent evidence has shown that the health, economic and social harms resulting from alcohol use can be reduced through alcohol interventions and policies implemented by governments. In recent years, a growing body of knowledge has shown that strategies that focus on increasing prices and tighter control over alcohol availability (i.e., sales hours and density of alcohol outlets) are highly effective in reducing alcohol-related problems compared to other commonly used strategies. such as educational campaigns, age restrictions and alcohol advertising bans [13-14]. In general, it is expected that strategies that go beyond providing information to mobilizing public opinion and support could be more effective in reducing alcohol-related problems [15]. Therefore, the population's perspective in this regard can be a key component in choosing and implementing appropriate alcohol control strategies in a given society. Previous studies in the UK found that among the general population greater enforcement was strongly supported, while support for pricing policies and restricting access to alcohol was more divided [16,17].

Based on the theoretical assumptions underlying strategies aimed at controlling alcohol-related harm [5], it is expected that alcohol-related interventions and policies can be generally applied within societies. However, as recommended in the global strategy to reduce the harmful use of alcohol proposed by the WHO [18], strategies aimed at reducing alcohol-related harm should be adapted according to national priorities and contexts.

Studies have shown a tendency to minimize negative alcohol-related feelings among drinkers [13]. Furthermore, previous studies have explored the effectiveness of alcohol strategies and policies mainly from objective perspectives such as police records, health care utilization, vital statistics, etc. [19-26]. However, to our knowledge, the population's beliefs about the harms caused by alcohol and the perception of the best strategies that should be used by the government to control alcohol-related problems have not been explored among people with hazardous alcohol use in all countries using a homogeneous system. approach. We hypothesized that hazardous drinkers might have similar perceptions of alcohol policies within societies with similar socioeconomic characteristics.

Enhancing community awareness of lifestyle risk factors associated with cancer has been recognized as a crucial strategy for global cancer prevention [13]. Cancer is one of the most feared diseases among adults in Australia and worldwide. Increasing awareness of the connection between alcohol and cancer may encourage individuals to consider moderation or abstinence. However, international evidence indicates that most people are unaware of this link. In Australia [14], a recent study found that only 36.6% of adults were aware of the significant link between alcohol and cancer. Additionally, the study revealed that those aware of the risk were less likely to exceed the health guideline threshold for lifetime alcohol consumption [15, 16, 17, 18]. Few studies have examined this awareness among young people; a UK study reported that only 37% of individuals aged 15-24 were aware of the link [18]. To our knowledge, awareness of the link between alcohol and cancer has not been previously studied among Australian high school students [19].

Understanding adolescents' reasons for drinking is essential for developing intervention strategies. The social development model posits influence from social controls, social learning, and patterns of association (whereby antisocial attitudes and behaviours are acquired through interaction with others) as important predictors of poor and good behavioural choices in adolescence [20]. Consistent with this model, youth alcohol use has been associated with parental drinking attitudes [21], peer use, and perceptions of peer drinking attitudes [22]. According to this model, peer influence becomes increasingly important in later adolescence, when parental involvement and family influence decline [20]. The role of peer influence, particularly in late adolescence, has been supported in both theoretical and empirical alcohol studies [23].

Alcohol consumption among school children has been associated with several other associated variables, including more weekly spending money [24]; self-reported academic difficulty among women [25]; and engaging in other risk-taking behaviours, including smoking [26]. The relationship between alcohol consumption and socioeconomic status (SES) is less clear than it is with other cancer risk factors. People with higher SES tend to drink more often than others, but among those who drink, lower socioeconomic groups tend to drink larger amounts [27, 28].

Alcohol consumption has been strongly associated with various negative effects on human health [29] and with the occurrence of all types of unintentional injuries, including motor vehicle accidents [30]. It is clear from this survey that almost the entire population studied understands the potential dangers of alcohol consumption. However, the results of the present study suggest that hazardous drinkers perceive lower risks from drinking in both locations. Educational strategies, which are among the most common approaches implemented by governments, may have failed to reach the population most at risk of alcohol use [27]. In this case, strategies aimed at increasing awareness of alcohol-related dangers in this specific group should be implemented with an emphasis on negative health outcomes in Romania, but also in the EU (European Union). Education has been shown to be successful in raising awareness and can also create a positive atmosphere for the implementation of interventions, however, evidence has shown that alcohol consumption remains largely unaffected by this strategy [7,31,32]. On the other hand, it is possible that hazardous drinkers tend to undermine the harmful effects of alcohol as a defence mechanism associated with their own addiction [33], to justify their behaviour and/or minimize their uncomfortable experience of Cognitive dissonance [33, 34], where a different approach will be required. Further studies should aim to establish the causes and consequences of these findings, and potential interventions aimed at increasing awareness of the dangers of alcohol among hazardous drinkers should be explored.

Despite the severe and far-reaching consequences of alcohol use, success in preventing these problems has been limited. The purpose of this chapter is to describe a model of public

health prevention, which the committee used as a framework to organize its discussion of promising avenues of prevention research. The model's focus on the interplay of factors related to alcohol problems, as well as its ability to encompass a wide variety of intervention approaches, appears particularly useful.

To gain insight into the interplay of multiple factors, prevention specialists have adopted an epidemiological or public health model of alcohol-related problems. The model presents three major elements that act together to either produce or alleviate specific problems: the agent—alcoholic beverages or ethanol itself; the individual (host) — traits that affect a person's susceptibility or vulnerability to the effects of alcoholic beverages; and the environment – the physical, interpersonal, or social environment surrounding alcohol consumption that either regulates the individual's exposure to the agent or mediates the risk the agent poses to the individual.

This concept includes both macro and microenvironments, such as the legal environment (alcohol beverage control) laws, drink driving laws, minimum purchase age laws, zoning); the economic environment (prices, excise duty rate, promotions); the normative environment (general attitudes and beliefs about alcohol, the effects of mass media); and physical aspects of the drinker's immediate environment. As the model suggests, a specific alcohol-related problem does not result from just one or the other of these sources. Rather, the model emphasizes the interplay of sometimes subtle forces that shape the type and magnitude of problematic outcomes. The etiology of the specific problem—whether intoxication, addiction, or drink driving—can often be best understood from a public health perspective by isolating the relevant individual, agent, and environmental variables that contribute to the influences. The preventive study provides a method to determine the influence of a particular variable and its implications for subsequent interventions to prevent problem outcomes.

The public health approach to primary prevention has traditionally been aimed at decreasing the rate of occurrence (incidence) of a disease or disorder in a defined population. Prevention interventions, in general, can be seen as attempts to either modify an agent, host (individual) or environmental factor that contributes to an alcohol problem or, conversely, to exploit a factor that reduces risk.

Poor oral health is a significant problem among people who drink alcohol regularly (chronic alcoholics), but little is known about their oral health care needs and whether interventions and guidelines are implemented within alcohol-dependent treatment services. alcohol.

Aim and objectives

The present study primarily proposes the identification of frequent oral pathology in chronic alcohol users, the assessment of existing oral health care needs, the assessment of oral health problems in relation to alcohol consumption as well as the assessment of the need for an oral health education program specially intended for people who consume alcohol chronically.

MATERIAL AND METHODS

To carry out this study, a cross-sectional comparative clinical study was carried out, which considered two groups: the test group - people addicted to alcohol and the control group - non-alcoholic subjects who visited 4 dental offices in Arad, between August and December 2023. Subjects were classified as alcohol dependent based on the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM-5) diagnostic criteria [12].

Subjects who agreed to participate in the study and who gave their written consent had to be at least 18 years old and have at least 20 permanent teeth. Subjects with systemic diseases and those using antibiotics could not participate in the study.

Data were collected using interview and clinical examination. The proforma consists of two parts: The first part consists of socio-demographic details, tobacco use and DSM-5 criteria for alcohol dependence. The second part was the assessment of the oral health status. The subjects' oral health status was assessed using a modified WHO Proforma [13]. The dental condition index was used to assess the prevalence of dental caries; Periodontal status was assessed using the CPI index, mucosal lesions were assessed using modified WHO criteria [13].

Convenience sampling was used, with a total of 86 alcoholic patients examined, of whom only 56 patients were included in the study according to the criteria, and a total of 104 non-alcoholic subjects, of whom 76 were matched controls who met the inclusion criteria. All subjects who entered the study were explained the study procedure.

Oral examination was done using mouth mirror, OMS probe under adequate light (type III clinical examination). Alcohol-dependent subjects were examined in the psychiatric ward by being asked to sit on a chair. The controls were carried out in the dental offices where the subjects were chosen. Oral examination was performed to evaluate dental caries using dentition status index, CPI and LOA, was used to evaluate periodontal status, oral mucosa lesions were evaluated using WHO criteria. This procedure was followed by saliva and plaque collection for pH assessment.

Saliva collection. Whole unstimulated saliva specimens were collected by instructing subjects (study group, control group) not to use any oral stimulation such as eating and drinking for 90 min before collection. Subjects were in a sitting position and in an anterior head-prominence position. Saliva samples were obtained by expectoration into plastic cups.

The plaque sample was collected by Fosdick's method [14]. Plaque was collected using the blunt probe from the buccal, lingual and proximal surfaces of selected teeth (16, 21, 26, 36, 31 and 46) and was mixed in 10 ml of distilled water. The pH of the plate was tested using a digital pH meter.

Statistics were performed more descriptively between the two groups and comparisons, where p was considered significant at $p<0.05$. This was performed in Excel 365 and SPSS 19.0.

RESULTS

The analysis of socio-demographic criteria revealed that the average age was approximately the same in the two groups: Test group - 34.39 years, dev std 5.3, minimum 19 years, maximum 66 years, Control group - 35.79, dev. Std. 4.97, minimum 19, maximum 65 years It is observed that both groups have male subjects in the proportion of 87.5% and 89.75% respectively, thus there are no statistically significant differences between the two groups. Regarding the environment of origin, it can be observed that the subjects from the two batches are similar, most coming from the urban environment 73.21%, respectively 71.82%. The situation remains relatively the same also regarding the level of education, the only significant difference is the presence of only one subject with secondary school education among the control group. Demographic data have been summarized in the following table:

Table 1. Demographic data of the study groups

Variable	1st Group – test	2nd Group - control
Age	Average age = 34,4 yrs ± 5,3y Minimum age = 19 yrs	V average = 35,8 ani ± 4,97 ani Minimum age = 19 yrs

	Maximum age = 66 yrs		Maximum age = 65 yrs	
Gender				
Male	49	87,50%	50	89,29%
Female	7	12,50%	6	10,71%
Residence				
Urban	50	89,29%	53	94,64%
Rural	6	10,71%	3	5,36%
Tobacco use				
Smoking	50	89,29	53	94,64
Nonsmoker	6	10,71	3	3
Completed studies				
Gymnasium	6	10,71%	1	1,79%
Highschool	31	55,36%	33	58,93%
College	19	33,93%	22	39,28%

In both groups most subjects are smokers 89.29% of the test group and 94.64% of the control group. The average number of cigarettes smoked/day is 18.7 with a standard deviation of 6.3 in the test group and 15.2 with a standard deviation of 4.1 in the control group.

Prevalence of dental caries among alcohol-dependent subjects and non-alcoholic subjects: In the entire experience dental caries among alcohol-dependent subjects and non-alcoholic subjects was assessed using dentition status.

Table 2. Oral evaluation results at the two study groups

Variable	1st Group – test		2nd Group - control	
Dental caries				
Present	11	37,50%	7	15,50%
Not present	35	62,50%	49	87,50%
Root residues				
Present	7	15,50%	4	7,14%
Not present	49	87,50%	52	92,86%
Missing tooth				
Present	22	39,29%	17	30,36%
Integral arch	34	60,71%	39	69,64%
Presence of periodontitis				
Severe +	19	33,93%	9	16,07%
Moderate -	37	66,07%	45	80,36%
Not present	0	0%	2	3,57

Caries experience was significantly higher among alcoholics (5.92±2.89) compared to non-alcoholic subjects (4.51±2.04). When individual damaged, missing, filled components were compared between alcohol-dependent and non-alcoholic subjects, the missing component was significantly greater among alcoholics (1.81±2.31) compared to non-alcoholic subjects (0.65± 0.96). No significant difference was observed for the decayed and filled components of the teeth.

Root remnants are more common in patients in the test group, as well as missing teeth, however the differences are not statistically significant, p=0.079 for root remnants and p=0.81 for missing teeth. The presence of periodontitis 33.92% of subjects in the test group and 16.72% of subjects in the control group.

Periodontal status among alcohol dependent and non-alcoholic subjects was assessed using the CPI index showing the prevalence of periodontitis was higher (89.61%) in alcohol dependent subjects compared to controls (78.67%). Periodontal disease was significantly

higher among alcoholics (2.31±1.68) compared to non-alcoholic subjects (1.39±1.22). Only non-pouching bleeding was significantly higher among non-alcoholic subjects (1.43±1.00) compared to alcohol-dependent subjects (0.83±0.80). Attachment loss up to 4–8 mm was significantly greater among alcohol-dependent subjects (0.96±1.61) compared to non-alcoholic subjects (0.43±0.99).

Table 3. Periodontal status

Signs of periodontitis CPI	1st Group – test Media/ Mediana	2nd Group - control Media/ Mediana	Test Mann-Witney p
No symptoms	0/0	0,3/0	0,081
Bleeding	0,83/ 1	1,45/1	0,002
Calcutta	2,80/ 3	3,15/ 3	0,078
4-5 mm pocket	1,98/ 2	1,27/ 1	0,003
Over 6 mm pocket	0,32/ 0,5	0,12/ 0	0,054

The prevalence of oral mucosal lesions was high in alcohol-dependent subjects (39.28%) compared to non-alcoholic subjects (26.78%). Among the various types of oral mucosal lesions reported, leukoplakia had the highest prevalence in alcohol-dependent subjects (16.07%), followed by oral submucosal fibrosis (5.67%), erythroplakia (7.14%) and candidiasis (10.71%).

The following table shows a comparative analysis of salivary and midpalate pH between alcohol-dependent subjects and non-alcoholic subjects. Subjects who were classified as alcohol dependent had lower plaque pH (6.59±0.25) and salivary pH (6.79±0.28) compared to non-alcoholic subjects (plate pH 6, 63±0.25, salivary pH 6.86±0.23), but the difference was not statistically significant.

Table 4. Plaque pH at the two groups

pH	Test group	Control group	Comparative test p
plaque pH	6,59 (0,25)	6,63 (0,25)	0,49
saliva pH	6,79 (0,28)	6,86 (0,23)	0,47

DISCUSSIONS

During the entire dental caries experience among alcohol-dependent subjects (test group) and non-alcoholic subjects (control group) was evaluated using dentition status. Caries experience was significantly higher among alcohol-dependent subjects (5.92±2.89) compared to non-alcoholic subjects (4.51±2.04), with a significantly higher number of missing teeth observed among alcoholics (1.81±2.31), this finding was like the conclusions of previous studies [5,15-18]. Subjects in the test group had permanent tooth loss three times greater than the national age-matched average as reported by the US Alcoholic Patient Survey [19]. Alcoholics and substance abusers are known to have poor oral health. Alcohol drinkers suffer from dry mouth at night and neglect both personal and professional health care and consume large amounts of refined carbohydrates, which may be the likely reason for the increased caries experience observed in them [5].

Alcohol addicts had an increased risk of periodontal disease. Pockets were significantly elevated among alcoholic subjects compared to non-alcoholic subjects. Like a study in Japan that reported that alcoholics have more than one-third of teeth with pocket depth ≥ 4 mm compared to non-drinkers [10]. The same study showed an association between amount of alcohol consumption and periodontal disease in Japanese factory workers [20].

Periodontal problems in alcoholics have been mainly associated with poor oral hygiene and poor dental care [21].

Alcohol addicts had an increased risk of loss of clinical attachment. Attachment loss was significantly greater among alcoholics compared to non-alcoholic subjects. Another study reported comparable advanced clinical periodontal attachment loss (≥5 mm) in alcoholics compared to community controls [23]. They reported that persistent alcohol abuse, as indicated by elevated levels of gamma glutamyl transpeptidase (GGTP) in the blood, is significantly associated with attachment loss. Additionally, greater attachment loss in alcoholics may be the result of abnormalities in cytokine production. This cytokine is toxic to various cells and can lead to apoptosis and cell death [24]. Alcohol can damage periodontal tissues having a negative effect on host defences. It results in complement deficiency, defective neutrophil function (decreased adhesion, motility, phagocytic activity) and increases the frequency of periodontal infections. Alcohol has a toxic effect on the liver. Prothrombin production, vitamin K activity, and the coagulation mechanism may be disrupted, and haemorrhage may occur. Exaggerated gingival inflammation, red-bluish discoloration, and bleeding with mild provocation are common in alcoholics [22].

The prevalence of mucosal lesions was high in alcoholics (39.75%) compared to non-alcoholics (26.97%). These findings are like other studies in specialized literature [2,7,25]. Alcohol abuse is an established risk factor for oral and pharyngeal cancer [1]. Evidence suggests that the increasing incidence of oral cancer, particularly in younger people, is associated with increased alcohol consumption rather than tobacco use [8]. Tobacco consumption and alcohol consumption synergistically influence the development of oral epithelial dysplasia, [6]. Alcohol alters mucosal permeability by altering the rate of penetration of substances from the oral environment through the mucosa, and this may play a role in carcinogenesis [8]. These findings were supported because the etiology of oral mucosal abnormalities is multifactorial, with lifestyle factors such as tobacco and alcohol consumption playing a major causal role in many lesions. This pattern of combined tobacco and alcohol use is not unusual, as unhealthy behaviours often occur in combination. Even in the present study, both alcoholics and controls were smokers, but the amount of smoking was greater among subjects who were classified as alcoholics.

Saliva and plaque pH in subjects who were classified as alcoholics had lower plaque pH (6.59±0.25) and salivary pH (6.79±0.28) compared to non-alcoholics (plate pH 6.63±0.26, salivary pH 6.81±0.23), but the difference was statistically insignificant. Another study conducted in the USA reported that the pH values of both unstimulated and stimulated saliva were lower in the alcoholic group [26]. Chronic excess consumption of acidic beverages such as alcohol can directly lead to a decrease in pH, chronic alcohol consumption can influence the decrease in salivary flow. Differences in salivary pH values are obviously caused by differences in flow rates, as low flow rates result in low pH values.

Alcohol consumption can have both short-term and long-term effects on oral health. While moderate alcohol consumption may not pose significant risks, excessive or chronic alcohol consumption can lead to various oral health problems. Our study demonstrated that alcohol consumption can affect oral health in several ways:

- **Dry mouth:** Alcohol is a diuretic, which means it increases urine production and can lead to dehydration. Dehydration can cause dry mouth, a condition where there is a decrease in saliva production. Saliva plays a crucial role in maintaining oral health by lubricating the mouth, neutralizing acids, and preventing tooth decay. Dry mouth can contribute to bad breath, tooth decay, gum disease and oral infections.
- **Increased risk of oral cancer:** Excessive alcohol consumption is a known risk factor for oral cancer. When alcohol is combined with tobacco use, the likelihood of developing oral

cancer increases significantly. Alcohol irritates and damages cells in oral tissues, making them more susceptible to cancerous changes.

- **Diseases of the gums.** Alcohol abuse weakens the immune system, making it harder for the body to fight infections, including gum disease. Long-term alcohol consumption can lead to gum inflammation, gum recession and periodontal disease. Gum disease, if left untreated, can lead to tooth loss and overall deterioration of oral health.
- **Dental caries.** Alcoholic beverages often contain sugars and acids, which can contribute to tooth decay. Frequent consumption of sweet and acidic drinks, such as cocktails or sweet wines, increases the risk of tooth decay. Alcoholic beverages can erode tooth enamel, making teeth more susceptible to decay.
- **Tooth staining and discoloration.** Alcoholic beverages, especially red wine and dark liquors can stain teeth over time. The pigments in these drinks can adhere to the tooth enamel, resulting in visible discoloration and a dull appearance of the teeth.
- **Delayed healing.** Alcohol affects the body's ability to heal and regenerate tissues. After oral surgery, drinking alcohol can hinder the healing process, increase the risk of complications, and delay recovery.

To minimize the potential negative impact of alcohol on oral health, it is advisable to consume alcohol in moderation or consider abstaining altogether. Practicing good oral hygiene, including regular brushing, flossing, and using antimicrobial mouthwashes, can help maintain oral health. In addition, regular visits to the dentist for professional check-ups and cleanings are crucial for early detection and treatment of any oral health problems. If drinking becomes a problem, it may be beneficial to seek professional help and support from health care providers or support groups.

To develop a prevention program aimed at reducing alcohol consumption and preventing the oral health problems associated with it, the following strategies can be implemented:

- **Education and awareness**: increasing public awareness of the link between alcohol consumption and oral health problems; providing educational campaigns, seminars and workshops highlighting the risks of excessive alcohol consumption on oral health and stressing the importance of moderation and responsible drinking.
- **Screening and intervention**: Implementing screening protocols in dental clinics, primary care settings, and substance abuse treatment centres to identify individuals at risk of alcohol abuse or binge drinking and providing brief interventions and referrals to specialized treatment programs, when appropriate.
- **Collaborative Care**: Encourages collaboration between oral health professionals, primary care providers, and substance abuse specialists on the one hand while developing referral networks and communication pathways to ensure comprehensive care for individuals who require both health oral as well as alcohol-related interventions.
- **Counselling and behavioural support**: Providing counselling and behavioural support services to people seeking help to reduce alcohol consumption and providing guidance on setting realistic goals, developing coping strategies, and accessing support groups or counselling services to address the underlying factors that contribute to excessive alcohol consumption.
- **Motivational interviewing**: Using motivational interviewing techniques to increase individuals' intrinsic motivation and willingness to change their drinking behaviour. This approach can help individuals explore their reasons for changing, identify barriers, and develop a plan to reduce alcohol consumption.
- **Oral health promotion**: Incorporating oral health promotion messages into alcohol prevention programs and materials. Highlighting the impact of alcohol consumption on oral health, including the risk of gum disease, tooth decay, oral cancer, and dry

mouth. Encouraging regular dental visits, proper oral hygiene practices and the importance of a healthy lifestyle.

- **Community Partnerships**: Collaborating with community organizations, schools, and local government agencies to implement comprehensive prevention programs and engaging in community events, health fairs and awareness campaigns to reach a wider audience and promote a culture of responsible consumption of alcohol and oral health.
- **Policy initiatives**: supporting policies that support responsible drinking and oral health. These may include regulations on the marketing and availability of alcohol, taxation, and measures to discourage alcohol abuse.
- **Virtual Reality Therapy:** Virtual reality (VR) can be a valuable tool in the treatment of alcohol addiction. By using VR programs that gradually expose patients to scenarios involving alcohol, such as being in bars or social situations where others are drinking and offering drinks, patients can develop and strengthen their ability to resist temptations. This method, known as exposure therapy, allows patients to face their triggers in a controlled environment, helping them build resilience and the capacity to say no to alcohol. Over time, this gradual exposure can reduce the power of these triggers, making patients less likely to relapse when they encounter similar situations in real life.

VR therapy can be customized to the specific needs and triggers of individual patients. For instance, scenarios can be designed to mimic bars or social environments where the patient has previously experienced difficulties. This personalized approach enhances the effectiveness of the therapy, as patients are more likely to encounter realistic simulations of their own experiences. Additionally, VR can be used to practice coping strategies in real-time, such as engaging in alternative activities, using refusal skills, or employing relaxation techniques, all within the safety of a virtual setting.

Moreover, the use of VR in addiction treatment offers a significant advantage in terms of accessibility and convenience. Patients who may find it difficult to attend in-person therapy sessions due to geographical, financial, or personal constraints can benefit from VR therapy sessions conducted at home or in local clinics. This flexibility can lead to higher engagement and adherence to treatment programs, ultimately improving outcomes. As technology advances, the integration of VR into addiction therapy holds promise for creating more immersive and effective treatment options, offering new hope for individuals struggling with alcohol addiction.

CONCLUSIONS

Subjects classified as alcohol-dependent exhibited slightly lower mean pH levels in dental plaque and saliva, along with a higher prevalence of dental caries, root remnants, missing teeth, periodontitis, and mucosal lesions compared to non-alcoholic subjects. Alcoholics often face an increased risk of missing teeth, cavities, and periodontal disease. The combination of alcohol consumption and poor oral hygiene practices can exacerbate these oral health issues. Our study highlighted the impact of alcohol on missing teeth, cavities, and periodontal disease in alcoholics, and we describe the possible causes below:

Chronic alcohol consumption can contribute to tooth loss in several ways. Firstly, alcohol abuse is often associated with poor nutrition, which can weaken teeth and gums, increasing the risk of tooth loss. Additionally, alcohol can impair judgment and coordination, leading to accidents or injuries that result in tooth loss. Lastly, neglect of oral health related to alcohol use, such as skipping routine dental care and necessary treatments, can further the progression of oral health problems and lead to tooth loss.

Alcohol consumption, especially when combined with sugary drinks or alcohol high in sugar, can contribute to the development of dental caries. Frequent consumption of sugary drinks and poor oral hygiene practices among alcoholics can create an environment conducive to the growth of harmful bacteria that cause dental caries. Furthermore, alcohol's acidic properties can erode tooth enamel, making teeth more susceptible to cavities.

Alcohol abuse weakens the immune system, affecting the body's ability to fight infections, including those of the gums. This compromised immune response can increase the risk of periodontal disease (gum disease) in alcoholics. Gingival inflammation, bleeding gums, gum recession, and even tooth loss can occur due to the combined effects of alcohol-induced immune suppression and poor oral hygiene practices.

Alcoholism often leads to the neglect of oral health care. Individuals struggling with alcohol dependence may prioritize alcohol consumption over routine dental care, including regular check-ups, professional cleanings, and necessary treatments. This neglect can further contribute to the progression of oral health issues, including tooth loss, dental caries, and periodontal disease.

Addressing these oral health issues in alcoholics requires a comprehensive approach that combines oral health education, access to dental care, substance abuse treatment, and behavioural support. Integrating oral health care into substance abuse treatment programs and providing tailored interventions can help individuals improve their oral health while addressing underlying addiction issues.

The integration of virtual reality (VR) therapy into the treatment of alcohol addiction represents a promising advancement in addiction management. By providing a controlled environment for gradual exposure to alcohol-related triggers, VR therapy helps patients build resilience and develop effective coping strategies. This innovative approach not only personalizes treatment to individual needs but also enhances accessibility for patients who may face barriers to traditional therapy methods. As VR technology continues to evolve, its application in addiction therapy holds the potential to significantly improve treatment outcomes, offering a novel and effective tool in the ongoing effort to combat alcohol addiction. The findings and discussions presented in this study underscore the importance of incorporating such cutting-edge technologies into comprehensive treatment plans, ultimately contributing to better health and recovery outcomes for individuals struggling with alcohol dependence.

As such, collaborative efforts between dental professionals, substance abuse specialists, healthcare providers and Virtual Reality Therapies are crucial in supporting the oral health needs of alcoholics.

Study Limitations

The small sample size was a limitation of the study, as it was conducted over a short duration, resulting in a smaller sample being obtained. Therefore, further studies on a larger sample size are recommended.

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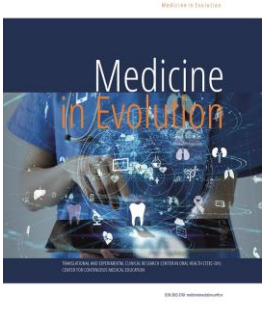
Prospective study on Glutathione expression and immune response in the oral cavity of diabetic patients



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Received: 4 March 2024; Accepted: 3 May 2024; Published: 30 June 2024

Abstract

Aim and objectives: This study aimed to investigate the association between antioxidant protection factors (glutathione and MTH1/MUTH) and immune response (CD3-lymphocyte T and CD20-lymphocyte B) in the oral cavity mucosa of diabetic patients. Material and methods: Glutathione levels and immune cell expressions (CD3 and CD20) were measured in the oral mucosa of diabetic patients and compared with a control group using immunohistochemical analysis. Results: Diabetic patients had significantly lower glutathione levels and altered immune responses, with higher oxidative stress in B lymphocytes (CD20) and T lymphocytes (CD3). The T/B lymphocyte ratio was significantly higher in diabetic patients, indicating immune imbalance. Conclusions: Diabetic patients showed reduced glutathione levels and a higher T/B lymphocyte ratio in the oral cavity, suggesting that oxidative stress negatively impacts immune function. This highlights the need for antioxidant therapies in managing oral health in diabetic patients.

Keywords: glutathione, diabetic patients, oral cavity

INTRODUCTION

Diabetes is a complex metabolic disease characterized by hyperglycemia, which results from anomalies in insulin secretion or insulin action [1]. The pathological effects of hyperglycemia adversely impact the function of various organs [2]. Diabetes is one of the most prevalent and challenging contemporary chronic diseases, significantly affecting patients' quality of life and life expectancy [3]. The global prevalence of diabetes reached 9% in 2019, and the number of newly diagnosed cases continues to rise [4].

Obesity, high carbohydrate consumption, processed red meat, alcohol, and refined grains are among the most commonly implicated risk factors for diabetes [5]. Additionally, a sedentary lifestyle and reduced physical activity are associated with a higher risk of prediabetes and type 2 diabetes [6].

Regarding oral health implications, periodontal disease and dental caries are diagnosed more frequently in patients with diabetes [7]. Periodontal disease and hyperglycemia share common risk factors, and individuals with diabetes are more susceptible to developing periodontal disease [8]. Moreover, in cases of uncontrolled diabetes, the severity of periodontal disease is greater than in other clinical contexts [9]. Dental caries have a higher prevalence among individuals with diabetes, likely due to alterations in the quality and quantity of saliva [10]. Other common complications in diabetic patients include salivary dysfunctions, tooth loss, oral lesions, candidiasis, and changes in taste [11].

Glutathione is a crucial non-enzymatic antioxidant present in mammalian cells, which protects cells against free radicals and pro-oxidants [12]. In patients with type 2 diabetes, glutathione concentration is reduced, though the mechanisms underlying this reduction are not fully elucidated [13]. Several clinical studies have indicated that glutathione and its precursors can reduce oxidative stress biomarkers and decrease insulin resistance [14]. The diminished synthesis of glutathione in patients with type 2 diabetes can be ameliorated through dietary supplementation, which also reduces systemic oxidative stress [14,15].

Traditionally, glutathione has been investigated in the blood, plasma, or serum of patients [16]. However, saliva is a valuable diagnostic tool and can also be used to measure glutathione levels [17]. Additionally, crevicular fluid [18] and oral tissue biopsies [19] can be utilized to evaluate oral glutathione levels. Once measured, glutathione levels can be compared between diabetic and non-diabetic individuals to assess any differences. Furthermore, glutathione levels can be correlated with other oral health parameters such as periodontal status, dental caries, and oral mucosal health to elucidate the relationship between glutathione and oral health in diabetic patients.

Aim and objectives

Based on the current state of knowledge, this study aimed to evaluate the possible association between antioxidant protection factors (glutathione and MTH1/MUTH) and cellular immune response (CD3-lymphocyte T), as well as the humoral immune response (CD20-lymphocyte B). Specifically, we aimed to assess the increase in glutathione as an oxidative protection factor in the oral cavity mucosa of patients with diabetes and to evaluate the involvement of immune mechanisms by quantifying the expression of CD20 and CD3.

MATERIAL AND METHODS

This study was designed as a prospective analysis involving the evaluation of 10 consecutive oral mucosa biopsies from patients with diabetes, compared to a control group of 10 non-diabetic patients, all sourced from the Resident Laboratory in Oradea, Romania. The

histological and immunohistochemical examination of the tissues necessitated their preservation in a condition resembling that in vivo. The research process comprised several successive stages:

- Tissue fixation: Tissue fragments were immersed in formalin, an aqueous solution, to prevent autolysis and necrobiosis. It was crucial to fix the tissue immediately after sampling, ensuring cold and warm ischemia times were under one hour.
- Dehydration: Water was extracted from the tissues through successive alcohol baths of increasing concentrations (70°, 90°, and 100°). This step aimed to replace tissue water with paraffin for solidification and sectioning.
- Clarification: The dehydrating agent was replaced with a paraffin solvent, such as toluene or xylene.
- Impregnation: Tissues were impregnated with paraffin.
- Embedding: The paraffin-impregnated tissue was embedded in a paraffin block, preparing it for the next step.
- Tissue sectioning: Tissue sections were cut at 3, 4, and 5 microns using a microtome, resulting in ribbons of tissue embedded in paraffin.
- Spreading: The sections were stretched on glass slides using warm water or heated platinum.
- Staining: The sections were deparaffinized, rehydrated, and stained using an automated Gemini-Epredia robot, following the manufacturer's Hematoxylin-eosin staining protocol.
- Mounting: The stained sections were protected with a glass slide.

Immunohistochemical analyses were conducted on an automated staining platform, the Ventana Benchmark GX, according to the manufacturer's instructions. Slides were deparaffinized with EZprep solution (Ventana Medical Systems, Inc.) at 90°C. All reagents and incubation times followed the instructions on the antibody inserts. Slides were prepared using the OmniMap DAB (3,3'-diaminobenzidine) detection kit (Ventana Medical Systems, Inc.) and counterstained with Hematoxylin.

Sections were incubated with polyclonal anti-glutathione primary antibody (ab9443, rabbit, IgG, cytoplasmic, Abcam, Cambridge, CB2 0AX, UK) following the manufacturer's protocol. Similarly, sections were incubated with rabbit polyclonal antibodies CD3 (clone 2GV6-ready-to-use, Ventana) and CD20 (clone L26-ready-to-use, Ventana) according to the respective protocols. Negative controls were established by omitting the primary antibody on identical sections.

Images of the tissues were captured using a Leica 300DM microscope equipped with an HD video camera, and analyzed using software provided by Leica. Specimens were assessed using the H-score, which is calculated by multiplying the percentage of cells at each intensity (scored from 0 to 3) and summing the results, with a maximum score of 300. In this system, <1% positive cells are considered a negative result.

Values were presented as mean values ± standard deviation (SD) using GraphPad Prism 8.0 software. Continuous variables were compared using paired and independent Student's t-tests, with p-values < 0.05 considered statistically significant.

RESULTS

The analysis of mean H-score values for GLUT revealed a significant difference between biopsies from patients with diabetes and those from patients with strictly oral pathology. The mean value and standard deviation (SD) of GLUT in the control group was 278.5 ± 22.73, compared to the mean value in patients with diabetes, which was 15 ± 8.49 (Table I).

Table I. Values for GLUT in the study group and the control group

No.	0	1+	2+	3+	SG-H-score	CG-H-Score
1	90	10	0	0	10	270
2	70	30	0	0	30	280
3	90	10	0	0	10	300
4	80	20	0	0	20	250
5	90	10	0	0	10	230
6	80	20	0	0	20	290
7	80	20	0	0	20	285
8	80	20	0	0	20	300
9	0	0	0	0	0	295
10	90	10	0	0	10	285
Mean value and SD					**15 ± 8,49**	**278,5±22,73**

SG – Study Group; CG – Control Group

The results of the T-test indicated that the variation in mean values and standard deviations of glutathione levels between the study group and the control group possesses high statistical significance ($p < 0.05$).

Microscopic analysis revealed a high expression of the H-score in the majority of control cases. The maximum H-score value was 300. Immunostaining for the presence of glutathione (GLUT) was visualized as a brown color. High chromogenic intensity was observed in the oral mucosa of control group patients, corroborated by the reaction presence in most of the examined cells (Figure 1A). In certain cases within the control group, a decrease in immunohistochemical expression for GLUT was noted, particularly in the superficial layers of the non-keratinized stratified squamous mucosa (Figure 1C). Among patients with diabetes, two distinct patterns were observed: the first pattern exhibited a total absence of GLUT expression (Figure 1B), while the second showed minimal expression, primarily in the basal layers (Figure 1D).

The variability in the balance between the cellular immune response (T lymphocytes) and the humoral immune response (B lymphocytes) is presented in Table II. The comparative evaluation of CD3 and CD20 expression in patients with diabetes revealed a significant difference between these two types of immune response. The mean value and standard deviation (SD) of CD3 in the control group was 265.5 ± 141.63, whereas the mean value and SD of CD20 in patients with diabetes was 60.5 ± 82.85 (Table II).

The results of the T-test revealed a high statistical significance in the analysis of the two parameters, CD3 (cellular immune response) and CD20 (humoral immune response) ($p < 0.05$).

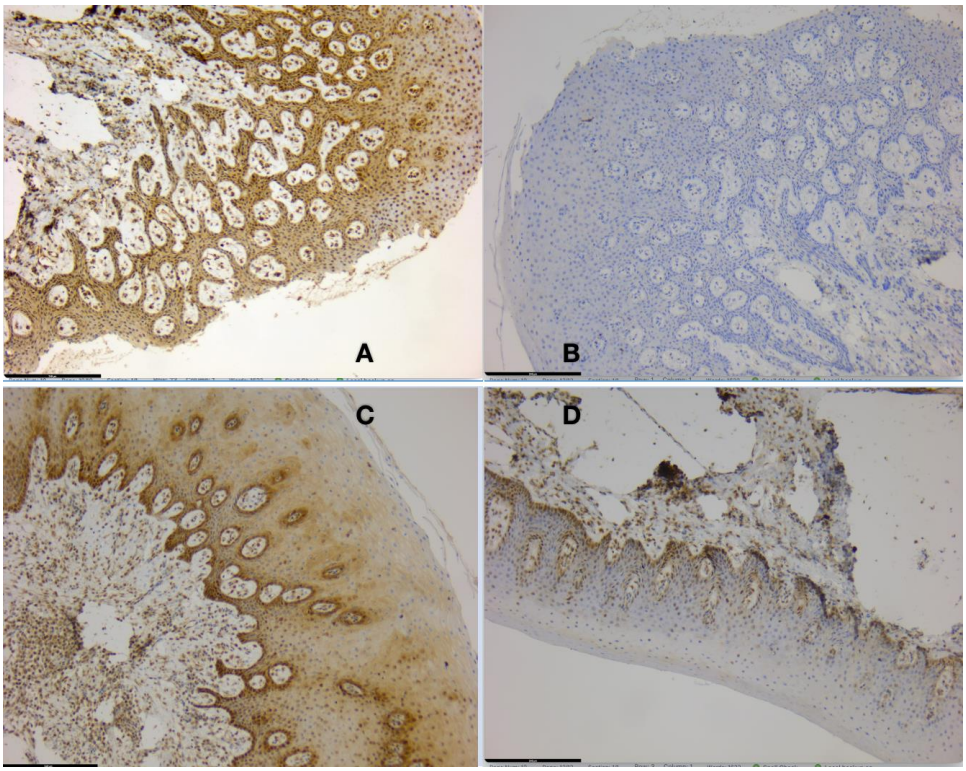

Figure 1. Immunohistochemical expression of glutathione in patients with diabetes and in the control group

Table II. Values for CD3 and CD20

No.	CD20	CD3
1	10	106
2	5	287
3	20	177
4	120	490
5	195	267
6	15	50
7	5	259
8	15	193
9	200	389
10	20	437
Mean value and SD	**60,5± 82,85**	**265,5± 141,63**

Microscopic analysis of the immune response showed that the cellular immune response, as evidenced by CD3 expression, is higher (Figure 2A) compared to the humoral immune response, as evidenced by CD20 immunolabeling (Figure 2B). In the case of B lymphocytes (CD20), there is greater variability (ranging from a minimum of 5 lymphocytes/HPF to a maximum of 200 lymphocytes/HPF) compared to T lymphocytes (CD3), which exhibit much less dispersion (ranging from a minimum of 50 lymphocytes/HPF to a maximum of 437 lymphocytes/HPF).

Evaluating the ratio of the medians of the two lymphocyte populations, it is evident that T lymphocytes are much more numerous compared to B lymphocytes, with a T/B ratio of 4.38. T lymphocytes (CD3) are primarily located in a band at the dermo-epidermal interface (Figure 2C), whereas B lymphocytes (CD20) tend to localize deeper within the dermis, often forming nodular aggregates (Figure 2D).

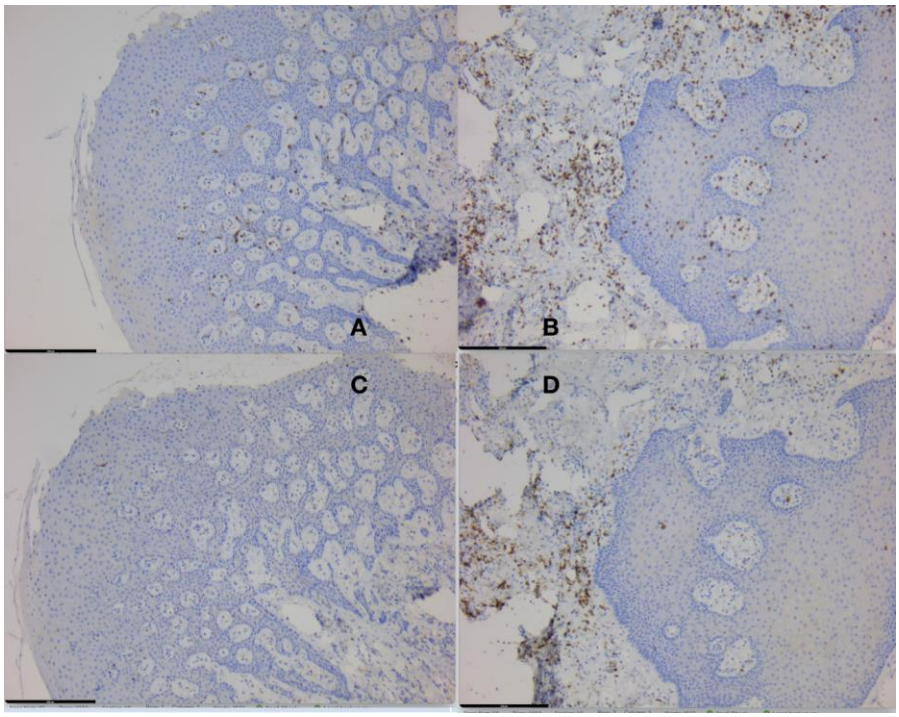

Figure 2. Immunohistochemical expression of CD3 and CD20 in patients with diabetes

DISCUSSIONS

The elevated blood sugar levels in patients with diabetes are associated with an increased release of reactive oxygen species (ROS), resulting in heightened oxidative stress. Elevated oxidative stress can induce the development of metabolic diseases [20]. High oxidative stress is linked to both increased cellular insulin resistance and the destruction of β-cells, as well as exacerbating diabetes-related complications such as angiopathies and neuropathies [20].

The body's mechanisms for counteracting the increased levels of reactive oxygen species include endogenous enzymatic systems such as catalase, superoxide dismutase, and glutathione peroxidase, as well as non-enzymatic mechanisms involving vitamins [21].

In our study, we observed a reduction in antioxidant factors within the oral mucosa. The antioxidant levels were assessed by quantifying the intensity of the immunohistochemical reaction of glutathione (GLUT) in the oral cavity mucosa. The role of glutathione as an intracellular antioxidant that balances oxidative stress is well established [22,23]. Glutathione deficiency, similar to other pathological states, has been investigated in the context of diabetes. Several studies have reported a decrease in erythrocyte glutathione concentration in diabetic patients [24-27]. Our analysis revealed a significantly lower glutathione level in diabetic patients, as evaluated by the H-score. The control group exhibited a mean H-score of 278.5 ± 22.73, compared to the diabetic group's mean of 15 ± 8.49. This low antioxidant level in the study group aligns with the observed high oxidative stress in the examined tissues.

Despite the extensive research on oxidative stress, the complexity of its mechanisms in type 2 diabetes patients remains incompletely understood. Considering the potential use of biomarkers to evaluate oxidative stress profiles, we propose the hypothesis of potential therapeutic options targeting these mechanisms. However, the literature provides conflicting data regarding the therapeutic benefits and limitations in the progression of diabetes [20]. Numerous studies have aimed to elucidate the impact of glucose levels on the immune system in diabetic patients.

The alteration of the immune response in patients with diabetes is a gradual process involving numerous cellular and humoral mechanisms. Patients with diabetes, especially those experiencing ketoacidosis, exhibit an increased incidence and severity of infections [28]. Many studies have posited that hyperglycemia serves as a metabolic substrate for various microorganisms [28]. More recent approaches focus on the impact of diabetes on the host's immune response to harmful factors.

A comparative analysis of the mean values of B and T lymphocytes reveals a lower number of B-type lymphocytes (CD20+), which directly results in decreased immunoglobulin levels [29]. Specifically, the number of B lymphocytes (CD20) varies widely (from a minimum of 5 lymphocytes/HPF to a maximum of 200 lymphocytes/HPF) compared to T lymphocytes (CD3), which range from 50 lymphocytes/HPF to 437 lymphocytes/HPF. The average ratio of T to B lymphocytes indicates that T lymphocytes are significantly more abundant (T/B=4.38).

Recent studies have shown that peripheral blood mononuclear cells stimulated with anti-CD3 and exposed to elevated blood glucose levels exhibit a significant decrease compared to non-diabetic patients [21]. Other studies have demonstrated the involvement of various interleukins (IL-2, IL-6, IL-10) in initiating the immune response, with extreme hyperglycemia associated with their reduced levels [30]. Despite significant advances in understanding the impairment of the immune response in diabetic patients, the underlying molecular mechanisms remain unclear. TGF-beta 1, which precedes the reduction of IL production, could serve as a useful biomarker in monitoring diabetic patients [30].

The analysis of lymphocyte subpopulations in the biopsies from this study revealed T lymphocytes predominantly at the dermo-epidermal interface, whereas B lymphocytes were primarily located in the deep dermis. Although not the primary focus of our study, it was noted that both B lymphocytes (CD20) and T lymphocytes (CD3) exhibited higher oxidative stress levels compared to the control group.

Numerous studies have highlighted the interrelationship between reactive oxygen species and immune response levels. A decrease in glutathione or other antioxidant factors is associated with inhibited synthesis and release of cytokines from T lymphocytes (CD3). Increased oxidative stress stimulates the production of IL-1, NF-kB, and TNF-α, altering the immune response [30].

Based on the existing literature, it is evident that not only the number of T lymphocytes is crucial for maintaining immune system homeostasis, but their functionality is also compromised by oxidative stress. In our study, the link between glutathione levels in the oral mucosa and immune system status could not be evaluated due to the limited number of cases. This small sample size diminishes the predictive value of the statistical data. Nonetheless, this research hypothesis remains significant for future studies.

CONCLUSIONS

In this study, the average value of glutathione was lower in patients with diabetes, and the difference between the average value in the control group and that in the diabetic group was statistically significant. The reduced levels of antioxidant factors in the oral mucosa were frequently associated with ulcerations and microangiopathies. Additionally, the analysis of T (CD3) and B (CD20) lymphocyte subpopulations in the oral mucosa of diabetic patients revealed a significant difference in the immune response between these two lymphocyte types. Consistent with other data from the specialized literature, it can be concluded that oxidative stress interacts with and impairs T lymphocyte function.

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Evaluation of behaviors and attitudes regarding oral health among students

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Received: Received: 16 April 2024; Accepted: 19 June 2024; Published: 30 June 2024

Abstract

The purpose of this study is to evaluate behaviors and attitudes towards oral health among first-year students at the Faculty of Dentistry at the "Carol Davila" University of Medicine and Pharmacy in Bucharest, and among first-year students at the Faculty of Management in Pitești, specializing in Educational Management at the master's level, and to compare the results between the two groups. The study is a descriptive cross-sectional one and includes a total of 256 students, 156 from the Faculty of Dentistry (Group I) and 100 from the Faculty of Educational Management (Group II). The sociological survey method based on a questionnaire was used. The questionnaires used were anonymous, and the same questionnaire was used in both groups, allowing for comparative evaluation. Students provided demographic information regarding gender and age, and the data were processed using Microsoft Excel. According to the respondents, dental and gingival health is generally good, with a percentage of 51.9% for students at the Faculty of Dentistry (Group I) and 66% for students in Group II. The assessment with an excellent rating was only 3% in both groups participating in the study. Behavior can be changed either through individual efforts, educators promoting health, opinion leaders, or as a result of changes in the economic, political, social, technological, and environmental fields.

Keywords: oral health, habits, knowledge, health education

INTRODUCTION

Social factors, overlaid with personal decision-making, can determine individual behavior change [1,2]. In contemporary society, individuals need to be informed and motivated, enabling them to positively influence their health and thereby reduce the incidence of oral and general conditions [3,4]. Maintaining oral health requires sustained and repeated efforts from individuals, dentists, as well as the entire community. Health promotion is the science that allows individuals and communities to increase control over health determinants and thus improve their health status [5,6]. In the post-pandemic period, concern for health and medical knowledge among the population has increased and influences individuals' behavior [7]. For students at the Faculty of Dentistry, interest in health is high, as they represent role models for family, peers, patients, and the community in which they live [3,8]. Although cross-sectional studies highlight a weak link between knowledge and behaviors, oral health knowledge conditions healthy habits [9]. Individual efforts are effective when accompanied by societal changes. The perspective of health benefits provides weak motivation for change until society adopts it as a new behavioral rule. From that moment on, motivation to adhere to the rule imposed by society becomes strong and leads to significant changes in individuals' behaviors [10-12]. The behavior of medical personnel towards their own health reflects an understanding of the importance of preventive approaches and the improvement and preservation of patients' health [4,13].

Aim and objectives

The purpose of the study is to evaluate behaviors and attitudes towards oral health among first-year students at the Faculty of Dentistry at the "Carol Davila" University of Medicine and Pharmacy in Bucharest, and among first-year students at the Public Faculty in Piteşti, specializing in Educational Management at the master's level, and to compare the results between the two groups.

The authors start from the premise that the level of knowledge regarding oral health is higher in the group of students from the Faculty of Dentistry. To assess the level of concerns related to oral health among both students from the Faculty of Dentistry and first-year Master's students from the Faculty of Educational Management, who are not particularly interested in health, we will compare the obtained results.

MATERIAL AND METHODS

The study is a descriptive cross-sectional one and includes a total of 256 students, of which 156 are from the Faculty of Dentistry (Group I) and 100 are from the Faculty of Educational Management (Group II). The survey method based on an anonymous questionnaire was used. The questionnaires used were the same for both groups, allowing the comparative evaluation. Students provided demographic information regarding gender and age, and the data were processed using Microsoft Excel.

RESULTS

Comparing the student groups, the authors found the following results: The respondents generally perceive their own dental and gingival health to be good, with a percentage of 51.9% for students at the Faculty of Dentistry (Group I) and 66% for students in Group II. The appreciation with an excellent rating was only 3% in both groups participating in the study. The perceived need for dental treatment varies: dental students believe they

need orthodontic treatment in 13% of cases (Master's students obtain a percentage of only 3%), 1.9% need extractions, unlike 4% in the Master's group, and the need for cleaning treatment is higher in the opinion of dental students - 27.5% versus 12% (Fig. 1 and Fig. 2).

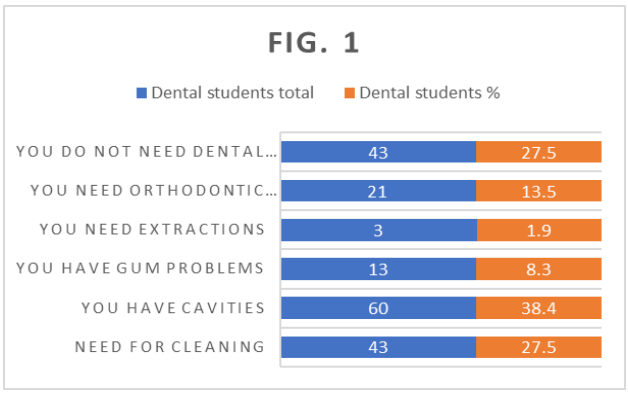

Figure 1. Self-perceived Treatment Need According to First-Year Dental Students (%)

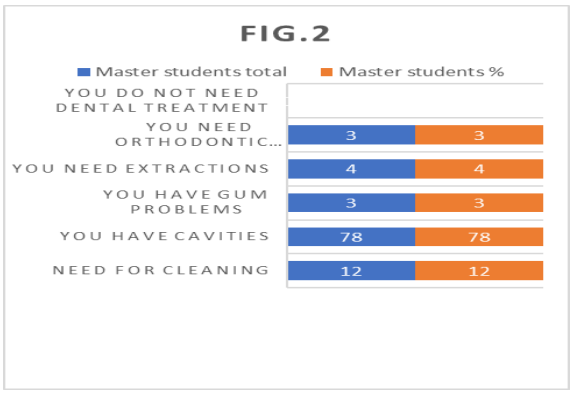

Figure 2. Self-assessed Treatment Need Among of Master's Students (%)

Results diametrically opposed were obtained regarding the level of knowledge regarding oral health. Paradoxically, dental students believe that tooth brushing does not prevent cavities (92.9% compared to 83% of master's students who assert that brushing plays a primary role) (Fig. 3).

Additionally, 41.3% of dental students believe that dental problems affect facial appearance, compared to 77% in group II (Fig. 4).

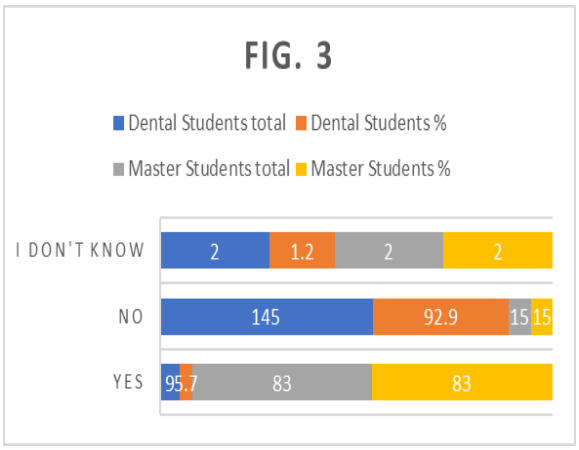

Figure 3. Respondents' Opinion Regarding the Role of Tooth Brushing in Dental Cavities Formation

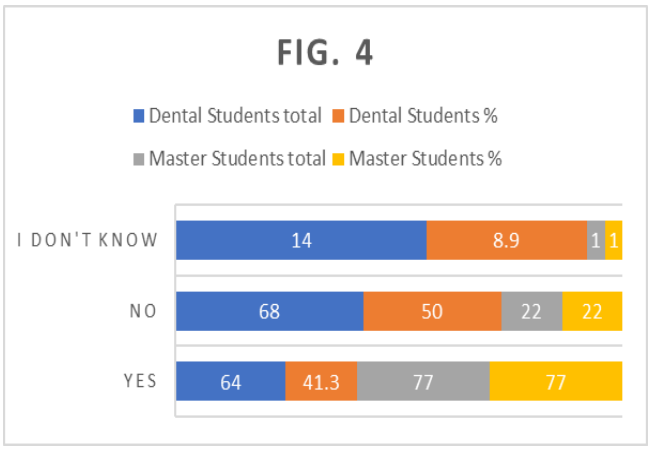

Figure 4. Opinion of Students from Both Groups Regarding the relation between dental problems and facial appearance

Regarding anxiety about dental treatments, the results are approximately equal; both groups of students claim to be afraid to go to the dentist (86.5% Faculty of Dentistry versus 63% Master), and some of them only go to the dentist when they have problems or pain (22.4% Dentistry versus 46% Master) (Fig. 5)

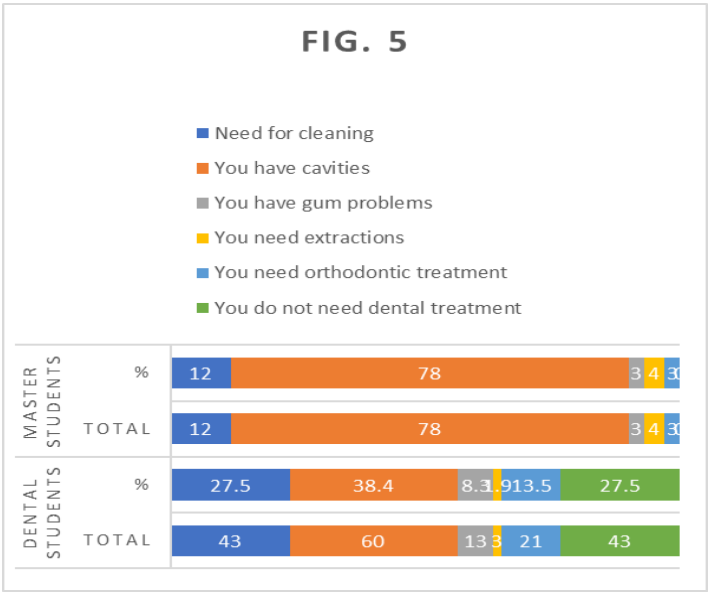

Figure 5. Reason for Visiting the Dentist among students from both groups

Similar results were obtained regarding the question about experiencing dental pain in the last year, with the majority experiencing frequent pain (34.6% and 63%, respectively). The dental treatment received so far differs between the two groups; dental students have undergone dental (76.9%) and preventive treatment (41.6%) (Fig. 6), while master's students have received prosthetic treatment (35%), dental treatment (26%), surgical treatment (15%), and only 3% orthodontic treatment (Fig. 7).

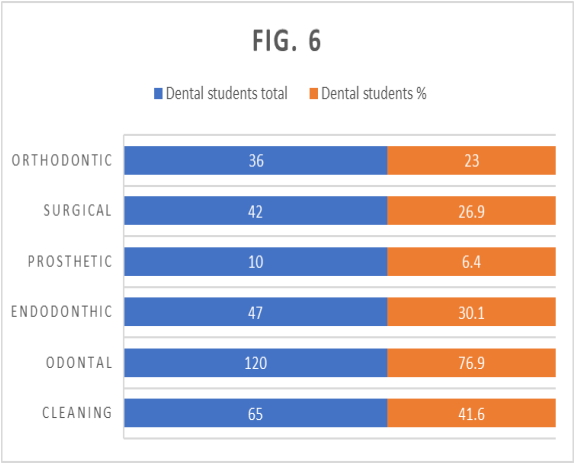

Figure 6. Type of Dental Treatment in the History of Dental Students

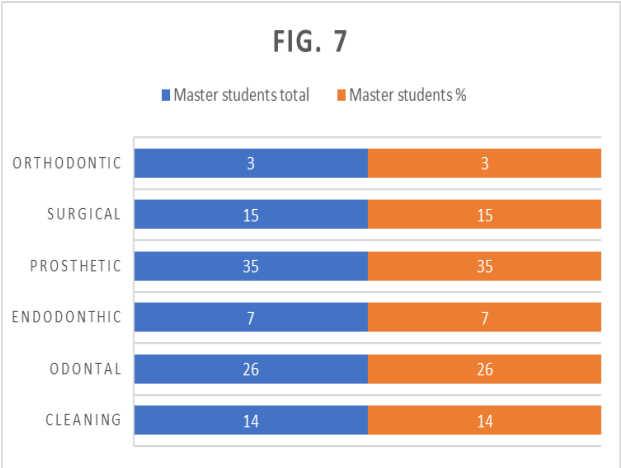

Figure 7. Type of Dental Treatment in the History of Master's Students

In terms of dental check-up frequency, the vast majority of students go twice a year (approximately 22%). The frequency of tooth brushing is twice a day, with subjects using fluoride toothpaste in approximately 90% of cases and a manual toothbrush.

Regarding diet, for dental students, the consumption of fruits and vegetables daily is approximately 40%, which is equal to the consumption of sweets, with a frequency of two to three times a week. Carbonated juices and sugary drinks have a consumption frequency of 2-3 times a week at 29.4%. Fast food is consumed once a week (32.6%) (Fig. 8).

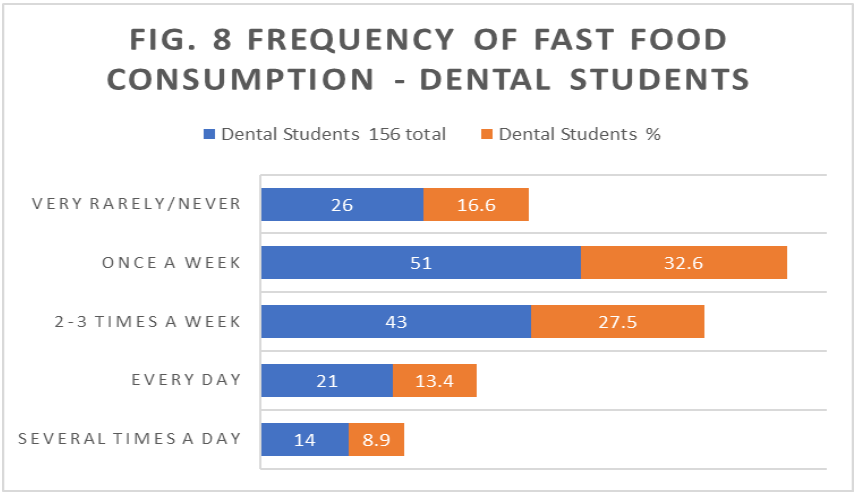

Figure 8. Frequency of Fast Food Consumption Among Dental Students

The diet of master's students includes a daily consumption frequency of fruits, vegetables (42%, respectively 45%), and sweets (51%). Carbonated juices are consumed several times a day (62%), while fast food is consumed once a week (30%) (Fig. 9).

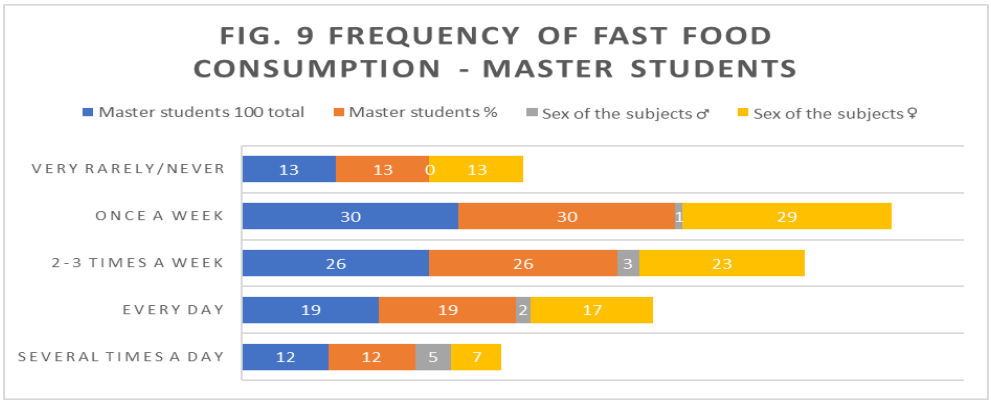

Figure 9. Consumption of Fast Food Among Master's Students

After meals, only 19.8% of dental students claim to brush their teeth. Master's students, on the other hand, chew gum in a percentage of 66%, while 19% brush their teeth (Fig. 10).

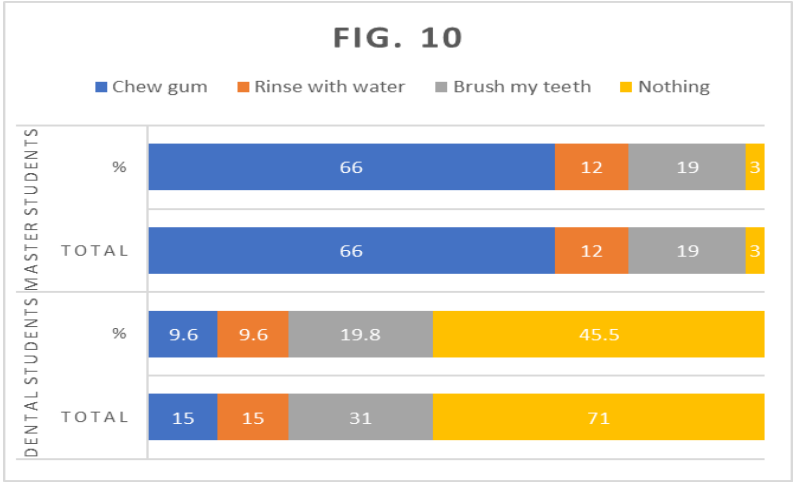

Figure 10. Post-Meal Behaviour Among Students from Both Groups

Tobacco consumption is low among students, with 58.5% not smoking (the group of dental students) versus 48% in the Master's group. A smaller percentage smoke between 5 and 10 cigarettes per day (11.5% in Group I and 21% for Group II) (Fig. 11).

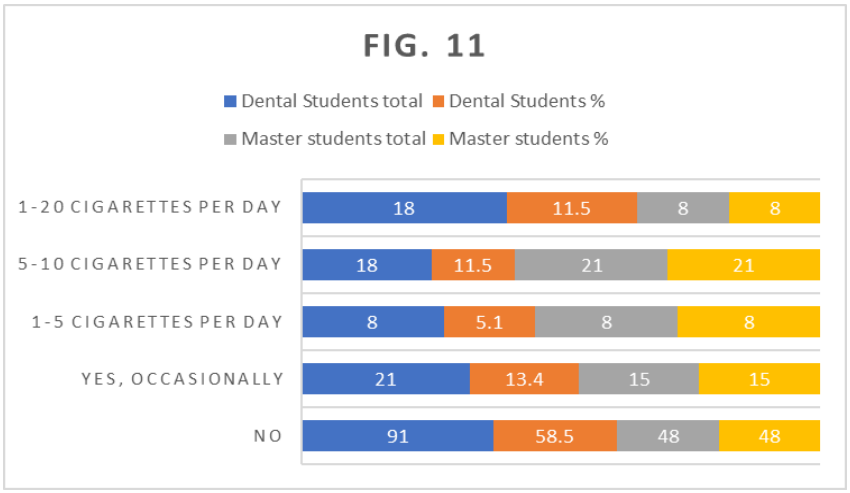

Figure 11. Tobacco Consumption in the Two Groups of students

DISCUSSIONS

Modifying behaviors and attitudes is a long process involving laborious educational efforts. Behavioral habits (dietary, hygiene, sexual, etc.) need to be monitored over time, sometimes for years, to draw valid conclusions regarding their formation, fixation, and consolidation.

Based on the results obtained, we conducted a comparison with similar studies in which both concerns and different behaviors regarding oral health were highlighted.

In one study, on a sample of 9203 subjects aged 12-21 years, it was shown that 93% had visited a dentist at least once, and 43% reported that their last dental visit was more than 1 year before the study [14]. For 7826 subjects, it was possible to classify the reason for the dental visit as symptomatic or asymptomatic, and 37% reported that symptoms were the reason for their last dental visit. In our study, 46% of Master students and 24% of Dental students go to the dental office when they have pain.

Another study conducted in Kuwait aimed to evaluate knowledge and behavior regarding oral health among 153 male students at the Health Sciences College [16]. The results showed that almost all students were aware of the role of fluoride in cavity prevention, the role of sugar in cavity etiology, and the fact that extraction is not the only treatment for dental pain. More than half of the students had visited the dentist for treatment, similar with the present study. 34% of students brush their teeth twice a day or more often, 45% once a day, and 20% less than once a day [15]. Their brushing practices are still far behind international recommendations (twice a day), and their oral health knowledge is also limited. Most students (70%) use fluoride toothpaste, whereas in our study (90%).

CONCLUSIONS

Oral health habits and knowledge needs to be improved in both groups. Behavior can be changed either through individual efforts, health-promoting educators, influencers, or as a result of the effects of changes in the economic, political, social, technological, and environmental domains.

For health education to be effective, it must encourage individuals to develop skills in implementing health-promoting practices, cultivate self-confidence, and shape perceptions rather than simply providing information.

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Legal considerations on criminal liability in the medical field

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Received: 25 March 2024; Accepted: 14 June 2024; Published: 30 June 2024

Abstract

Medical criminal liability is a current, leading to a series of consequences regarding the future professional life of doctors. In the context where the health and safety of patients are major priorities, understanding legal medical responsibility is essential for ensuring the quality of medical services and preventing the commission of acts that constitute offenses. **Materials and Methods:** To conduct this observational-prospective study, a questionnaire consisting of 10 closed choice or selection questions was compiled, aiming to analyse the level of information among dentists regarding the Romanian legislation that regulates the legal framework for engaging the medical staff's liability once offenses related to the practice of the profession are established. **Results and Discussions:** After the completion period ended, the questionnaires were centralized and statistically analysed. Dental practitioners from urban areas are better informed about the medical legislation and are aware how to protect themselves against and their professional activity. **Conclusions:** The main conclusion of this study focuses on the importance of increasing the level of information among dentists regarding the content of the existing criminal legislation currently in force in our country, and one of the professional bodies that could contribute to this is the College of Dental Physicians of Romania through its active involvement.

Keywords: criminal liability, crime, imprisonment, fine, medical personnel

INTRODUCTION

Criminal liability is a fundamental institution of criminal law, involving those accountable who have committed an act defined by criminal law, through the application of legal criminal sanctions [1]. Not every antisocial act entails criminal liability, but only those acts which, according to legal provisions, are qualified as constituting the elements of a crime. Identifying the types of crimes that can be committed in the medical field during the performance of the professional duties, is base on the combination of two distinct elements: crimes existing in the current national criminal legislation and the direct link between the professional activity of medical personnel and the life, health, physical and psychological integrity of the patient [2]. By performing medical acts, doctors are not predisposed to commit any of the crimes provided by criminal legislation. Certain categories of crimes like the ones that may interact with the life, health, physical or psychological integrity are harmed. Alongside the crimes through which the aforementioned social values are harmed, crimes of service can also be committed, as the doctor, when exercising professional competencies, is engaged in a service activity, which must be carried out correctly, respecting the legal interests of the person [3]. In the case of any of the crimes, the question arises of the existence or non-existence of unprofessional behaviour, inferior to the standards of competence and skills unanimously admitted and accepted by the medical professional body based on negligence or incompetence, behaviour that draws a series of negative consequences on the patient [4]. In relation to the research topic, the legal regime of practicing the medical profession, currently regulated within Law no. 95/2006 on health reform, need to be primarily considered. According to Law no. 95/2006 on health reform in Romania, practicing the medical profession by a person who does not have this qualification, constitutes a crime and is punished according to the Criminal Code [5]. The perpetrator's ignorance of the abilities necessary to practice the medical profession, namely that of a dentist or the ignorance of the legal conditions for exercising them, does not remove the criminal nature of the act. The provisions regulating the regime of practicing the medical profession, even included in a non-criminal law, have the character of criminal norms that complete the content of the crime [6]. Practicing the medical profession, by a person who does not hold a qualification according to article 348 of the New Criminal Code, the unauthorized practice of a profession or activity is sanctioned according to criminal law, with imprisonment from 3 months to one year or with a fine [7]. Considering the previously mentioned legal provisions, the active subject of this crime can even be a doctor who unlawfully practices a medical profession of another specialty, in the absence of legal authorization or specialization in this regard [8].

Aim of the study

The purpose and objectives of this research study is focusing on analysing the level of knowledge that dental practitioners have regarding the risks they face upon committing an act defined by criminal law, which meets the constitutive elements of a crime. In this context, we aim to observe to what extent they are familiar with the content of the applicable criminal legislation in the medical field, in order to understand which antisocial acts are sanctioned by the legislator when committed during the practice of their profession.

MATERIAL AND METHODS

This research aims to conduct an observational-prospective study through a questionnaire, to a group of 60 dentists in Timiș County, from urban and rural areas.

The questionnaire was comprised of 10 closed-ended questions with three answer choices, focusing primarily on analysing the level of information that the dental practitioners have regarding the content of the criminal legislation applicable in the medical field. Before distributing the questionnaire, dental practitioners were asked for their consent to participate in the study, and the purpose of the study was explained to them. Before filling out the questionnaire, the participants were invited to ask questions regarding this study.

The questionnaire was distributed in physically to dental practitioners in Timiș County, who had one week to fill it. The first question aimed to analyse the level of information that dental practitioners have regarding the knowledge of Romanian legislation regulating the criminal liability of medical personnel, especially dental practitioners, which can be incurred due to the commission of a crime related to the practice of their profession. The main purpose of this question was to evaluate the level of familiarity of dental practitioners with the criminal legislation in the medical field. Moreover, we wanted to observe the source of information regarding the existence of criminal legislation for those dental practitioners who claim to have knowledge in this regard. It is essential for dental practitioners to be aware of the legal responsibilities that come with their profession, as well as the legal consequences associated with practicing their profession. Thus, this aspect can contribute to improving the quality of provided medical services, avoiding the commission of potential crimes related to the practice of the profession, and increasing patients' trust in Romania's healthcare system.

The second question aimed to evaluate to what extent dental practitioners have, until now, sought specialized legal representation in medical malpractice cases to represent them in a criminal trial related to the commission of a crime during their professional practice. Thus, it is important to know if dental practitioners have been involved in such situations and if they have sought specialized legal assistance to defend them in a criminal trial.

The third question addressed to dental practitioners tackled a highly debated topic in various studies over time and in the media, namely, to what extent the criminal legislation in the medical field should be stricter, punishing more severely the antisocial acts committed by medical personnel, which infringe upon the rights and interests of patients, even endangering their safety. We aim to observe whether the tightening of sanctions would lead to a decrease in the number of crimes committed in the medical field by professionals, by increasing awareness of the consequences they face. The fourth question, analyse the extent to which dental practitioners are familiar with various cases from medical practice that have been made public through the media when it comes to different accusations of practicing the profession without the right. Additionally, we wanted to observe if there were dental practitioners who were closely familiar with these cases, informing themselves about how these accusations against their colleagues were resolved.

Question number five is related to dentist’s awareness regarding the forms of legal responsibility that can be attributed to them upon the concurrent commission of a crime and a disciplinary infraction during the practice of their profession. Additionally, we wanted to observe if dental practitioners are aware of the legislation that prescribes their sanctioning both from a criminal and disciplinary standpoint when the committed act requires it. Through the sixth question, we aimed to examine the extent to which dental practitioners are aware that the current legislation in Romania applicable in the medical field criminalizes the act of practicing a profession or activity without the right, being considered a crime according to Romanian criminal law. The responses can reflect the level of information that dental practitioners have, regarding legal regulations related to practicing their profession and can highlight the importance of adhering to the legal framework in medical practice. Evaluation of this aspect, can contribute to understanding the need for continuous education and adherence to norms and professional ethics in medical activities.

The seventh question aims to assess the level of knowledge of dental practitioners regarding the role of the Romanian College of Dental Practitioners in identifying crimes related to the practice of the profession. The obtained responses provide information about the level of awareness and familiarity of practitioners regarding the responsibilities and duties of the Romanian College of Dental Practitioners in this context. The results obtained can contribute to strengthening doctors' awareness of the importance and involvement of the Romanian College of Dental Practitioners in managing professional violation and can offer relevant information for improving the regulatory and control system in dental medical field.

Question number eight debates a sensitive topic regarding the sanctions applied in cases where medical personnel are found guilty of committing a crime during the practice of their profession. The goal is to analyse their opinion about the measure of exclusion or how the case should be judge when a dentist is found guilty by committing a crime. The ninth question addressed to dental practitioners examines the extent to which they have become aware so far of situations that involve the identification and sanctioning according to legal provisions of various crimes committed in the medical field by some of their colleagues. The obtained results serve to provide important information regarding the frequency and types of crimes committed in the field of dentistry, as well as the methods of sanctioning them.

The last question included in the questionnaire, is focuses on dental practitioners' perception of the current legislation in Romania in the field of medical criminal liability in the context of crimes related to the practice of the profession. The goal is to evaluate the doctors' opinion on the clarity and conciseness of the legislation regarding possible scenarios of committing crimes in the medical field. The results obtained can offer relevant information about the perception of dental practitioners regarding the effectiveness of the legislation in preventing and sanctioning crimes in dental medical practice, as well as possible suggestions for improving the legislation in this area.

RESULTS

The collected data were analysed based on the responses of 60 dental practitioners from rural and urban environment.

Question 1: Are you aware that there is currently legislation in Romania regulating the criminal liability of medical personnel and implicitly of dental practitioners? The results showed that four from the rural and fourteen from the urban environment do not know which law currently regulates the criminal liability of medical personnel. Seven dental practitioners from rural and twenty-five from the urban environment learned about the existence of legislation regulating medical criminal liability through acquaintances practicing in the legal field as lawyers. Three practitioners operating in the rural environment and seven in the urban environment know in detail the legislation regulating the criminal liability of the dental practitioner, given that they have participated in a professional training course on this topic (Figure 1).

Question 2: Have you so far resorted to lawyers specialized in the field of medical malpractice to defend yourself in a criminal process involving the commission of a crime? Ten dental practitioners from rural and eleven from the urban environment have resorted to lawyers specialized in the field of medical malpractice to defend themselves by criminal accusations. Four practitioners operating in the rural environment and thirty-five from the urban environment mentioned that they have not been involved in a criminal process involving the accusation of committing a crime so far (Figure 2).

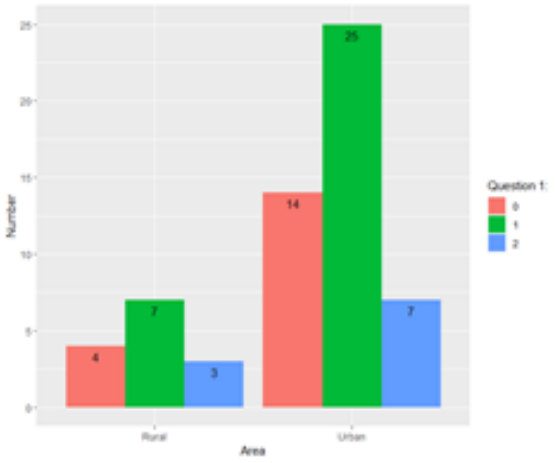

Figure 1. Question 1, statistical results according to urban and rural environment

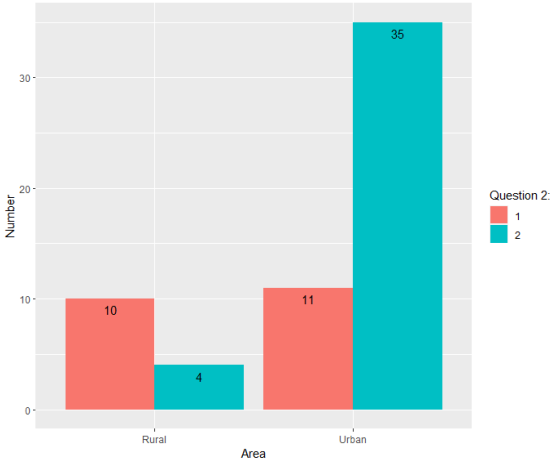

Figure 2. Question 2, statistical results according to urban and rural environment

Question 3: Do you think that the criminal legislation in the medical field should sanction with much harsher punishments the crimes committed by dental practitioners related to the practice of the profession? Results showed that three dentists from the rural and nine from the urban environment believe that the criminal legislation in the medical field should sanction with much harsher punishments the crimes committed by medical personnel related to the practice of the profession. Nine dental practitioners from the rural environment and twenty-four in the urban environment did not provide an opinion on the subject, considering that they have knowledge regarding the applicable criminal legislation in the medical field. Two practitioners from the rural and thirteen from the urban environment consider that the criminal legislation in the medical field should not become harsher in terms of the applied sanctions (Figure 3).

Question 4: Have you become aware through the media of cases in the dental medicine field where certain individuals were accused of practicing the profession without the right, and were subsequently sanctioned according to legal provisions? The results showed that four from rural areas and twenty-six from urban areas stated that they have noticed a series of cases related to various accusations of practicing the profession without the right appearing in the media recently; however, they do not have knowledge about how these complaints were resolved. Two dental practitioners from rural areas and four from urban areas specified that they are aware of such cases appearing in the media, given that in one of these situations the accusation made was directed at one of the individuals within their close circle of friends. Eight dental practitioners from rural and sixteen from urban areas stated that they are not aware of such cases being publicized in the press (Figure 4).

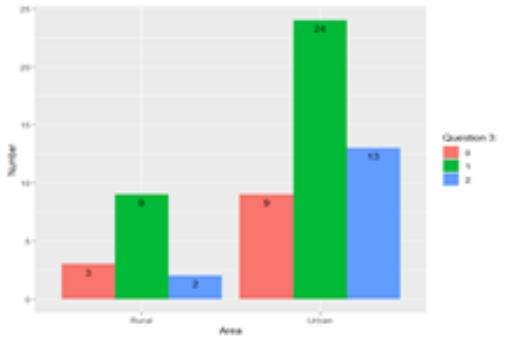

Figure 3. Question 3, statistical results according to urban and rural environment

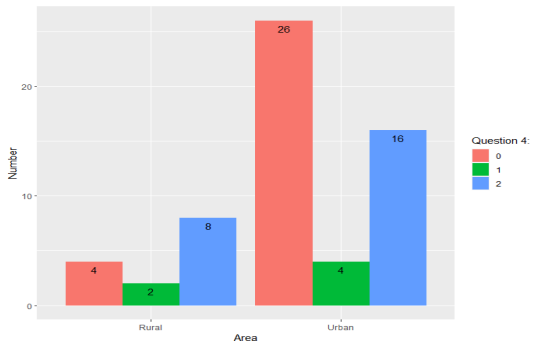

Figure 4. Question 4, statistical results according to urban and rural environment

Question 5: Are you aware that according to legal provisions, dental practitioners can be subject simultaneously to both criminal and disciplinary responsibility in cases where they commit an act that constitutes both the elements of a crime related to the practice of the profession and those of a disciplinary infraction? Two dentists from rural and nine from urban areas are aware that according to legal provisions, dental practitioners can be subject simultaneously to both criminal and disciplinary responsibility. Ten dental practitioners from rural areas and thirty-one from urban areas responded affirmatively to this question, but they specified that they do not have exact knowledge about the legislation that regulates this aspect, and two of the practitioners from rural areas and six from urban areas are not informed about this legislative provision.

Question 6: Are you aware that practicing a profession or activity in the medical field without the right constitutes a crime under Romanian criminal legislation? Only one from the rural area and one from the urban area are not aware about the act of practicing a profession without the right that constitutes a crime under the current legislation in Romania. Nine dental practitioners from rural areas and thirty-four from urban areas stated that they are aware of the criminalization of this act but do not know the legislation in detail, and four practitioners from rural areas and eleven from urban areas are familiar with the legal provisions regarding the act of practicing a profession or activity without the right.

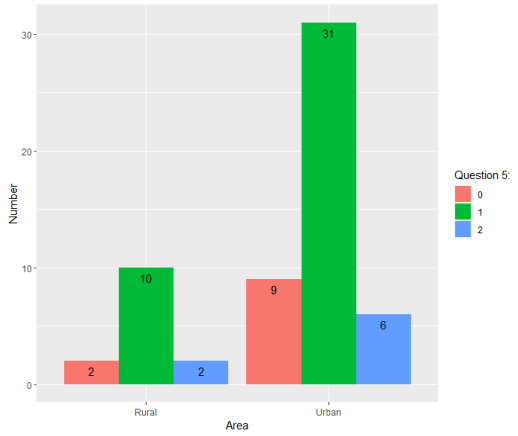

Figure 5. Question 5, statistical results for question 5 according to urban and rural environment

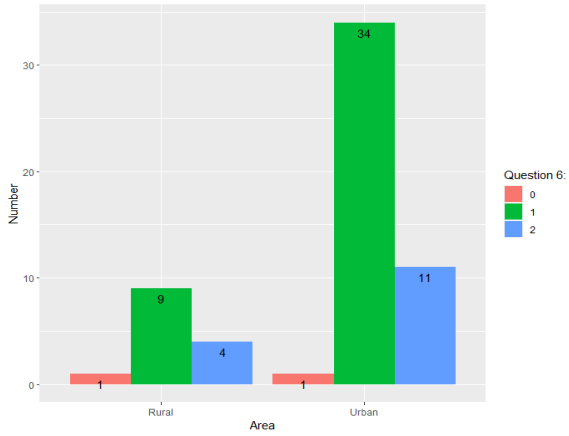

Figure 6. Question 6, statistical results for question 6 according to urban and rural environment

Question 7: Are you aware of the role played by the Romanian College of Dental Practitioners in identifying crimes related to the practice of the profession by a dentist? The results showed that two from rural areas and eight from urban areas do not possess information regarding the role and duties the Romanian College of Dental Practitioners fulfils in identifying crimes concerning the practice of the profession. Eleven dental practitioners from rural and thirty-four from urban areas know the role this professional body plays in identifying crimes related to the practice of the profession. One dental practitioner from a rural area and four from urban areas know in detail the role this professional body plays in identifying crimes related to the practice of the dentistry profession, considering they have been accused in the past by a patient of committing such an act.

Question 8: Do you think that regardless of the act committed, when the commission of a crime by medical personnel related to the practice of the profession is proven, the sanction that should be applied is permanent exclusion from the profession? The results showed that one dental practitioner from a rural area and seven from urban areas consider that regardless the act committed, when the commission of a crime by medical personnel related to the practice of the profession is proven, the sanction that should be applied is

permanent exclusion from the profession. Six dental practitioners from rural areas and fifteen from urban areas do not have legal knowledge for a relevant opinion. Seven practitioners from rural areas and twenty-four from urban areas believe that the sanction of permanent exclusion from the profession should only be applied in cases where the committed criminal act presents a significant social danger.

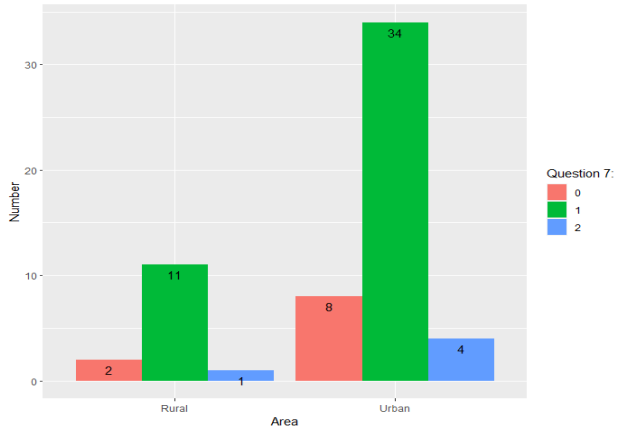

Figure 7. Question 7, statistical results for question 7 according to urban and rural environment

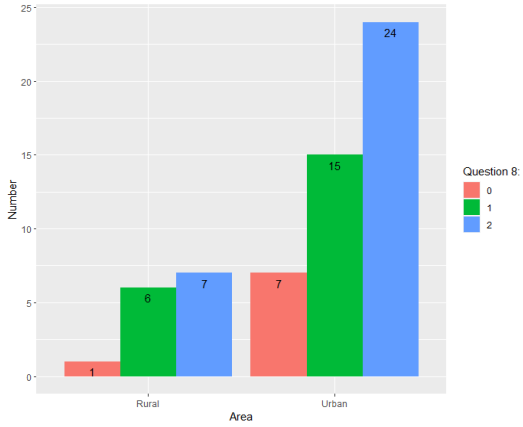

Figure 8. Question 8, statistical results for question 8 according to urban and rural environment

Question 9: To your knowledge so far, are there cases within the Romanian College of Dental Practitioners you are part of where the commission of a crime related to the practice of the profession by a dentist has been proven, with criminal responsibility being attributed to them? The results showed that three dental practitioners from rural areas and four from urban areas stated they are aware of certain cases within the Romanian College of Dental Practitioners they are registered in which some of their colleagues were found guilty of committing criminal acts related to the practice of the profession, with their responsibility being engaged. Only two dental practitioners from urban areas stated that, up to this date, no cases have been recorded within the Romanian College of Dental Practitioners they are registered in which the commission of a crime related to the practice of the profession by some of their colleagues has been proven. Eleven practitioners from rural areas and forty from urban areas do not have precise information in this regard.

Question 10: Do you think the current legislation in Romania in the field of medical criminal liability is sufficiently explicit and comprehensive considering the possible scenarios related to the commission of crimes in the practice of dental medicine? The results showed that two dentists from rural and eleven from urban areas consider the current legislation in Romania in the field of medical criminal liability to be not sufficiently explicit and comprehensive and is requiring a series of modifications and legislative adjustments to ensure adequate protection for both patients and dental practitioners. Nine dental practitioners from rural areas and thirty-one from urban areas state they do not have enough knowledge about the current legislation of medical criminal liability to issue a relevant opinion. Three practitioners from rural areas and four from urban areas believe the current legislation in Romania in the field of medical criminal liability is sufficiently explicit and comprehensive.

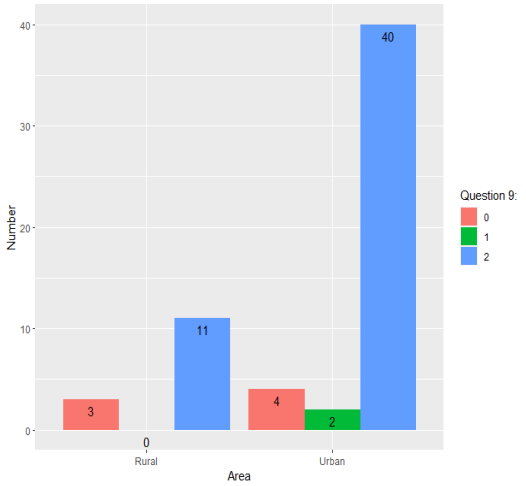

Figure 9. Question 9, statistical results for question 9 according to urban and rural environment

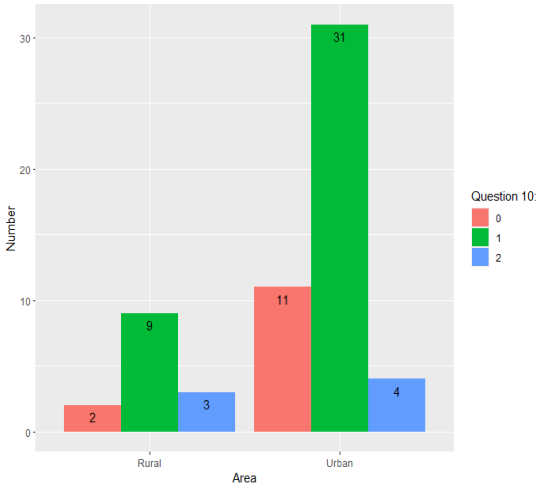

Figure 10. Question 10, statistical results for question 10 according to urban and rural environment

DISCUSSIONS

It is important for dental practitioners to be up to date with relevant legal provisions to ensure a practice that complies with the law and ethics. Besides being aware of the existence of legislation in Romania that sanctions crimes in the medical field and being familiar with its provisions, they will be informed about the consequences arising from violating these laws. The number of dentists in the urban areas is higher so, connections in the medical practice and with other medical specialities are more stronger.

The knowledge of criminal legislation in the medical field by dental practitioners, especially the sanctions they are exposed to upon committing a crime, serves to decrease the number of unlawful acts, instilling in each practitioner a sense of responsibility for both the lives of their patients and their own life and freedom.

The role of the Romanian College of Dental Practitioners in identifying medical crimes is essential for ensuring ethics and professionalism in the field of dentistry. The Romanian College of Dental Practitioners (CMSR) has the role of monitoring and verifying how each dental practitioner exercises their profession, identifying potential violations of legislation and professional standards. Through the CMSR, efforts are made to protect patients and maintain high standards in the dental medical field.

CONCLUSIONS

Following the completion of this study, one of the conclusions highlights the imperative need for clear and precise legislation regarding criminal liability in the medical field. The provisions within the legislation should be well-defined, providing precise guidance for medical professionals and ensuring protection for both doctors and patients. Ambiguous or incomplete legislation can create confusion and lead to various uncertainties regarding the criminal liability that may be attributed to dental practitioners following the identification of a committed crime.

It is of real importance for dental practitioners to be aware of the real need to inform themselves about the current legislation regarding informed consent, medical legislation, medical malpractice and it's consequences. Criminalized actions in the medical field, can and need to be prevented in any situation that would dental practitioners outside of legality and which would lead to their sanctioning [9, 10].

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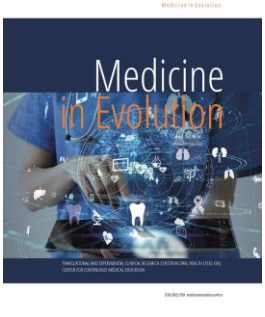
Success rates of dental implant restorations and alveolar bone reconstruction: a clinical-statistical study



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Received: 22 May 2024; Accepted: 22 June 2024; Published: 30 June 2024

Abstract

The aim of the study was to determine the clinical and statistical success rates for implant-prosthetic rehabilitation and alveolar bone crest reconstruction in edentulous patients, evaluating the overall state of patients, identify potential risk factors during implant-prosthetic therapy, track the evolution of the patients' subsequent prognosis over time, and assess the ultimate results of implant-prosthetic treatment. The research approach was a retrospective and prospective longitudinal study, which was conducted over a period of seven years (2016-2023).

Keywords: dental implant, bone graft, prosthetic rehabilitation

INTRODUCTION

A dental implant is a crucial component in modern dentistry for replacing missing teeth, offering high success rates and improved patient outcomes. Enhancing dental implants with novel designs and materials has been the subject of research. To fix issues like peri-implant inflammation, research has suggested dental implants with separate parts made of different materials, like ceramic with zirconium dioxide added and surface treatments to make them more superhydrophilic [1]. In addition, the adoption of the augmentation procedure enhanced implantological success rates. These techniques are dependent on the specific clinical situation, such as the level of bone loss, implant site, and the patient's overall condition. Successful augmentation is crucial to the long-term stability and function of dental implants, requiring proper planning, the use of modern materials and techniques, and competent execution by the clinician [2]. Overall, dental implants have significantly transformed the field of dentistry, providing effective solutions for patients requiring tooth replacement [3]. Implants can be accepted and fused into the bone if the general condition is correctly evaluated, the peri-implant conditions are improved, the right surgical treatment is used and the right biomaterials are used. It is necessary to make a correct assessment of the general status of patients with different systemic diseases under therapeutic control. To keep post-implant complications from happening, it's important to treat diseases of the teeth and gums and get a good idea of how patients with different systemic diseases are doing overall [4]. This is because reconstructing prosthetics on implants involves a lot of invasive procedures and interventions [5]. The specialists perform dental extractions, surgical treatments to establish a suitable bone receptor bed, implant insertion and manoeuvres while the patient is under anaesthesia. The patient must be in good general condition to be able to undergo all these procedures. Therapeutic success, as well as the execution of pre-implantation and implantation procedures, depend on individual anatomical parameters, the preoperative clinical situation, grafting materials, and implant types used in relation to the initial preoperative local and loco-regional conditions [6-8].

Aim and objectives

The aim of the study was to find out what the clinical and statistical success rates for implant-prosthetic reabilitation and reconstructing missing alveolar bone crests in edentouluos patients. The specific study's objectives were to evaluate the general condition of partially (unimaxillary, bimaxillary, mixed) or fully (maxillary, mandibular, both arches) edentulous patients, identify potential risk factors during implant-prosthetic treatment, track the evolution of the patients' subsequent prognosis over time and assess the final results of implant-prosthetic treatment, while considering the number of implants and the topography of the edentulousness.

MATERIAL AND METHODS

The study included 104 patients, 56 male and 48 female, aged 30-67 years, with an average age of 51.6 years, who had 298 implants inserted. The research method used is a retrospective and prospective longitudinal study, which was conducted over a period of seven years (2016–2023) with periodic evaluations at one year, two years, three years, five years, and even more than five years. Patients were selected from the cases of the dental and oral implantology practices “Dr. Spânu Dental & Implant Clinic” in Oradea and “Dentalnet Oradea”. Patients needed prosthetic treatment of maxillary and mandibular partial edentulousness, or even bilateral maxillary edentulousness. Anamnesis, clinical, and

paraclinical examinations (orthopantomography, CBCT) were performed. Two study groups were defined from the total of 104 patients, applying inclusion and exclusion criteria. Group I comprises 55 patients with implant rehabilitation and Group II comprises 49 patients with both implant and natural teeth rehabilitation, in order to evaluate the success rate over time.

RESULTS

Out of the total 104 patients taken in the study, a total of 48 patients were female, representing a percentage of 45.65%, and a total of 56 patients were male, representing a percentage of 54.35% (Table 1). The patients were aged between 30-67 years. A total of 298 implants were inserted in these patients.

The demographic assessment showed that, taking into account the environment of origin, out of the total of 104 patients, 74 of them come from urban areas, which represents the majority percentage, with a value of 73.91%, and 30 of the patients come from rural areas, representing a percentage of 26.09% (Table 1).

Table 1. Demographic data

Patient sex	Patient number	%
M	56	54,35%
F	48	45,65%
Place of origin		
Urban	74	73,91%
Rural	30	26,09%

Among the associated pathologies, the most common was high blood pressure (hypertension), present in 62 of the patients, representing a percentage of 65.21%, followed by smoking which is present in 36 of the patients representing a percentage of 39.13%. Ischemic heart disease is found in 18 patients, representing a percentage of 17.39%. Diabetes mellitus was encountered in 20 of the patients, representing a percentage of 18.47%, followed by osteoporosis, 8 patients, representing a percentage of 8.69%. Alcohol consumption is encountered in 6 of the patients, representing a percentage of 5.43%. The least common pathology in the studied group is gastric/duodenal ulcer, present in 3 of the patients representing a percentage of 2.17% (Table 2).

Table 2. Distribution of cases by associated pathology

Associated pathology	Patient number	%
High blood pressure	62	65,21%
Ischemic heart disease	18	17,39%
Diabetes mellitus	20	18,47%
Gastric/duodenal ulcer	3	2,17%
Osteoporosis	9	8,69%
Smoking	38	39,13%
Alcohol consumption	6	5,43%

In the group of patients, an inflammatory periodontal pathological lesion was the most common cause of edentulousness (85 out of 104 patients, or 85.86%). Poor oral hygiene was the second most common cause, affecting 17 patients, or 15.21%. The least common cause of edentulousness in the studied group is oro-gingival mucosal disease, which is present in 12 of the patients, representing a percentage of 9.78% (Table 3, Figure 1).

Table 3. Percentage distribution of cases by cause of edentulousnes

Cause of edentulousness	Patient number	%
Inflammatory periodontal pathological lesions	85	85,86%
Oro-gingival mucosal lesions	12	9,78%
Poor oral hygiene	17	15,21%

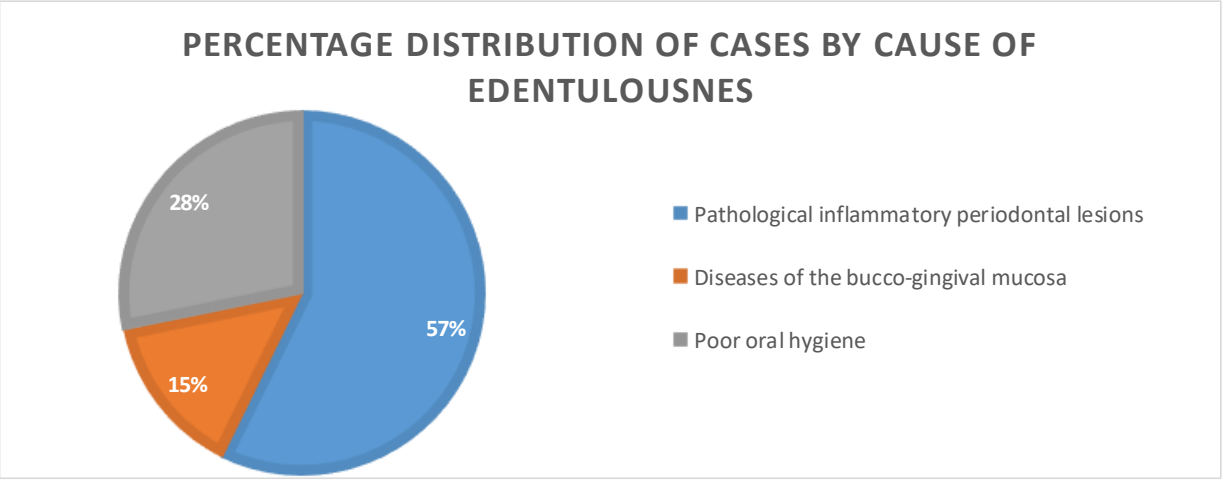

Figure 1. Percentage distribution of cases by cause of edentulousnes

In terms of edentulous topography, statistically we have the following result: in the maxilla, 31 patients have edentations, representing a percentage of 33.69%. Edentations in the maxilla can be partially unilateral in 19 of the patients, representing a percentage of 20.65%, or partially bilateral in 12 of the patients, representing a percentage of 13.04%. In the mandible, 34 of the patients have edentulousness, representing 36.95%. Edentulousness is partially unilateral in 21 patients, representing 22.82%, or partially bilateral in 13 patients, representing 14.13%. Mixed edentulousness, which includes both partial mandibular and partial maxillary defects, is present in 27 patients, accounting for a percentage of 29.34%. It is unilateral, occurring in 16 of the patients and accounting for 17.39%, or bilateral, occurring in 11 of the patients and accounting for 11.95% (Figure 2).

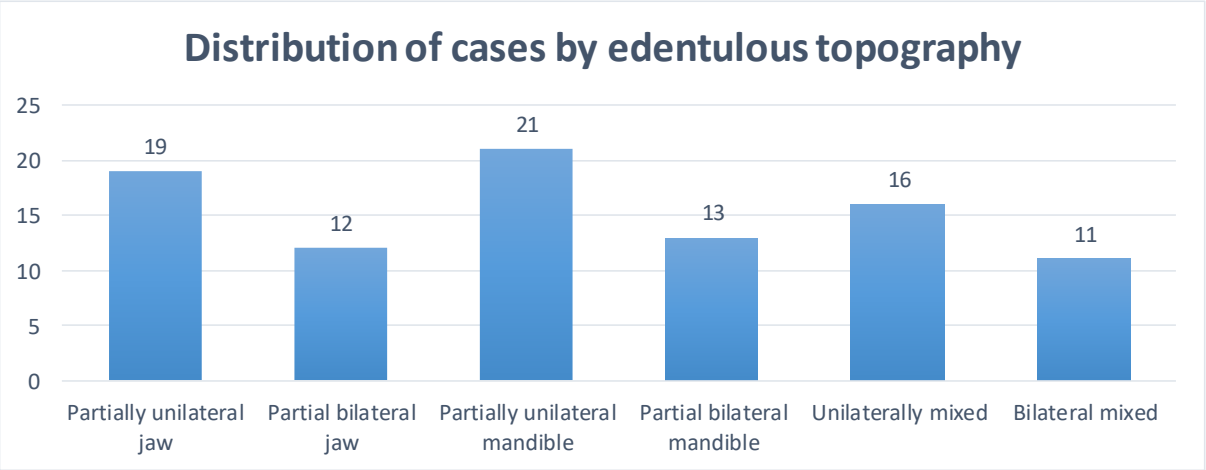

Figure 2. Distribution of cases by edentulous topography

In the 55-64 age group were inserted 34.06% or 99 implants, while in the 45-54 age group 97 implants or 32.31%. Patients aged 35–44 years accounted for 17.03% of the total, with

56 implants inserted. The lowest number of implants inserted is in patients over 65 years of age: 46 implants, representing a percentage of 16.59%, because the number of patients in this age group who went to the implantologist for oral rehabilitation on implants was much lower compared to the other age groups (Table 4, Figure 3).

Table 4. Distribution of inserted dental implants by age group in relation to total number of implants

Age group	Implant number	%
35-44 years	56	17,03%
45-54 years	97	32,31%
55-64 years	99	34,06%
>=65 years	46	16,59%

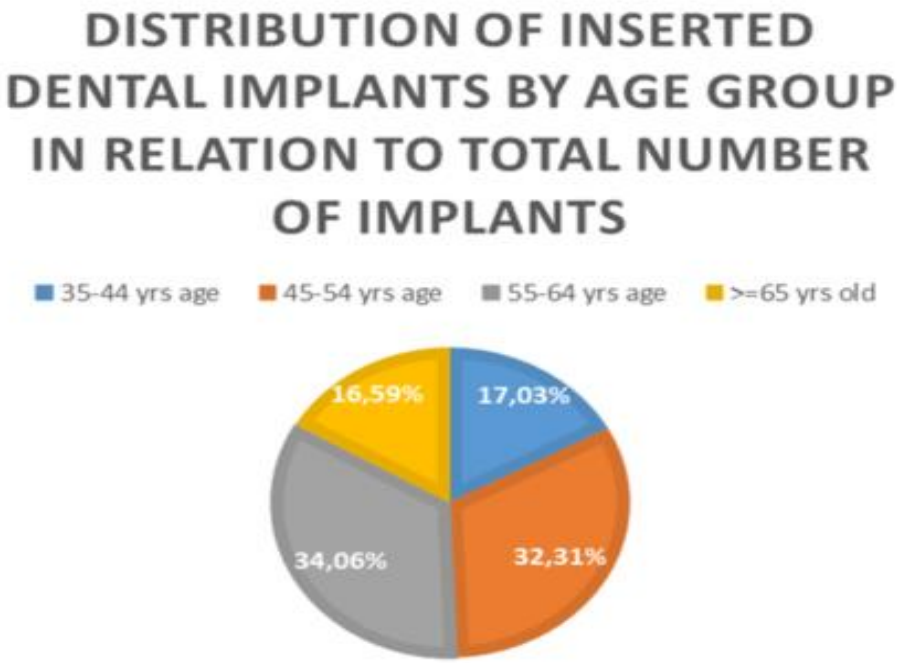

Figure 3. Distribution of inserted dental implants by age group in relation to total number of implants

The majority of patients had moderately diminished bone supply (63 of the patients represented 51.08%), followed by slightly diminished bone supply (27 of the patients representing 31.52%), and severely diminished bone supply (14 patients representing 17.39%) (Table 5, Figure 4).

Table 5. Distribution of cases according to bone supply

bone supply	Patient number	%
Slightly diminished	27	31,52%
Moderate diminished	63	51,09%
Severely diminished	14	17,39%

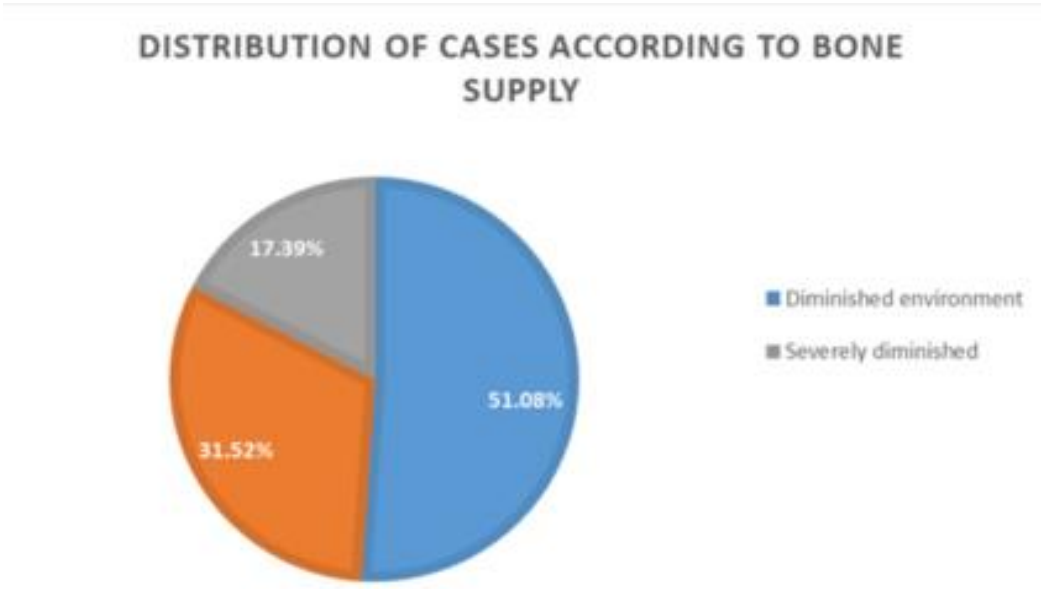

Figure 4. Distribution of cases according to bone supply

Out of the total number of 104 patients, 27 did not need bone augmentation to have their implants inserted. For a total of 29 female patients, it was performed alveolar ridge reconstruction in 14 cases using the Sinus-Lift technique (maxillary) and in 15 cases using bone augmentation (mandibular). Out of 38 male patients, 19 underwent the sinus-lift technique, and 24 underwent the bone augmentation technique. It was performed both techniques on a total of seven male patients, who required both maxillary and mandibular bone augmentation. Of the total number of patients who needed bone augmentation, 65 patients, 34 female patients, represent 45%, and 36 male patients represent 55%. Only 29.35% of patients require bone augmentation. The percentage increases to 70.65% when bone augmentation is required (Table 6).

Table 6. Distribution of cases according to the need to improve bone supply or not, by patient gender and total number of patients, expressed as a percentage

Gender	No. of cases with increased bone volume	%	No. of cases without increased bone volume	%
M	38	39,13%	14	15,21%
F	34	31,52%	13	14,14%
Total	65	70,65%	27	29,35%

Ossteointegration is particularly important in order to achieve long-lasting dental implants and to have strong bones that can withstand the prosthetic load. From the above table, we can see that in a very high percentage of cases, bone integration was achieved at 6 months, representing 69.57%, and in a much smaller number of cases, cases with extensive medical manoeuvres of reconstruction of the alveolar, maxillary, and mandibular crests, on extensive territories, bimaxillary, with complex implant-prosthetic work, and patients with various associated diseases, integration was achieved at 9 months, representing a percentage of 30.43%, at which time prosthetic loading could be achieved (Table 7).

Table 7. Case distribution by bone integration

Bone integration	Patient number	%
6 months	72	69,57%
9 months	32	30,43%

Table 8 illustrates the implant-prosthetic treatment plan, revealing that out of 104 cases, 55 underwent oral rehabilitation on implants, with 51.1% of these cases focusing solely on implant-prosthetic rehabilitation. In 49 cases, it was decided to perform implant-prosthetic rehabilitation, including both implants and abutment teeth. These have a 48.9% percentage representation (Figure 5).

Table 8. Distribution of cases by type of implant-prosthetic rehabilitation performed

Prosthetic rehabilitation type	implant-prosthetic rehabilitation	prosthetic rehabilitation implant – natural teeth abutment
Number of cases	55	49
%	51,1%	48,9%

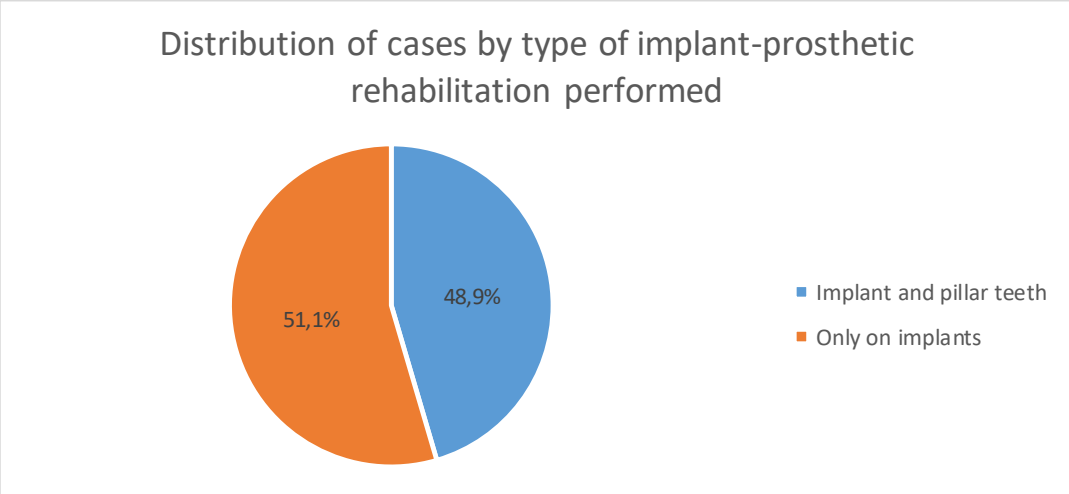

Figure 5. Distribution of cases by type of implant-prosthetic rehabilitation performed

DISCUSSIONS

Bone volume augmentation is a crucial aspect of implant dentistry to ensure successful implant placement and prosthetic outcomes. Various techniques such as Guided Bone Regeneration, sinus floor elevation, ridge splitting, autogenous block bone grafting are commonly used to address bone defects and achieve adequate bone volume for implant placement [9-12]. Advances in surgical techniques, biomaterials, and growth factors have significantly improved the predictability and success of bone augmentation procedures in recent years [13]. Overall, bone volume augmentation plays a vital role in achieving ideal prosthetic results in implant dentistry, emphasizing the importance of selecting the most suitable technique based on individual patient needs and anatomical considerations.

In this study a total of 298 implants were inserted in patients aged between 30-67 years. According to the technique of bone volume reconstruction, of the total number of 104 patients, 29% did not need bone volume augmentation. In a total of 29 female patients, alveolar ridge reconstruction was performed in 14 cases by the sinus-lift technique (maxillary) and in 15 cases by the bone augmentation technique (mandibular). In a total of 36 male patients, the sinus-lift technique was performed in 19 of them, and the bone augmentation technique was performed in 24 patients. In a total of 7 male patients, both techniques were performed, as both maxillary and mandibular bone augmentation were required. Practitioners, as part of the treatment plan, should opt for those techniques that have low peri-implant and bone graft complication rates that are beneficial to the patient [14]. In order

to be able to choose the right type of surgery to restore lost bone volume, which often has undergone only vertical resorption or both vertical and horizontal resorption, it is necessary to perform a three-dimensional analysis of the edentulous ridges using 3D CBCT images [14]. In situations where we have deficient prosthetic fields for implant insertion, surgery is required to augment the recipient bone field [15,16]. Vertical augmentation with bone grafts, with or without resorbable membranes and growth factors, as well as horizontal expansion of atrophic alveolar ridges, are the most commonly used surgical interventions in oral implantology [17]. For example, in the posterior maxillary area, in some patients, bone height is limited even when teeth are present. In conditions where teeth are lost in the posterior area, pneumatization of the maxilla results in the need for sinus elevation (122). Increasing the bone supply required for implant insertion is done by bone augmentation techniques using bone growth factors and resorbable membranes [18-21].

Out of the total of 104 patients who received implant prosthetic treatment, the number one cause of edentulism was inflammatory periodontal pathological lesions, which was found in 85 patients. The second cause of edentulousness, poor oral hygiene, was found in 17 patients. Oro-gingival mucosal diseases were found in 12 patients. All these causes can also lead to early loss of implants. In the study of Basson et all from a total of 585 individuals with implant failure the location of implants, and smoking history were significant correlates of early implant failure [22].

Today, oral implantology has evolved with outstanding medical results, both functionally and aesthetically. Patients prefer implant prosthetic rehabilitation to oral rehabilitation with mobile prosthetics. However, the decision for implant-prosthetic rehabilitation and the establishment of a treatment plan require a careful assessment of the patient's general condition, a careful evaluation of the prosthetic field, the bone supply, and the local and loco-regional status [23]. The patient assessment stage holds significant importance as it defines the clinical problem and establishes an optimal treatment plan, leading to implant-prosthetic rehabilitation that yields satisfactory results, both aesthetically and functionally, and increases the long-term success rate [24].

CONCLUSIONS

As part of the pre-implantation preparation and in order to establish a treatment plan, each patient must undergo a complete evaluation of the general condition, an evaluation of the prosthetic field, an analysis of the local and loco-regional status, an evaluation of the bone supply through imaging examinations, and a thorough clinical examination to assess the alveolar morphology. In most cases, the resorbability of the bone prevents the implant from being inserted and the implant from being rehabilitated. Pre-implant preparation includes taking care of the oral and perioral tissues. Establishing the criteria and contraindications of poor alveolar ridge reconstructions, as they significantly influence the results produced, the thickness reconstruction of alveolar ridges yields better results than the height reconstruction. The type of implant depends on the clinical status of the patient, the age of the patient, the bone supply and the dental periodontal status. Successful treatment requires that the surgical procedure is performed under aseptic conditions and that the patient is under antibiotic protection. If implants are to be inserted after bone reconstruction, this should be done after 4-6 months. The success of the surgical procedure also depends on correct wound coverage with muco-periosteal flaps, without suturing in tension, without wound dehiscence.

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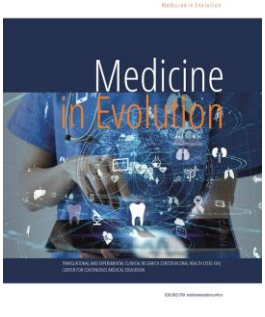
Impact of dietary habits on health outcomes in children and adolescents with poor oral hygiene



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Received: 19 April 2024; Accepted: 25 June 2024; Published: 30 June 2024

Abstract

Aim and Objectives. This study aimed to investigate the relationship between nutrition and the health status of children with poor oral hygiene. Specifically, it sought to identify factors influencing their health and to explore strategies for improving their nutrition and overall well-being. Material and Methods. Conducted at the Pediatric Department of the Emergency County Clinical Hospital in Oradea, the study reviewed medical records of patients aged 0 to 18 years hospitalized from May 13, 2023, to June 13, 2023. Inclusion criteria encompassed patients with poor oral hygiene, excluding those with chronic general diseases or syndromes. Demographic and dietary data were analyzed alongside laboratory parameters and systemic pathologies. Results. Among the 100 participants, the majority were male, with normal weight status, and followed artificial or mixed diets. Pathological alterations were predominant in the respiratory system, while no significant association was found between dietary patterns and pathological changes in other systems. However, significant correlations were observed between specific dietary habits and paraclinical parameters, such as Total-IgE and CPE levels. Conclusions. This study emphasizes the critical role of nutrition in children's health, particularly in the context of poor oral hygiene. Findings suggest that a natural or mixed diet may mitigate risks associated with allergies and immune disorders compared to an artificial diet. Advocating for balanced nutrition strategies could offer substantial benefits in mitigating chronic ailments and enhancing long-term health outcomes in children. Further research is warranted to validate and expand upon these findings.

Keywords: pediatric nutrition, oral hygiene, dietary impact

INTRODUCTION

The growth and development of children is a complex and prolonged physiological process influenced by various factors [1]. Among these, nutrition plays a pivotal role in children's health and development, directly impacting the functioning of biological systems and the immune system [2]. A balanced and adequate diet supports healthy growth and development, while also reducing the risk of diseases and illnesses [3].

Nutrition is crucial both during the intrauterine development period [4] and immediately after birth [5]. The foundations of a healthy diet, which will sustain an individual throughout life, are established during early childhood. Therefore, it is important that the diet during this stage is balanced and adheres to recommendations from specialized associations [5]. As children grow older and enter adolescence—a period characterized by transformative growth and development—their nutritional needs continue to have significant long-term health implications [6]. During these periods, the risk of obesity can increase, affecting children across all age groups. The prevalence of obesity continues to rise, with approximately one-third of children and adolescents in the United States being classified as obese [7]. Multiple factors contribute to the rise in obesity, including biological, developmental, behavioral, genetic, environmental influences, and the composition of the intestinal microbiome [8,9]. If left untreated, obesity can lead to chronic conditions such as cardiovascular diseases, type 2 diabetes, and hypertension [10].

Thus, it is essential to provide children with a diet that supplies all necessary nutrients and substances to support their physical growth and cognitive development from the earliest years of life [11]. A diet rich in proteins, vitamins, minerals, and healthy fats contributes to the development of a robust immune system and helps prevent conditions such as obesity, diabetes, and cardiovascular diseases later in life [12]. Studies have also demonstrated that children's dietary choices can influence other aspects of their health, including energy levels, concentration, emotional state, and academic performance [13]. Consequently, promoting healthy eating habits among children and educating parents about the importance of nutrition can have a significant positive impact on long-term health and well-being [14].

Oral health is closely linked to the quality of nutrition [15]. Some studies have identified associations between obesity and increased caries prevalence [16], as well as between malnutrition and higher caries rates [17]. Excessive accumulation of dental plaque leads to the overgrowth of pathogenic microorganisms, contributing to dental caries and periodontal disease, and significantly altering the oral microbiome [18,19]. These changes may even impact the intestinal microbiome [20].

Aim and objectives

Considering these aspects, the aim of this study was to explore the relationship between nutrition and the health status of children with poor oral hygiene. The focus is on identifying factors that influence their health and strategies to improve their nutrition and overall health.

MATERIAL AND METHODS

The study was conducted in the Pediatric Department of the Emergency County Clinical Hospital in Oradea from May 13, 2023, to June 13, 2023. Medical records of patients hospitalized during this period were reviewed.

The following inclusion criteria were applied: patients aged 0 to 18 years who presented to the Emergency Department of the Oradea County Emergency Clinical Hospital

with urogenital, neurological, digestive, respiratory, or other emergencies. Additionally, patients with poor oral hygiene (characterized by plaque deposits, dental caries, or periodontal disease) were included. Information regarding birth type, breastfeeding duration, and predominant diet during the first two years of life was required for inclusion.

Patients were excluded if relevant information was unavailable, if they had been diagnosed with chronic general diseases, or if they were syndromic.

The variables analyzed included: patient age groups (0-6 years, 6-12 years, 12-18 years), gender (male, female), body mass index (BMI) categories (underweight, normal weight, obesity degree I, obesity degree II), predominant diet during the first two years of life (natural, mixed, artificial), and duration of breastfeeding (1 month, 3 months, 6 months, 12 months, 18 months). BMI was calculated using the formula: BMI = weight (kg) / height² (m^2).

Laboratory examination values for the following parameters were investigated: Total Immunoglobulin E (Total-IgE), cationic protein of eosinophils (CPE), eosinophils, diamine oxidase, Respiratory Immunoglobulin E (Respiratory-IgE), Total Calcium (Total Ca), Ionic Calcium (Ionic Ca), Iron (Fe), Magnesium (Mg), Phosphorus, and Vitamin D. The digestive, urogenital, nervous systems, and sensory organs were also examined.

Statistical analysis was performed using IBM SPSS Statistics 26 and Microsoft Office Excel/Word 2013. Categorical variables were expressed in absolute numbers or percentages and were tested using Fisher's Exact Test. Z-tests with Bonferroni correction were conducted to detail the results from the contingency tables.

The research adhered to the principles specified in the Declaration of Helsinki, following its 2008 guidelines and the latest amendment in 2013. Approval was obtained from the Research Ethics Committee of the Faculty of Medicine and Pharmacy at the University of Oradea (IRB No. CEFMF/10, dated May 30, 2022).

RESULTS

The study comprised a final sample size of 100 patients. Table I presents the demographic characteristics of the patients under investigation. The majority of participants fell within the age brackets of 2-5 years (44%) or 6-12 years (31%), with a predominance of male subjects (57%) and a prevalence of normal weight status (80%). Regarding dietary habits, a substantial portion of the sample followed either an artificial (46%) or mixed (42%) diet regimen. Analysis of breastfeeding patterns revealed that the most prevalent durations were 3 months (52%), followed by one month (25%), and 6 months (17%).

Table I. Patients' characteristic

Variable	Value
Age	44 (44%) 2-5 years, 31 (31%) 6-12 years, 25 (25%) 12-18 years
Gender	43 (43%) Female, 57 (57%) Male
BMI	10 (10%) Underweight, 80 (80%) Normal, 7 (7%) Grade I Obesity, 3 (3%) Grade II Obesity
Diet	12 (12%) Natural, 42 (42%) Mixed, 46 (46%) Artificial
Duration of breastfeeding	25 (25%) 1 month, 52 (52%) 3 months, 17 (17%) 6 months,5 (5%) 12 months, 1 (1%) 18 months

In terms of pathological changes identified across various bodily systems, a significant majority of patients exhibited anomalies within the respiratory system (99%), while only a minority presented abnormalities in the digestive system (10%). Pathological alterations were observed in a smaller proportion at the genitourinary level (6%), followed by the nervous system (3%) and sensory organs (3%). Notably, no patients exhibited pathological changes in either the cardiovascular (0%) or endocrine (0%) systems, as illustrated in Figure 1.

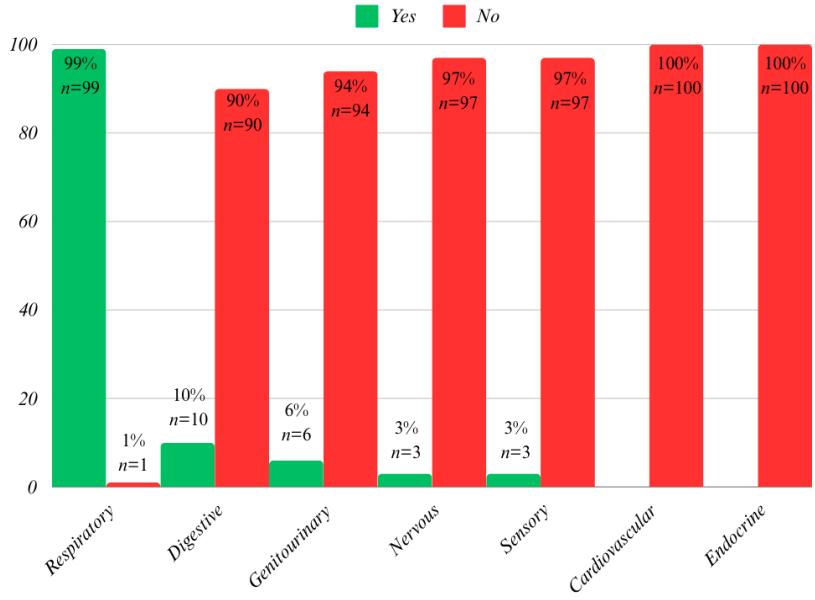

Figure 1. Systemic pathologies

The impact of nutrition on paraclinical examinations and the various systems under investigation was explored. Within this sample, no significant correlation was discerned between the presence of pathological alterations in the studied systems and specific dietary patterns. Analysis utilizing Fisher tests indicated nonsignificant differences between groups ($p>0.05$), as summarized in Table II.

Table II. Distribution of patients related to type of diet and the existence of pathological changes

Diet/Alterations – Digestive System	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Absent	10	83.3%	38	90.5%	42	91.3%	0.723
Present	2	16.7%	4	9.5%	4	8.7%	
Diet/Alterations – Genitourinary System	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Absent	10	83.3%	39	92.9%	45	97.8%	0.101
Present	2	16.7%	3	7.1%	1	2.2%	
Diet/Alterations – Nervous System	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Absent	11	91.7%	11	97.6%	45	97.8%	0.486
Present	1	8.3%	1	2.4%	1	2.2%	
Diet /Alterations – Sensory Organs	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Absent	12	100%	41	97.6%	44	95.7%	1.000
Present	0	0%	1	2.4%	2	4.3%	

*Fisher's Exact Test

However, significant findings emerged from certain paraclinical examinations conducted. Notably, for Total IgE levels, statistical significance was observed between the groups as per the Fisher test ($p<0.001$). Further analyses using Z-tests with Bonferroni correction revealed that patients exhibiting normal Total IgE values were significantly more prevalent among those adhering to a natural or mixed diet compared to those on an artificial diet (91.7%/76.2% vs. 37%). Conversely, patients with elevated Total IgE levels were

significantly more associated with an artificial diet compared to a natural or mixed diet (63% vs. 8.3%/23.8%), as illustrated in Figure 2.

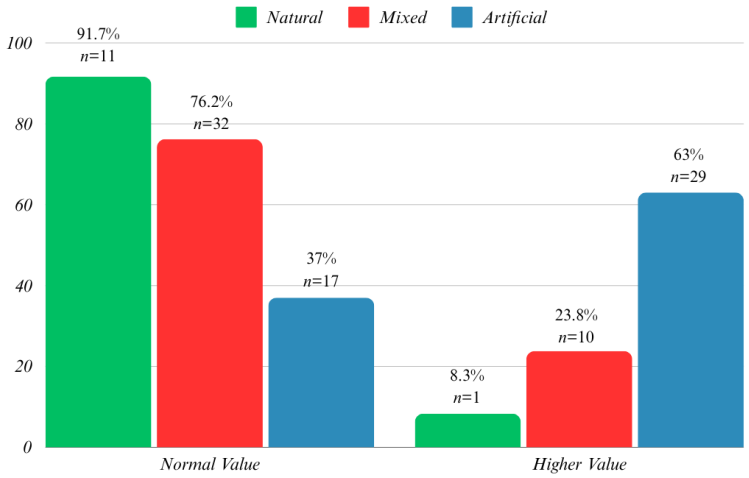

Figure 2. Distribution of patients related to type of diet and Total-IgE values

Figure 3 depicts the distribution of patients categorized by their dietary habits and CPE values. Statistical analysis, conducted using the Fisher test, revealed significant differences between the groups ($p<0.001$). Subsequent Z-tests, incorporating Bonferroni correction, demonstrated that patients with normal CPE values exhibited a significantly higher prevalence of association with natural or mixed diets compared to those with artificial diets (100%/76.2% vs. 8.7%). Conversely, patients with elevated CPE values were notably more associated with artificial nutrition compared to natural or mixed diets (91.3% vs. 0%/23.8%).

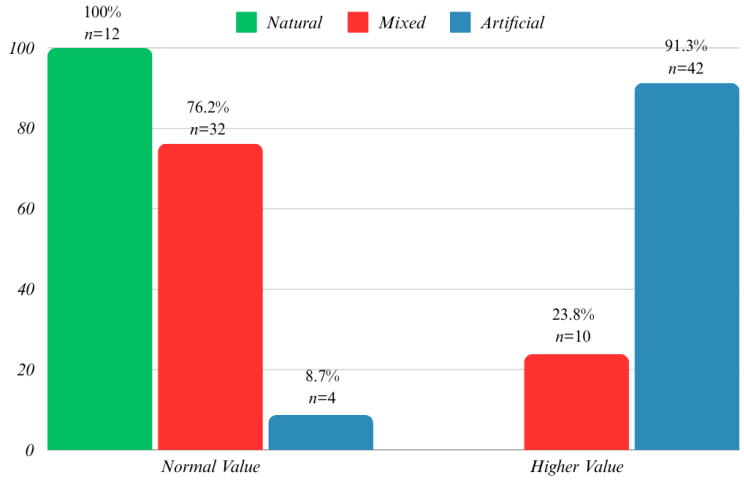

Figure 3. Distribution of patients related to type of diet and CPE values

The data presented in Table III illustrate the distribution of patients categorized by their dietary habits and the values of eosinophils, diamine oxidase, and total Ca. The following observations were made:

- Patients with normal eosinophil levels were notably more associated with a natural or mixed diet than with an artificial diet (100%/78.6% vs. 43.5%), while those with elevated eosinophil values exhibited a significant preference for artificial nutrition over natural or mixed diets (56.5% vs. 0%/21.4%).

- Patients with normal diamine oxidase levels were significantly more prevalent among those following a natural or mixed diet compared to an artificial diet (100%/92.9% vs. 37%), whereas individuals with elevated diamine oxidase values were notably more associated with artificial nutrition than with natural or mixed diets (63% vs. 0%/7.1%).

Patients with low total Ca values exhibited a significantly higher frequency of association with natural nutrition than with artificial nutrition (16.7% vs. 0%).

Table III. Distribution of patients related to type of diet and eosinophils, diamine oxidase and Total Ca values

Diet/Eosinophils	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Normal Value	12	100%	33	78.6%	20	43.5%	<0.001
Higher Value	0	0%	9	21.4%	26	56.5%	
Diet/Diamine oxidase	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Normal Value	12	100%	39	92.9%	17	37%	<0.001
Higher Value	0	0%	3	7.1%	29	63%	
Diet/Total Ca	**Natural**		**Mixed**		**Artificial**		**p***
	No.	%	No.	%	No.	%	
Normal Value	10	83.3%	40	95.2%	45	97.8%	0.043
Higher Value	0	0%	0	0%	1	2.2%	
Lower Value	2	16.7%	2	4.8%	0	0%	

*Fisher's Exact Test

The data depicted in Figure 4 illustrate the distribution of patients categorized by their dietary patterns and Respiratory-IgE values. Statistical analysis, conducted using the Fisher test, revealed significant differences between the groups ($p<0.001$). Further examination through Z-tests with Bonferroni correction revealed that patients with normal Respiratory-IgE values exhibited a significantly higher prevalence of association with natural or mixed diets compared to artificial diets (100%/78.6% vs. 15.2%). Conversely, patients with elevated Respiratory-IgE values were notably more associated with artificial nutrition than natural or mixed diets (84.8% vs. 0%/21.4%).

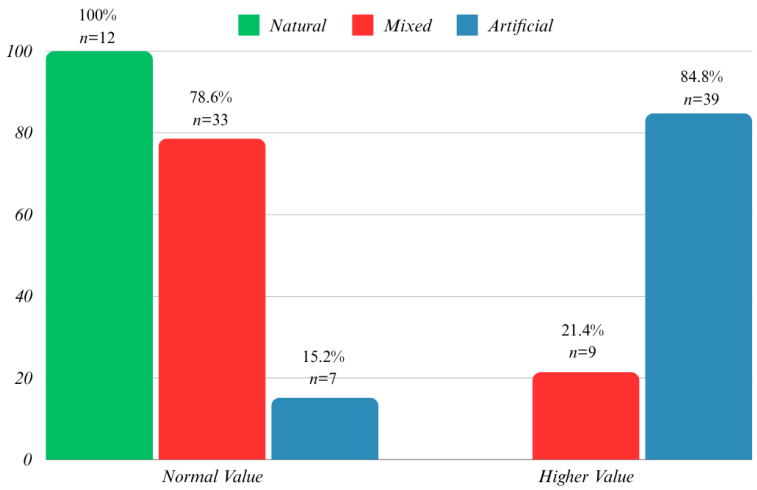

Figure 4. Distribution of patients related to type of diet and Respiratory-IgE values

The data illustrated in Figure 5 portray the distribution of patients categorized by their dietary habits and vitamin D levels. Statistical analysis, conducted using the Fisher test, revealed significant differences between the groups ($p=0.011$). Subsequent Z-tests with

Bonferroni correction demonstrated that patients with normal vitamin D values were significantly more frequently associated with mixed nutrition compared to artificial nutrition (69% vs. 39.1%). Conversely, individuals with low vitamin D values exhibited a notable preference for artificial nutrition over mixed nutrition (60.9% vs. 31%).

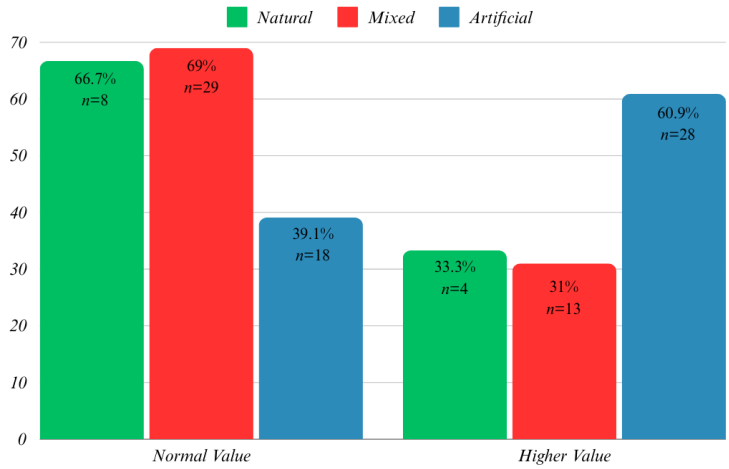

Figure 5. Distribution of patients related to type of diet and Vitamin D values

Conversely, for Iron (Fe), Ionic Calcium (Ca), Phosphorus, and Magnesium (Mg), no significant differences between groups were observed according to the Fisher test.

DISCUSSIONS

The analysis of the results garnered in this study offers a comprehensive perspective on the link between nutrition and children's health. These findings underscore several correlations between patient characteristics and pathological changes identified across various bodily systems.

Although the majority of patients were under artificial or mixed nutrition regimens, no significant association was identified between these diets and the presence of pathological alterations. Notably, body mass index (BMI) assumes critical importance as it exerts multifaceted impacts on a child's well-being. Furthermore, elevated maternal BMI heightens the likelihood of complications during natural childbirth and correlates more frequently with cesarean deliveries [21].

An important discovery of this investigation was the notable correlation between diet type and specific paraclinical parameters. Notably, patients exhibiting normal total IgE, ECP, eosinophils, diamine oxidase, and respiratory IgE values were significantly more associated with a natural or mixed diet than with an artificial one. These findings suggest that a natural or mixed diet may entail a diminished risk of allergies and immune system disorders compared to an artificial diet. Notably, all major international medical associations advocate exclusive breastfeeding for the initial six months, followed by the commencement of complementary feeding and the introduction of mixed feeding thereafter. Among the manifold benefits of a natural diet are a reduced risk of atopic dermatitis, gastrointestinal disorders, childhood leukemia, obesity, and diabetes. Moreover, infants exclusively breastfed for the first six months tend to exhibit higher IQs in adulthood [22]. The correlation between natural feeding and a diminished allergy risk has also been underscored by other researchers [23], while some authors have posited a decreased risk of immune-related ailments [24,25].

The insights gleaned from these results present substantial opportunities for enhancing clinical practice and public health policies pertaining to child nutrition.

Advocating for a balanced diet could serve as an efficacious strategy for mitigating the risk of chronic ailments and augmenting the long-term health of children. Nonetheless, it is imperative to acknowledge certain limitations inherent in this study, such as the relatively modest sample size and the observational nature of the study design. Consequently, further research is warranted to validate and expand upon these findings.

CONCLUSIONS

In conclusion, the findings of this study underscore the pivotal role of nutrition in shaping the health trajectory of children. A deeper comprehension of this interplay holds promise for crafting more efficacious strategies aimed at bolstering children's well-being during the formative stages of their lives.

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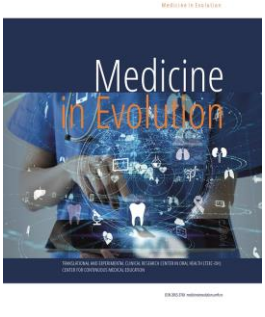
Patient satisfaction after treatment of Angle class II anomalies using the twin-block orthodontic appliance



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Received: 4 March 2024; Accepted: 10 June 2024; Published: 30 June 2024

Abstract

The study aims to demonstrate the efficacy of the Twin-Block device in addressing various dental issues, including overjet, overbite, mandibular retrognathism, and facial aesthetics in children. A sample of 64 patients from a clinic in Arad, comprising both treated and ongoing cases with Class II Angle dental anomalies, was examined. Exo- and endo-buccal assessments were conducted to identify functional, pathological, and physiognomy issues, followed by radiological examinations and custom Twin-Block appliances. Of the 64 patients, 39 were female and 25 were male, aged 7 to 14 years. Sixty patients completed treatment, while four discontinued due to non-compliance. All patients exhibited Angle class II malocclusion, with overjet ranging from 7 to 10 mm and overbite from 2/3 to 3/3. Cephalometric analysis revealed ANB angles between 5° and 9°, SNA angles between 83° and 85°, and SNB angles between 75° and 78°. Treatment duration varied, with 91% completing the active phase in 6-9 months, followed by maintenance (3-6 months) and retention (9 months) phases, totaling up to 18 months. In 9% of cases, treatment duration exceeded expectations by 2-5 months. Following treatment completion, 53 patients expressed high satisfaction, seven were satisfied, and four were dissatisfied due to non-compliance with Twin-Block device requirements.

Keywords: class II Angle malocclusion, Twin Block appliance, orthodontic treatment, patient satisfaction

INTRODUCTION

Orthodontic treatment, aimed at correcting dental irregularities, encompasses a broader concept termed 'dental orthopaedics,' as coined by Sir Norman Bennett [1]. This term extends beyond mere dental correction to include the enhancement of facial development, although it lacks a precise definition in this regard. "Dentofacial orthopaedics", a more encompassing term, not only addresses dental and orthopaedic concerns but also focuses on achieving facial harmony. By embracing this broader perspective, the field expands its scope, fostering a better understanding among the public regarding the aesthetic benefits of dentofacial treatments [2,3].

In cases where malocclusion stems from muscular or skeletal anomalies, orthopaedic interventions are necessary. Functional orthopaedic devices aim to rectify muscle imbalances and skeletal issues, particularly by correcting aberrant muscle conditions and restoring facial balance [4-7]. These interventions are rooted in the understanding of genetic influences on maxillofacial development, initially explored through studies utilizing tools like Broadbent's Cephalostat. This philosophical framework perceives bone structure as genetically determined, irrespective of environmental factors [7].

Functional orthopaedic treatment involves expanding and enhancing the upper arch to improve overall facial morphology. By repositioning the mandible in alignment with the upper jaw, it addresses issues like a retruded lower jaw and controls malocclusion during early development stages. Unlike traditional orthodontic approaches that focus on tooth movement, orthopaedic treatments prioritize altering jaw position to correct intermaxillary relations [8,9].

Studies examining forces exerted during jaw movement have highlighted the substantial pressures involved, particularly in cases of Class II malocclusion. Orthopaedic forces, which target jaw repositioning rather than individual tooth movement, distribute evenly across dental arches [5]. This approach minimizes the risk of exceeding the periodontal tissue's tolerance levels and focuses on optimizing muscle function, crucial for bone growth and remodeling [10].

Twin-Block appliances, comprising acrylic blocks, offer a continuous orthopaedic correction mechanism [5]. These devices facilitate rapid malocclusion correction by transmitting favorable occlusal forces through inclined planes onto posterior teeth [11,12]. By promoting protrusive mandibular function and modifying occlusal planes, they effectively address Class II malocclusion. Patients wear these appliances continuously for 24 hours to maximize functional forces, including those generated during chewing [5].

Post-treatment, patients experience notable facial improvements, including enhanced lip closure and facial balance, evident within the initial treatment phases. These changes are attributed to the swift adaptation of facial muscles to corrected occlusal functions. Moreover, dental improvements, such as distal occlusion correction, often manifest within six months of treatment initiation, underscoring the efficacy of Twin-Block devices compared to other functional appliances requiring removal during mastication [5,7].

Aim and objectives

The study aims to demonstrate the efficacy of the Twin-Block device in addressing various dental issues, including pronounced overjet or overbite, mandibular retrognathism, and the closure of vertical occlusion spaces. Additionally, it focuses on restoring both the normal and aesthetic facial appearance of the child. In contemporary dental medicine, the goal is to enhance patients' psychosocial well-being by providing aesthetic, functional, and healthy dental outcomes.

MATERIAL AND METHODS

For this investigation, we utilized a sample of 64 patients treated at a clinic in Arad. We extracted records of both treated and ongoing cases, specifically targeting those with Class II Angle dental anomalies requiring the functional Twin-Block appliance.

Initially, an exo- and endo-buccal examination was conducted to identify functional, pathological, and physiognomic issues. This assessment was followed by radiological examinations, including OPG and profile teleradiography, alongside cephalometric analysis. Subsequently, impressions of the oral cavity were taken, and plaster models were created to facilitate individualized treatment planning and the identification of dento-maxillary anomalies necessary for the fabrication of Twin-Block functional appliances.

The study findings were presented through graphical representations and tables, illustrating personal characteristics of the sample, treatment duration, patient compliance, and satisfaction levels.

RESULTS

Among the total sample, 39 were female and 25 were male, aged between 7 and 14 years. Sixty patients successfully completed the therapy, while four discontinued wearing the appliance at various intervals.

All patients exhibited Angle class II malocclusion, diagnosed through clinical and para-clinical assessments. Overjet measurements ranged from 7 to 10 mm, and overbite ranged between 2/3 and 3/3. Cephalometric analysis revealed ANB angles between 5° and 9°, SNA angles between 83° and 85°, and SNB angles between 75° and 78°.

Treatment duration varied among patients; however, our study found that in 91% of cases, the active phase lasted an average of 6-9 months, followed by a maintenance phase of 3-6 months, and a retention phase of 9 months. The total treatment duration, including retention, could extend up to 18 months. In 9% of cases, treatment exceeded the average duration by 2-5 months, attributed to patients' non-adherence to physician instructions or physiological factors affecting treatment progress.

Table 1. Treatment duration

TREATMENT DURATION	Patients (N)
18 months	58
> 18 months	6

Throughout the study, we noted a minor yet discernible portion of patients who discontinued wearing the Twin-Block device during the active phase, consequently hindering the completion of the initial treatment regimen. Approximately 6% of all patients displayed inconsistency in adhering to the orthodontist's directives, while the remaining 94% effectively fulfilled the prescribed treatment plan.

Additionally, post-study, I sought to delineate the oral hygiene standards among the treated patients. Seventy-five percent exhibited good hygiene, 16% demonstrated very good hygiene, and 9% presented with poor hygiene.

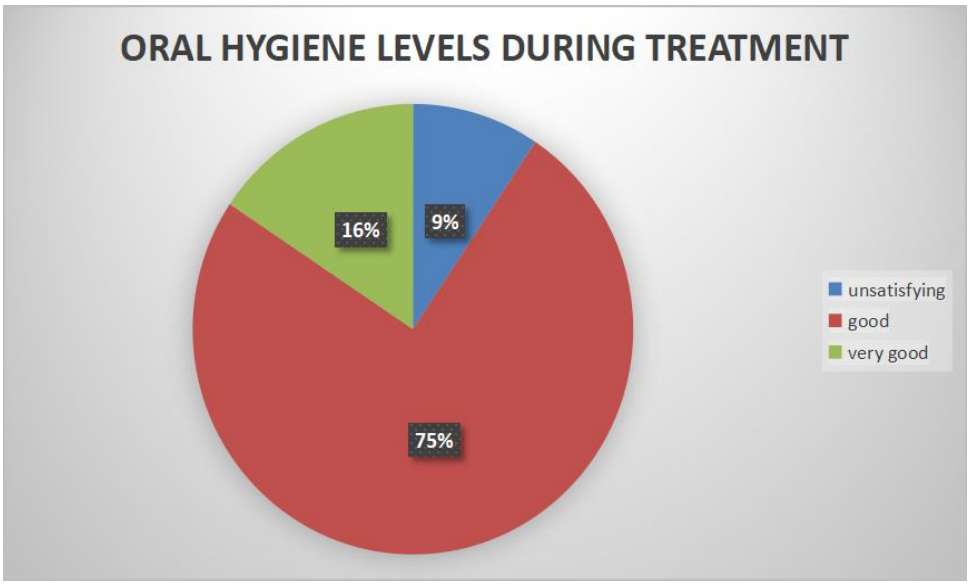

Figure 1. Oral hygiene of patients during the treatment period

Following the completion of the treatment period, 53 patients were very satisfied with the results obtained, 7 patients were satisfied and 4 of the patients were dissatisfied, the dissatisfaction arising after abandoning compliance with the requirements of wearing the Twin-Block device.

DISCUSSIONS

In the evolution of orthodontic techniques, fixed devices with multiple bands were developed for treating permanent dentition [13-15]. Traditionally, treatment was delayed until the eruption of canines and premolars, coinciding with the full development of malocclusion. This involved retracting the upper arch using orthodontic correction to achieve occlusal reconstruction.

However, in most Class II malocclusions, there is a lateral constriction of the upper jaw linked to the skull base, leading to insufficient development of the lower jaw. This bone problem cannot be adequately corrected solely by retracting the normal upper jaw if the lower jaw is deficient [14,16,17]. Mandibular bony deficiencies manifest early in dental and facial development. Orthopaedic treatment aims to correct bone relationships before malocclusion manifests in permanent dentition, potentially restoring normal function and facilitating correct occlusal relationships [17].

Functional treatment aims to expand and develop the upper arch, utilizing it as a template to reposition the mandible in alignment with the normal upper jaw. This early intervention addresses bony issues associated with a retracted lower jaw and controls malocclusion during developmental stages [18-20].

The role of inclined planes is crucial in establishing cuspid relationships and achieving occlusion during tooth eruption. A functional balance is established via neurological control responding to tactile stimuli. Occlusal forces transmitted through the dentition influence growth rate and supporting bone structure [19].

Malocclusion often stems from arch discrepancies due to bone and tissue factors, resulting in unfavorable cuspid orientation and defective occlusal function [19,20]. Functional appliances aim to improve dentofacial structural relationships by addressing unfavorable development factors and enhancing muscular conditions crucial for occlusal development [21].

In cases requiring Twin-Block functional devices for Class II anomalies, early diagnosis during childhood growth phases is imperative. This allows cranial bones to undergo changes, restoring desired aesthetic appearances and mitigating psycho-social impacts [22-24].

Post-study observations revealed a higher prevalence of this dental anomaly among females, though causative factors remain unclear. Additionally, fewer patients from rural areas sought orthodontic treatment, with only 27% originating from such regions, often correlating with poor oral hygiene. Increased education and awareness initiatives targeted at rural populations, particularly parents, are essential for improving oral health complacency.

Furthermore, while 94% of patients adhered to physician instructions, a notable 6% did not, often due to subjective or objective reasons. Identifying and addressing the causes behind non-compliance are crucial to reducing this percentage.

CONCLUSIONS

The satisfaction rate among patients who underwent treatment with Twin-Block functional appliances stands at 83%. This significant percentage underscores their recognition of the effectiveness and comfort provided by Twin-Block appliances compared to other orthodontic devices, which typically cannot be removed from the oral cavity until treatment completion.

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Evaluating aesthetic benefits of composite veneers: investigating dental students and lay people's self-perception

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Received: 8 March 2024; Accepted: 10 May 2024; Published: 30 June 2024

Abstract

Aims and objectives: This study aims to explore how demographic variables such as gender, age, and country influence perceptions related to dental health and aesthetics. Materials and methods: We conducted an online survey, gathering responses from participants across various countries. The survey included questions ranging from satisfaction with dental aesthetics to the perceived benefits of dental treatments such as veneers. Results: The results revealed significant differences in dental health perceptions based on gender, with males generally more satisfied with their gum health compared to females. However, age did not significantly influence dental health perceptions, suggesting a universal concern across age groups. The country of residence significantly affected perceptions of the confidence-boosting effects of dental veneers, highlighting cultural differences in dental aesthetics. Conclusions: The findings emphasize the need for dental health professionals to consider demographic factors when planning treatment and education programs. Gender differences suggest that targeted educational campaigns might be necessary to address specific misconceptions and expectations.

Keywords: dental aesthetics, direct veneers, indirect veneers, self-perceptions

INTRODUCTION

Throughout history, as the standards of contemporary society have increasingly drawn attention to ideals of beauty, there has been a noticeable shift in the way most people view themselves [1-3]. With the growing interest in health and esthetics, the demand for dental procedures designed to enhance aesthetic appeal has increased significantly [4,5]. In this context, the evolution of dental materials and techniques that professionals can use to execute these aesthetic improvements plays an important role. This is particularly true for enhancing the aesthetic appeal of a person's smile, a complex aspect that is prioritized due to its potential to boost patient self-confidence [4,5].

From a dental practitioner's perspective, it is very important to be updated on all the techniques and dental materials, to deliver the best esthetic results for the patients. This is especially relevant when considering the enhancement of one's smile, which holds significant importance due to its ability to elevate patient self-confidence [4,5]. When exploring composite veneer restorations, two primary approaches stand out: direct and indirect methods.

Direct composite veneers involve the application of composite resin directly onto the tooth surface. The advantages of this method refer to: (1) immediate results – they provide instant transformation, as they are applied chairside in a single visit, and the patient can leave the dental office with a modified smile [6]; (2) cost-effectiveness – as direct composite veneers are generally more cost-effective than their indirect veneer restorations [7]: (3) minimal tooth preparation - unlike indirect veneers, direct composite veneers require minimal to no tooth preparation, which is beneficial, particularly for patients hesitant about irreversible alterations to their teeth [8]; (4) allows for further modifications - direct veneers allow for easy adjustments during the application process, to achieve the desired shape, color, and texture, ensuring optimal aesthetics) [9].

Compared to direct veneer technology, indirect veneer restorations have several advantages, such as (1) enhanced aesthetics - superior aesthetic outcomes compared to direct technique, due to meticulous customization of shape, shade, and surface texture [10]; (2) improved durability - indirect veneers are fabricated using high-quality composite materials and bonding techniques, enhancing their longevity and resistance to staining and wear [11]; (3) precise fit and optimal occlusal relationships – by using either complete digital workflow or by using conventional methods, best results can be obtained to ensure both function (optimal occlusal relationships) and aesthetics [12].

However, both methods, have their limitations and drawbacks. Direct veneers present durability concerns, being more prone to staining, chipping, and wear over time, necessitating periodic maintenance and replacement [13]. In addition, direct veneers present limited aesthetic control, as achieving natural translucency and surface texture with direct composite veneers can be challenging [14]. On the other hand, for indirect veneers, there is an extended treatment time, which might be an inconvenience for the patient [15]. Also, there are higher costs for indirect veneers due to additional laboratory fees and chairside time required for fabrication and placement [16].

Patient perception regarding direct and indirect veneers can vary based on factors such as aesthetic outcome, durability, and cost-effectiveness. Direct veneers, being chairside applications, may be perceived positively for their immediate results and affordability [7]. However, some patients may express concerns about their durability and long-term aesthetics due to potential staining and wear issues [13]. In contrast, indirect veneers, despite requiring multiple appointments and being more expensive, are often favored for their superior aesthetic outcomes and durability [10]. Patients may view them as long-term investments in

their smiles [11]. Understanding these perceptions is crucial for aligning treatment options with patient preferences and expectations, ultimately leading to more satisfactory outcomes in cosmetic dentistry.

In contemporary dentistry, understanding patient perceptions regarding their smiles and the psychological impact of aesthetic treatments is very important [17]. The present study was designed to investigate how dental patients visualize their smiles across various contexts and to assess the impact of treatments specifically involving composite veneers on their self-perception and aesthetic satisfaction.

Aim and objectives

The primary aim of this article was to evaluate the aesthetic benefits of composite veneers and their impact on patient self-perception. This involves exploring how patients perceive their smiles before and after treatment to assess changes in self-confidence and satisfaction. The study evaluated patient expectations and knowledge regarding dental veneers, gathering insights through a comprehensive questionnaire. By understanding these dynamics, the research seeks to improve the alignment of dental practices with patient needs and preferences, ultimately contributing to successful results in dental aesthetics.

MATERIAL AND METHODS

A questionnaire was created to assess the peoples' opinions about dental aesthetics. The survey was first pilot-tested among five subjects, to validate the clarity of the questionnaire, and the response options and to estimate the time needed for completion. The questionnaire was structured into three distinct parts, aiming to gather comprehensive insights into the range of patient opinions on dental aesthetics and their expectations from veneer treatments. The survey design was approved by the Ethics Committee of the "Iuliu Hatieganu" University of Medicine and Pharmacy of Cluj Napoca (DEP136/ 27.06.2023)

While the first section of the questionnaire included demographic questions, the second section explored general perceptions of patients' smiles, providing a foundation to indicate patient satisfaction and areas for improvement in dental practices (table 1). The third part of the questionnaire focused on the specific knowledge and expectations patients held about dental veneers, aiming to align these with clinical outcomes. This methodological approach was intended to ensure a thorough understanding of the subjective and objective aspects of dental aesthetics, which is critical for advancing treatment practices and patient care in the field of cosmetic dentistry (table 2).

Table 1. Section 1 and 2 included in the survey

DEMOGRAPHIC QUESTIONS	
Age	
Gender	
Student\ not student	
If yes, in which year of study?	
If yes, in which Faculty?	
Which country are you from?	
QUESTIONS REGARDING DENTAL ESTHETIC SELF-PERCEPTION	
Are you are confident about your smile?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you like showing your teeth while smiling?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you ou feel the need to put your hand in front of your mouth to cover your teeth while smiling or speaking?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you like the position of your teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not

	know, ( ) slightly disagree, ( ) strongly disagre
Are you satisfied with your teeth color?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Are you satisfied with the way your gums look?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you like the shape of your teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Are you pleased with the appearance of your teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you compare your teeth with others?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you like how your teeth image in the mirror?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you like how your teeth appear in photos?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Are you concerned about what other people think about your teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you wish your teeth looked better?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Naturally, the teeth may be worn.	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Naturally, the teeth may be stained, e.g. by coffee.	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
The function is the most important property of the teeth.	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
The appearance of the teeth is their most important property.	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you want to undergo treatments to improve the appearance of your teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree

Table 2. Section 3 included in the survey

QUESTIONS REGARDING DENTAL VENEERS PERCEPTION	
Do you know what dental veneers are?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you know when dental veneers are indicated?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you know the benefits of dental veneers?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you know the disadvantages of dental veneers?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
D you consider that dental veneers could change the teeth color?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could change the tooth shape?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could replace missing teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could be used on fractured anterior teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could be used on badly stained teeth?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could resist tea/coffee/smoking stains?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers require brushing and flossing?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers require extensive care and hygiene?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers may negatively affect the gums?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers require the	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( )

removal of tooth structure?	slightly disagree, ( ) strongly disagree
Do you consider that dental veneers may fracture due to a specific way of eating?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers may prevent tooth decay/caries?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could improve the smile appearance?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree
Do you consider that dental veneers could increase your confidence?	( ) strongly agree, ( ) slightly agree, ( ) I do not know, ( ) slightly disagree, ( ) strongly disagree

The survey was generated using the Google Form platform. Subjects for this study were selectively recruited from a diverse population that included both dental students and laypeople across various countries. Participants were chosen based on their willingness to engage in an online survey designed to assess their perceptions and expectations regarding the aesthetic benefits of composite veneers. The selection process aimed to ensure a balanced representation of different genders, ages, and cultural backgrounds to provide a broad perspective on the influence of these demographic factors on dental health aesthetics. It was distributed via email to a diverse range of individuals of different ages, educational backgrounds, and countries. The responses were gathered through the Google Form tool and subsequently imported into Microsoft Excel. Following this step, the data was analyzed and translated into visual graphs.

Data analysis

Answers obtained from direct distribution were extracted and entered into the Statistical Package for Social Sciences software 22.0 (SPSS, Chicago, Il). The data obtained from the were downloaded from the Google Forms website as a Microsoft Excel (Microsoft Corp., Redmond, WA) file. After recording the variables, the answers were exported to SPSS and merged to the direct distribution database.

First, a descriptive analysis was performed and for statistical differences regarding the social-demographic factors, the Chi-Square test was applied. It also includes the McNemar test for the significance of modifications. Statistically significant differences were those with $p \leq 0.05$.

RESULTS

49 subjects responded initially to the survey, but after validating the data, answers obtained from 42 individuals were statistically analyzed. Out of 49 responses initially gathered from a diverse group of dental students and laypeople, only 42 were analyzed further. This selection was due to the elimination of incomplete or inconsistent responses, ensuring that the analysis was based on reliable data. This approach facilitated an accurate assessment of perceptions regarding the aesthetic benefits of composite veneers across various demographic groups.

Out of the 42 subjects, 17 were females and 25 were males. Among them, 8 were non-students while 34 were students. The age distribution of the respondents is depicted in Figure 1 below.

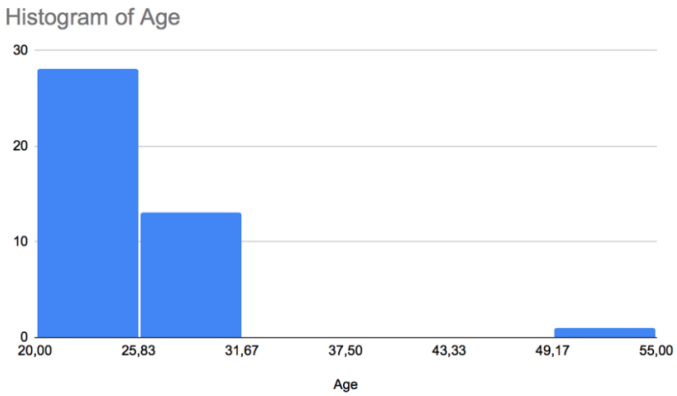

Figure 1. Age distribution of the subjects included in the survey

There were 28 students, most of them on Dentistry faculty, but also on General Medicine Faculty, Economy, etc. 15 respondents were from Germany, 9 from Italy, while the others from other European and non-european countries (figure 2).

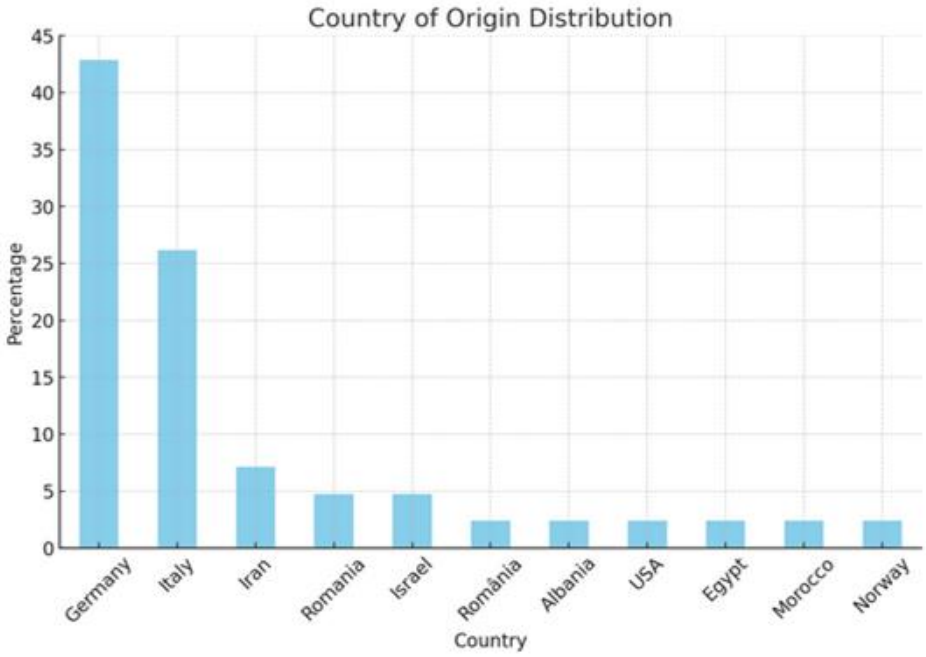

Figure 2. Distribution of subjects based on the country of origin

Regarding the answers to the questions included in the second and third sections of the survey, for the question "Are you confident about your smile?" 83,4% of the responses were split between slightly and strongly agree, while only 16,7% did not agree with the question.

For the question "Do you like showing your teeth while smiling" 90,5% of responses were split between slightly and strongly agree, while only 9,5% did not agree with the question. 92,9% of the respondents did not agree with the question "Do you feel the need to put your hand in front of your mouth to cover your teeth while smiling or speaking." Meanwhile, 7,1% agreed. 88,1% of the respondents agreed with the question "Do you like the position of your teeth?", meanwhile 11,9% did not agree. 59,5% of the responses to the question "Are you satisfied with your teeth color?" slightly agreed and only 16,7% strongly agreed, meanwhile, 23,9% disagreed in some forms, having a higher percentage of negative

responses compared to the 4 questions mentioned above. For the question "Are you satisfied with the way your gums look?" 78,6% of the respondents agreed with this question, meanwhile, 21,4% disagreed in some forms, with females being less satisfied compared to men. 80,9% of the respondents agreed with the question "Do you like the way your teeth are shaped?", meanwhile 19,1% disagreed in some forms. For the question "Are you pleased about the appearance of your teeth?" 42,9% of the respondents strongly agreed, 45,2% slightly agreed and only 11,9% disagreed with the question. 50% of the respondents agreed with the question "Do you compare your teeth with others?" and the other 50% disagreed in some forms. For the question "Do you like how your teeth appear in the mirror?" 88,1% of the respondents agreed in some forms and 11,9% disagreed with the question. 66,7% of the respondents agreed with the question "Do you like how your teeth appear in photos?", meanwhile 33,2% did not agree. 35,7% of the respondents agreed with the question "Are you concerned about what other people think about your teeth?", meanwhile 31% did not agree, 23,8% strongly disagreed and 9,5% slightly disagreed. Question 13 was, "Do you wish you teeth looked better?" 64,3% of the respondents agreed with the question, meanwhile, 35,7% did not agree. 66,7% of the respondents agreed with the question "Naturally, the teeth may be worn", meanwhile 19% did not agree, 4,8% strongly disagreed and 9,5% slightly disagreed. 66,7% of the respondents agreed with the statement "Naturally, the teeth may be stained, e.g. by coffee", meanwhile 19% did not agree, 9,5% strongly disagreed and 4,8% slightly disagreed. For the statement "function is the most important property of the teeth" 90,5% of the respondents agreed with the statement, meanwhile, 9,5% disagreed. Only 2,4% of the respondents strongly agreed with the statement "the appearance of the teeth is their most important property", 52,4% slightly agreed, and 45,2% did not agree. For the statement "Do you want to undergo treatments to improve the appearance of your teeth" 21,4% of the respondents strongly agreed with the statement, 40,5% slightly agreed, meanwhile 14,3% did not agree, 16,5% strongly disagreed and 7,1% slightly disagreed.

Regarding the third section of the survey, the following percentages were obtained via statistical analysis: (19) "Do you know what dental veneers are?" - 83,1% of the respondents agreed with this question, meanwhile, 16,9% disagreed in some forms. (20) "Do you know when dental veneers are indicated?" 85.7% of the respondents agreed with the question, meanwhile, 14,3% disagreed in some forms. (21) "Do you know the benefits of dental veneers?"- 80,9% of the respondents agreed with this question, meanwhile 19,1% did not agree. (22) "Do you know the disadvantages of dental veneers?"- 69,1% of the respondents agreed with the question, meanwhile 16,7% did not agree, 4,8% strongly disagreed and 9,5% slightly disagreed.

(23) "Do you consider that dental veneers could change the teeth' color?" - 80,9% of the respondents agreed with this question, meanwhile, 16,7% did not agree and 2,4% slightly disagreed. (24) "Do you consider that dental veneers could change the tooth shape?" - 88,1% of the responses agreed with the question, meanwhile, 11,9% disagreed in some forms. (25) "Do you consider that dental veneers could replace missing teeth?" - 14,3% of the respondents strongly agreed with this question, 23,8% slightly agreed, 28,8% did not agree, 26,2% strongly disagreed and only 7,1% slightly disagreed. (26) "Do you consider that dental veneers could be used on fractured anterior teeth?" - 54,8% of the respondents agreed with this question, meanwhile, 31% did not agree, 9,5% strongly disagreed and only 4,8% slightly disagreed. (27) "Do you consider that dental veneers could be used on badly stained teeth?" - the majority of respondents agreed with the question at 90,5% while only 9,5% disagreed. (28) "Do you consider that dental veneers could resist tea/coffee/smoking stains?" - the majority of the respondents disagreed with the question at 52,4%, meanwhile only 47,6% agreed in some forms. (29) "Do you consider that dental veneers require brushing and flossing?" - the majority of people agreed with this question at 95,2% and only 4,8% did not agree. (30) "Do

you consider that dental veneers require extensive care and hygiene?" - 90,5% of the respondents agreed with this question and only 9,5% did not agree. (31) "Do you consider that dental veneers may negatively affect the gums?"- 64,3% of the respondents agreed with this question, meanwhile, 23,8% did not agree, 7,1% strongly disagreed and only 4,8% slightly disagreed. (32) "Do you consider that dental veneers require removal of tooth structure?" - the majority of the people agreed with this question 88.1%, and only 11,9% disagreed. (33) "Do you consider that dental veneers may fracture due to specific ways of eating?" - 78,6% of the respondents agreed with this question, meanwhile, only 21,4% disagreed. (34) "Do you consider that dental veneers may prevent tooth decay/caries" - the majority of people did not agree with this question at 59,6% and 40,4% agreed. (35) "Do you consider that dental veneers could improve the smile appearance?" - a total of 88,1% of the respondents agreed with this question and only 11,9% disagreed. (36) "Do you consider that dental veneers could increase your confidence?" - the majority of the responses agreed with this question at 90,5% and only 9,5% disagreed in some forms.

Performing inferential statistical analysis, Chi-square tests were applieded between demographic data and the questions included in the two sections of the survey investigating respondents's self-perception. Analyzing the respondents' gender and answers, for the question "Are you are satisfied with the way your gums look?" Chi2 Statistic was 21.77 (P-Value = 0.040), and for the question "Do you consider that dental veneers could resist tea/coffee/smoking stains?" Chi2 Statistic was 23.02 (P-Value = 0.028). Also, when analyzing the country of residence with the questions' answers, the responses to whether dental veneers could increase confidence, showed a significant association with the country of residence (Chi2 Statistic: 83.06, P-Value: 0.0067) (table 3).

Table 3. Chi-Square Test Results for Demographic Influences on Dental Aesthetics Perceptions

Question	Demographic Factor	Chi-square Statistic	P-Value	Significance
Are you satisfied with the way your gums look?	Gender	21.77	0.040	Significant
Do you consider that dental veneers could resist tea/coffee/smoking stains?	Gender	23.02	0.028	Significant
Do you think dental veneers could increase confidence?	Country of Residence	83.06	0.0067	Significant

DISCUSSIONS

Recent research on self-perceptions regarding dental health highlighted significant variations in how different demographic groups perceive their oral health and aesthetics. A survey spanning several countries and age groups provided insights into these perceptions, particularly focusing on the impact of gender, age, and geographical location. The findings suggest some differences that could influence dental care practices and patient education programs. As the global population continues to embrace dental cosmetics and health equally, understanding these demographic distinctions becomes crucial [18].

The Chi-square analysis revealed a notable difference in how genders perceive their gum health, with males generally more satisfied than females. This outcome aligns with previous studies indicating that women are often more critical of their physical appearance, including dental aesthetics, which might influence their lower satisfaction rates [19]. Furthermore, the survey indicated significant gender-based differences in perceptions regarding the resistance of dental veneers to staining from substances like tea and coffee, suggesting targeted educational campaigns might be necessary to address and recalibrate unrealistic expectations or misinformation prevalent among certain demographic groups.

Interestingly, the study found no significant differences across age groups concerning dental health perceptions, challenging the common assumption that older individuals might be more concerned with dental functionality over aesthetics. This lack of significant age-related variation suggests that modern dental concerns transcend traditional age boundaries, possibly due to the increasing accessibility of dental information and cosmetic dentistry across all age groups [20]. This indicates a shift in societal attitudes towards dental aesthetics and health, reflecting a more uniform understanding and concern across different ages.

One of the most striking findings from the survey was the significant variation in how respondents from different countries perceived the confidence-boosting effects of dental veneers. This variation could be influenced by cultural, economic, and social factors that shape public health behaviors and perceptions in different regions [21]. Countries with higher exposure to cosmetic dentistry and media portrayals of ideal dental standards might show greater belief in the efficacy of cosmetic dental procedures to enhance self-esteem and social confidence.

These demographic insights are invaluable for dental health professionals who aim to provide tailored care that considers patients' cultural, gender, and age-related preferences and perceptions. By integrating a deeper understanding of these factors into patient interaction and treatment planning, dental practitioners can improve patient satisfaction and treatment outcomes. Moreover, public health campaigns and educational programs can be designed to address specific misconceptions or knowledge gaps identified through such comprehensive surveys, ultimately leading to better overall dental health and aesthetic satisfaction [22].

CONCLUSIONS

This study evaluated the aesthetic benefits of composite veneers and their impact on the self-perception of dental students and laypeople, highlighting the significant influence of demographic factors such as gender, age, and country. Notably, gender differences revealed that males are generally more satisfied with their gum health, suggesting a need for gender-specific educational programs in dental aesthetics. Furthermore, the lack of significant age-related differences suggests a universal value placed on dental aesthetics across all age groups, indicating broad acceptance and interest in cosmetic dental treatments.

Cultural factors significantly affected perceptions, particularly the confidence-boosting effects of dental veneers, underscoring the importance of culturally tailored treatment options and patient education programs. These findings emphasize the need for dental practitioners to adopt a consultative approach that involves patients in treatment decisions, aligning plans with their aesthetic preferences and cultural expectations.

Overall, the study supports the need for enhanced patient education and practitioner awareness to effectively address and manage the diverse expectations and perceptions of dental patients. By integrating these insights into clinical practice, dental professionals can improve treatment outcomes and patient satisfaction, ensuring that composite veneers meet both aesthetic desires and functional needs.

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Implementation of alternative technological options for processing ceramic masses in current practice

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Received: 18 April 2024; Accepted: 23 May 2024; Published: 30 June 2024

Abstract

Considering the evolution of current technologies, this study aims to assess the implementation of alternative digital technologies in dental medicine for student's education and for practicing doctors.

Materials and Methods: This primary study evaluated a heterogeneous group of doctors and students through a questionnaire. The questionnaire, conducted on the Google Forms platform, consisting of 12 open-ended questions, analysed the level of implementation of traditional technologies versus the digital workflow for processing ceramic masses. The responses were statistically interpreted using the R statistical software version 4.3.1.

Results and Discussions: The statistical analysis of the questionnaires showed that digital alternative technologies are a viable method in dental practices, and it is recommended for students, being included among their specific skills.

Conclusions: The implementation of the digital workflow for processing ceramic masses, compared to the traditional one, will represent a more significant proportion in the immediate future, in generating diagnoses, developing treatment plans, and applying them in clinical practice.

Keywords: Digital workflow; traditional workflow; statistical processing

INTRODUCTION

Full ceramic systems currently used in dental prosthetics have modified compositions that allowed wide usages and indications in prosthetics. The advantages of full ceramic systems include superior aesthetics, biocompatibility, low thermal conductivity, chromatic and chemical stability [1,2]. These materials are recommended for patients' who desire natural and aesthetic restorations, coupled with the high precisions offered by digital workflows [2]. Practitioners, in addition to the optical behaviour of the restorations, have sought to improve their mechanical properties and explore new processing perspectives [3,4]. The longevity of full ceramic prostheses is multifactorial, with material selection, design, and processing procedures being of great importance [1,4].

The psychological impact of dental trauma in the anterior region is significant, and by using CAD/CAM milling systems in the clinic, we can rehabilitate the dental arches with a natural appearance in the same session, meeting both aesthetic and mechanical expectations [5,6]. Digitization in medicine has become a reality, and its implementation depends not only on understanding the digital workflow but also on the financial implications [1,7,8].

By implementing digitalization in dental practice beyond the high accuracy, time saving and efficiency in the technologic process, cross-contamination between the dental office and the dental laboratory can be prevented [7, 8]. The current trend is to use more monolithic full ceramic prosthetic restorations. Multi-layered prosthetic restorations have proven to be more prone to failures such as layer fracture or delamination [7,9]. Single-unit and partial fixed full ceramic prostheses can be successfully created using CAD/CAM technology, restoring disrupted functions through additive or subtractive processing technologies [9,10,11].

The disadvantages of using CAD/CAM systems include high costs for the devices and their maintenance [12,13]. The milling process can be either hard or soft, depending on the choice of the material that must later be sintered or not, bringing with it advantages and disadvantages [1].

Aim and objectives

The aim of this study is the assessment, through questionnaires, of the digital workflow for processing ceramic masses in prosthesis technology implementation in current dental practice in the western part of Romania. The hypotheses formulated at the beginning of the study should provide clarification regarding the need to achieve the necessary skills for students and doctors of this technological procedure. To carry out this evaluation, initially, a systematic review of data from the specialized literature has been done in order to create the design of the assessment questionnaire.

MATERIAL AND METHODS

This primary study is a questionnaire, whose results, were statistically interpreted. The digital questionnaire, created using the Google Forms platform consists of 12 questions. It was sent on email addresses for two target groups after informing them about this study and obtaining the informed consent.

The two groups included were: one represented by 50 dental practitioners and one represented by 50 final-year students from the Faculty of Dental Medicine,"Victor Babeş" University of Medicine and Pharmacy of Timişoara. The null hypothesis was that there are differences in the perspective of choosing alternative options for processing ceramic masses between experienced dental practitioners and recent graduates. The number of questionnaire

participants was chosen to be equal for each group to have balanced data. The types of questions in the questionnaire included multiple-choice, short-answer, paragraph-answer, selection, and drop-down questions. After completing the questionnaire by both groups using the Google Forms platform, the results were organized into an Excel table and use for statistical analysis.

For the statistical evaluation was used the R statistical software version 4.3.1. Bar charts were employed for visual analysis using the R package ggplot2, Wordcloud and Wordcloud2 packages were used for text analysis. To test the statistical dependence between categorical variables, the Chi-Square test was used. The Chi-Square test in R is a statistical method used to determine whether two categorical variables have a significant correlation.

The first two questions aimed to determine group affiliation: practitioner or student, and age distribution in the group. Question 3 aimed to establish the level of knowledge of the digital processing protocol for ceramic masses, while question 4 quantify the percentage of level of digital workflow usage in dental prosthetics.

As metal-free fixed prostheses are more commonly used in recent years, question 5 aimed to identify the proportion of choosing traditional versus digital technologies in the current processing of ceramic masses and question 6 assessed the use of intraoral scanning in the dental office. Considering that full ceramic systems generally require knowledge about indications, contraindications, advantages, and disadvantages, questions 7 and 8 evaluated these aspects for the traditional additive protocol in processing ceramic masses.

The working time required to obtain metal-free prostheses using CAD-CAM systems is an essential variable evaluated with question 9, along with the benefits brought by digital workflow that was assessed through question 10. Questions 11 and 12 aimed to analyse respondents' opinions regarding the difficulty of implementing the digital workflow for processing ceramic masses in Romania and the percentage they believe digital full ceramic prostheses will occupy in the coming years.

RESULTS

Initially, visual analyses were conducted for the questionnaire responses. Questions 1 and 2 highlighted the heterogeneity group. For question 3, “Are you familiar with the digital protocol for full ceramic prostheses? Yes/No,” the majority of the medical practitioners answered “Yes”, while among the students, only half are familiar with the digital protocol, and the other half is not familiar with it. For questions 2 and 3 regarding the knowledge of the digital workflow, based on respondents' age, the analysis showed that those, aged between 30-40 years are familiar with the protocol, most respondents aged 20-24 do not know the protocol and those aged 24-30 mostly know it. The majority how are older than 40 are familiar with the protocol (Figure 1).

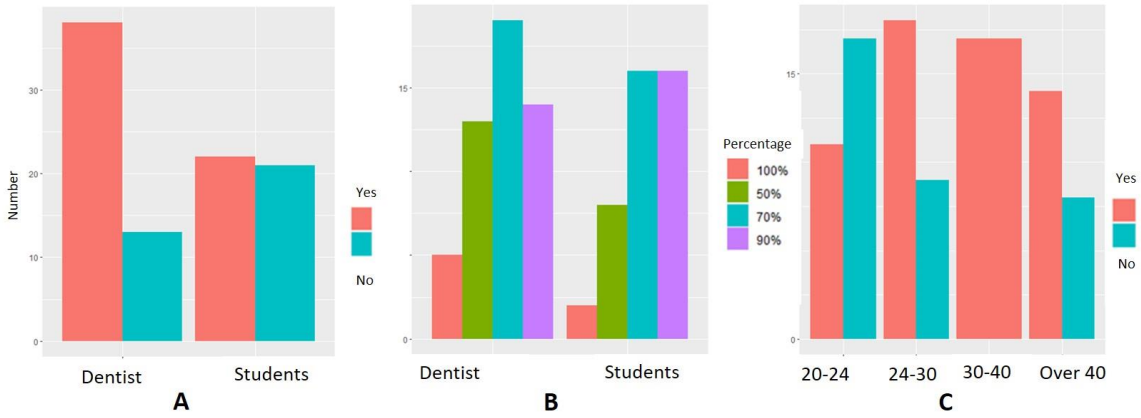

Figure 1. A- graphic representation of question regarding the knowledge about digital protocol for full ceramic prostheses 3; B-graphic representation of questions 2 and 3; C-graphic representation of age and familiarity with digital protocol

The analysis of the answers to question 6 show that 55% of the participants in the questionnaire use digital scanning, while the other 45% use the traditional method. Among those who use digital scanning, 45% scan intraoral, 4% scan the analysed model and a percentage of 6% use both variants. When asked question 12, "select what percentage you believe digital full ceramic prostheses will occupy in the coming years with options: 50%, 70%, 90%, 100%" showed that, majority of dental practitioners believe that in the coming years digital full ceramic prostheses will be produced at a rate of 70%. A smaller percentage of dentists believes it will reach 100%. On the other hand, students consider that the percentage will reach 70% or even 90% (Figure 2). For question 5, "what technologies do you use for ceramic processing? Traditional or digital?" the responses indicated that dental practitioners mostly use traditional technologies, while they use digital technologies to a greater extent. In contrast, students use traditional technologies to a higher percentage than dental practitioners, who use digital technologies more frequently (Figure 2).

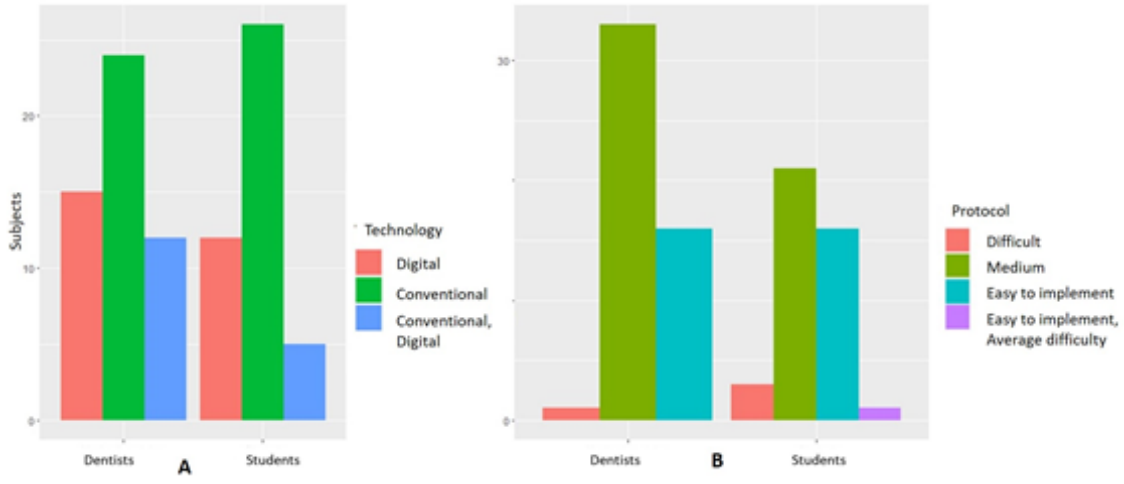

Figure 2. A- graphic representation for the answers of question 5; B - graphic representation for question 11

The majority of dental practitioners chose their response to question 11:"The digital protocol for creating full ceramic prostheses is: Difficult to implement / Easy to implement / Medium level of difficulty" (Figure 2B). This reflects that the implementation of digital technologies for processing ceramic masses is considered of medium difficulty. In contrast, students prefer a simpler implementation method. The response to question 12 had different

percentages, and the choice was influenced by the age of the respondents. Individuals between 20-24 years old believe that digitally manufactured full ceramic prostheses will occupy a percentage of 90%. Those aged between 24-30 believe it will be 70% (Figure 3).

For all age categories, the choice of response to question 11, regarding the difficulty of implementing the digital protocol for creating full ceramic prostheses, indicates that respondents consider the digital workflow need to have a medium level of implementation (Figure 3).

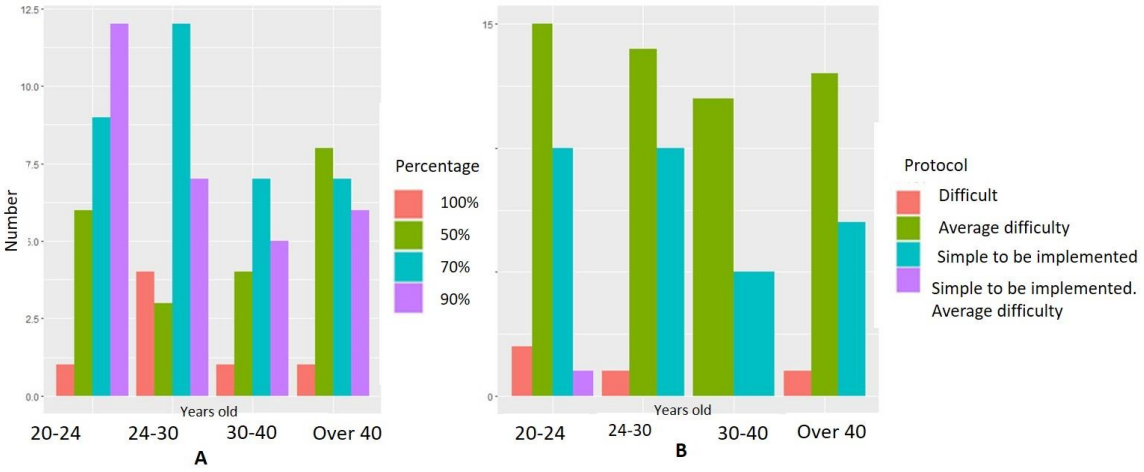

Figure 3. A. Graphic representation for questions 2 and 12. B. Graphic representation for questions 2 and 11

For question 5, if age has influenced the choice of response differently, specifically, for the age group of 20-24, the predominantly used technology is traditional, while for the age group between 24-30, digital technology predominates. For those over 40 years old, traditional technology is still predominant. Question 6 aimed to establish a very important aspect of the digital workflow represented by collecting data about the prosthetic field through various scanning methods: intraoral or analogue model. The presented results are a conclusion of the cascade questions (Figure 4).

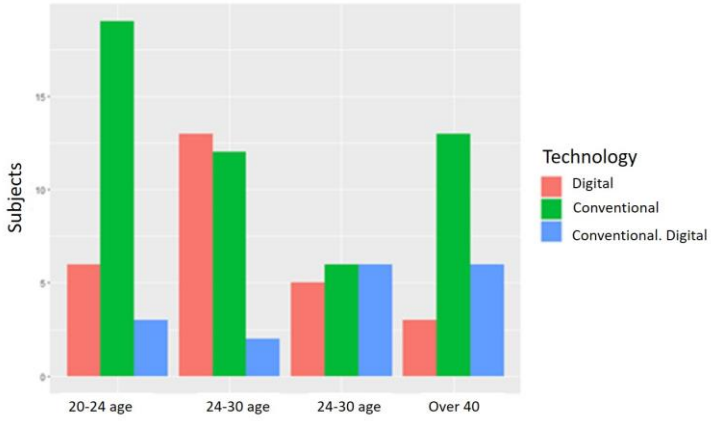

Figure 4. Graphic representation for answers of questions 2 and 5

For questions with short-answer or paragraph-type responses was made a text analysis and followed to analyze which are the benefits of traditional full ceramic prostheses. The most frequently used words were identified and the most relevant characteristics were aesthetics, working time adaptation of prosthetic restorations made through a digital protocol.

For question 10, "What are the benefits of digitally produced full ceramic prostheses?" the most frequently found responses were: reduced/shorter working time, better adaptation. The responses to question 8, "What disadvantages/difficulties have you encountered regarding the adaptation of ceramic prostheses?" most frequently were represented by difficulties in cementation and brittleness.

Among young individuals aged 20-24, a higher percentage of students still do not know the digital protocol for full ceramic prostheses. After the age of 24, the percentage of knowledge about this protocol increases. All dental practitioners come to know this protocol between the ages of 30-40, and after the age of 40, there is a percentage similar to that of students aged 24-30 who either do not know or do not wish to implement new technologies in dental offices. The reasons are the lack of opportunity to learn and practice since their studying years and the costs of the technology.

Despite the expectation that modern technology would be the most used one, the reality is different. Traditional technology is the mostly used among both students and dental practitioners in 2023. Having more experience, dental practitioners use modern ceramic processing technology to a higher percentage compared to students. This percentage could become at least equal in the future among students and dental practitioners if the mandatory use of new ceramic processing methods could be implemented in the university curriculum, bringing benefits not only to medical professionals but also to patients.

Regarding the difficulty level of the digital protocol for creating full ceramic prostheses, all age categories consider that the digital protocol for ceramic prostheses has a medium level of implementation difficulty.

The benefits of digitally manufactured full ceramic prostheses are presented from the perspective of both dental practitioners and students. Among the most frequent mentioned benefits are reduced/shorter working time, improved adaptation to the natural or artificial abutments, the possibility of milling and fixing the restoration in the same day and patient comfort during impressions.

The disadvantages/difficulties encountered by both students and dental practitioners regarding the adaptation of ceramic prostheses are: occlusal adaptation and proximal contact areas which are more challenging for designing an free interference occlusion and proximal contact areas. Materials dedicated to full ceramic prostheses are prone to brittleness, have a high risk of fracture, sensitive adaptation at the threshold level, laborious luting and higher expenses.

Using the Chi-Square statistical test, we compared the relationship between the variables "You are" and "You know", and the p-value was 0.01377 (less than 0.05). It can be concluded that transitioning from the student group to the doctor group will change knowledge regarding technology.

The two important criteria considered in interpreting the questionnaire responses were their correlation with age groups and whether or not the participants had knowledge of the digital workflow from various perspectives.

DISCUSSIONS

The introduction of digital technologies in dental medicine has significantly altered the field of dental practices, particularly in the ceramic prostheses fabrication. The findings from our study underscore a growing acceptance and use of these technologies among dental practitioners and student's curriculum, with noticeable ease of implementation and high accuracy of prosthetic restorations.

Our results indicate a higher familiarity and implementation of digital workflows among practicing dental professionals compared to students. This discrepancy, may be

attributed to the exposure and access to digital tools in clinical settings, which is more pronounced among practitioners than in educational settings. Practitioners are likely to have direct experience with CAD/CAM systems, which offer distinct advantages such as improved precision and efficiency in creating dental prosthetics. This observation aligns with previous studies which suggest that the integration of digital technologies in dental curriculum is essential to bridge this gap [2].

The significant variance in the level of digital workflow familiarity between students and professionals, highlights the need for curriculum improvement and implementation of digital dentistry. Incorporating comprehensive training on digital dental technologies within dental curricula could enhance student competency and readiness for modern dental practices, which increasingly rely on digital techniques [10]. This approach is supported by the findings from Baroudi and Ibraheem [14], who advocate for the inclusion of digital dentistry training as a core component of dental education to meet the evolving demands of the field.

Despite the advantages, our study also highlight the challenges associated with the adoption of digital technologies in dental practices. High equipment costs and maintenance are significant barriers, as noted in several responses are supported by research from Galante et al. [12]. Additionally, the complexity of integrating new technologies into existing systems poses a notable challenge, particularly for older practitioners who may have less flexibility in adapting to new workflows [7,15,16].

Looking forward, the advancement of digital technologies, such as the integration of Augmented Reality (AR) in surgical procedures, is continuously changing dental medicine by enhancing the capabilities of dental professionals to perform complex procedures with greater accuracy and patient comfort [1, 7].

With these digital technologies in development, Augmented Reality (AR) will reinvent surgical procedures, enhance healthcare providers' ability to treat patients, and transform healthcare as a whole. The future certainly looks bright and virtual [14,15].

In the e-book published in 2021, “Digitalization in Dentistry, Clinical Applications,” Jain P. and Gupta M provide readers with evidence-based guidance on the clinical applications of digital dentistry. They present the use of devices incorporating digital or computer-controlled components for dental procedures. Information about current digital procedures in various dental fields is published and presents in detail digital protocols in endodontics, orthodontics, implantology, and other dental specialties [1].

The main objective is to improve daily practice and equip practitioners with the necessary knowledge and skills to cope with innovations. In this regard, a problem-solving method is addressed, emphasizing key concepts and presenting details in a sequential and easy-to-follow manner [1,16].

AI is already present in the digital dentistry workflow, the DiagnoCat tool being already widely used and provided by dental radiology offices. These tools offer an analysis of the patient’s oral cavity providing quickly an overview regarding: the presence or radio-transparency in a teeth structure, the number of root canals etc [18].

The transition toward digital workflows in dental medicine is both an opportunity and a challenge. As digital technologies become more embedded in dental practices, it is crucial for educational institutions to adapt and provide robust training in these technologies. Furthermore, addressing the barriers to adoption, particularly through cost management and training, it will be essential for the widespread acceptance and use of digital workflows in dental medicine. By overcoming these challenges, the dental industry can fully leverage the potential of digital technologies to improve patient outcomes and operational efficiency.

CONCLUSIONS

Digitalization in Medicine in general, and especially in Dentistry in the near future, will play a significant role in generating diagnoses, developing treatment plans, and their application.

In Romania, medical digitalization is currently undergoing substantial development, but there is a need to increase the level of proficiency in new technologies, both among experienced doctors and recent graduates.

The implementation of digital technologies for processing ceramic masses is becoming a reality because the advantages of these systems are proofed and the working protocols are understood. The focus of the digitalization in the curriculum in dental schools can accelerate the integration of the digital workflow in dental practice.

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Digital workflow for ten upper veneers: a case report

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Received: 10 May 2024; Accepted: 10 June 2024; Published: 30 June 2024

Abstract

Aim and objectives: The purpose of this article is to present the case of ten upper veneers using a full digital protocol in the interest of evaluating the results both estethically and functionally, duration of the whole process, overall cost, the efficiency of the workflow and patient's satisfaction.

Material and Methods: The digital workflow consisted of a previsualization of the final result by using the Smile Cloud application, therefore creating a digital wax-up and printing a model for the mock-up. The ten upper preparations from first molar to first molar were performed. In the end, after the intraoral scanning of the preparations, the restorations were milled from ceramic ingots in CAD-CAM 5-axis milling unit and tried-in in order to verify the integration and adaptation, finally ten upper monolithic veneers being cemented.

Results: The digital workflow allows to have a predictible final result – especially esthetically, offering a natural final touch thanks to micro and macro textures, alongside with color choice and shade integration, improving the whole facial aspect.

Conclusions: In terms of time and predictability, the digital workflow offers a better time-management and faster results, alongside with an improved esthetic outcome. The duration of the entire clinical process was shorter compared to the average time for conventional protocol, increasing patient's satisfaction for the whole treatment. Overall cost can surpass the usual one of traditional workflow, as the CAD-CAM system used, the software updates and the special-created materials for digital protocol require significant financial investment.

Keywords: digital workflow, veneers, digital smile design

INTRODUCTION

When in comes to digital workflow, designing a final restoration using CAD-CAM (computer-assisted design and computer-assisted manufacturing) is likely more profitable in terms of time and efficiency than using the conventional protocol – the patient can actively be a part of their own treatment plan by choosing between the projects made in the Digital Smile Design system, giving valuable feedback which drastically enhance the communication between the dental team and the patient, thus avoiding any medico-legal issues by previsualizing the outcome and obtaining a predictable result [1].

The digital smile design is an essential step of the process – not only it permits to predict the final makeover, but it motivates the patient to be compliant and confident in the dental team's treatment and being tolerant during each step of the treatment [2].

The digital wax-up created after the digital smile design is used in order to make a mock-up, an important clinical step during the treatment – this pre-op mock-up not only gives the patient the opportunity to previsualize the final result, but it represents a good moment for making adjusments both aesthetically and functionally. Therefore, the dentist can assess the future aspect of the restorations before doing irreversible procedures (like preparing the teeth), so it reduces the risk of misjudgement and making mistakes [3].

With all the benefits of the digital protocol in terms of predictability, efficiency and time-management, the downsides of this treatment approach consists in a permanent need of software updates which implies professionally continuous evolution and financial investment, alongside with its limitations, like a required minimal thickness value of the restorations [4].

Aim and objectives

The purpose of this clinical report was to present the digital protocol used for a case of ten upper veneers and examining the results regarding the duration of the entire clinical process, functional and esthetic outcomes, final costs and patient's satisfaction, by taking into consideration the opinions and desires during the clinical steps, especially in the mock-up and try-in sessions.

The aim of choosing a digital protocol was not only to determine the improvement of communication between the patient and the dental team and to evaluate the overall benefits using de digital workflow in terms of predictability, time-efficiency and quality of restorations, but also to assess the facial and aesthetic integration of digital manufactured veneers.

MATERIAL AND METHODS

The patient was a 32 years old woman interested in improving the aspect of the upper teeth, but also wishing for a natural, yet functional and esthetic result (Fig. 1, Fig. 2). The patient followed an orthodontic treatment and after the final clinical evaluation there were some esthetics concerns, such as tooth-to-tooth disproportions, assymetric occlusal plane and lack of morphology in terms of micro and macrotexture. Analysing the aspect of the smile and taking into considerations the young age and the patients' desires, it was decided to make ten upper veneers, from first molar to first molar.

Figure 1. Initial situation – intraoral frontal photography

Figure 2. Dento-labial and dento-facial analysis

The digital workflow consisted of multiple steps, starting with an entire set of photographs, both intra and extraoral, taken with a DSLR Nikon 3500 with a 105 mm macro lens. The intraoral scanner used for the digital first impression was Trios 3 (3Shape Co., Copenhagen, Denmark). Afterwards, the images and the intraoral scanning were imported into de Smile Cloud online application to perform a smile analysis and digital design of the future veneers. The references used for designing future restorations were the facial ones, alongside with the lip contour. The Smile Cloud applications offers multiple types of natural teeth in its library, and thank to the algorithms integrated in the application, it was easier to choose between different shapes of dental morphologies in order to make a suitable digital smile design project.

In the Smile Cloud online application, the interdisciplinary team was able to see the project, and the communication with the patient was easier thanks to the Smile Cloud Passport feature, which gives the opportunity to discuss with the patient via chat, in order to modify the project according to patient's desires and thoughts, making the entire process of treatment more trustworthy. Finally, after all the modifications were made by the digital team, the project was approved by the patient and imported into the 3Shape Dental System (3Shape Co., Copenhagen, Denmark).

The dental technician, having the chosen digital smile design project, was able to go further with the digital wax-up by superimposing the project and the initial scanning, thus printing a model using a 3D printer (Asiga MAX 4K, Asiga). On this model it was made a silicone key using putty and light body addition silicone material (Virtual, Ivoclar Vivadent). The silicone key was used for performing a mock-up in the dental office using resin material (Protemp 4, Bleach, 3M), so the whole team – patient – dentist -dental technician - can assess the functionality and the esthetics, along with taking a new set of photographs in order to analyze every detail (Fig. 3, Fig. 4).

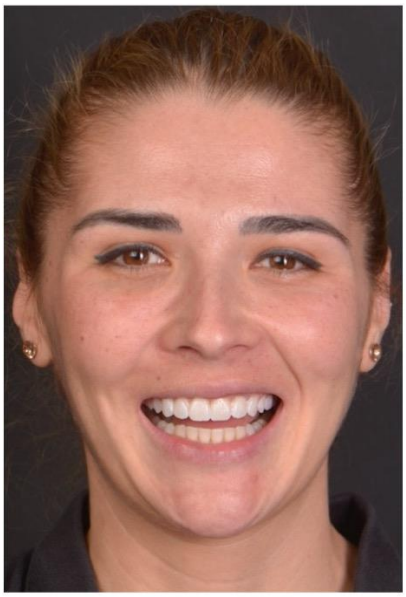

Figure 3. The mock-up – facial integration

Figure 4. The mock-up – labial analysis

After the teeth preparations from the first molar on the right side to the first molar on the left side (Fig. 5, Fig. 6, Fig. 7) were done, another scan was made and a Smile Cloud feature was used to superimpose the digital wax-up and the scanning of teeth preparations. By doing so, the clinician verified the existing space for the future restorations in order to obtain minimal invasive preparations (Fig. 8), so the enamel structure could be preserved as maximum as possible.

Figure 5. Teeth preparations on right side

Figure 6. Teeth preparations on left side

Figure 7. Teeth guided preparation – frontal view

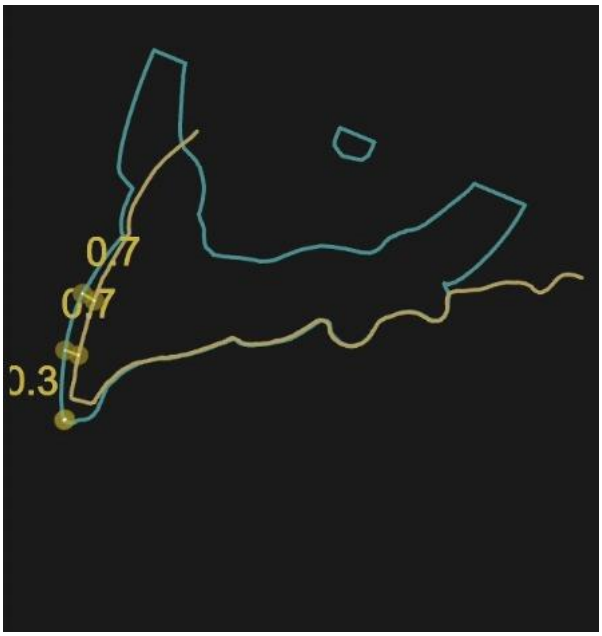

Figure 8. The difference between the scanned preparated tooth and the digital wax-up

The material chosen for the final restorations was leucite-reinforced glass ceramics for CAD-CAM system (IPS Empress CAD multi B1, *Ivoclar Vivadent*).

Before even the preparation began, the technician made provisional veneers using the shell technique, so the prepared teeth are protected and the patient can get used with the future aspect of their teeth (Fig. 9, Fig. 10, Fig. 11). The technician digitally prepared the teeth on the wax-up model in order to fabricate the provisional restorations, sent them to the dental office so the clinician only relined with resin material into the provisionals while inserting them on the teeth, in order to obtain optimal marginal fit.

Figure 9. The provisionals – right side

Figure 10. The provisionals – left side

Figure 11. The provisionals – frontal view

The protocol for the dental laboratory was to superimpose both of the two standard tessellation language (STL) files (the one with the digital wax-up and the last one, with teeth prepared) into the same software, along with using the virtual programmed articulator, the milling process was done with a 5-axis milling unit (Imes-Icore CORiTEC 150 i), finishing and glazing.

Another set of photographs, both extraoral and intraoral, were taken after the final restorations were tried-in (Fig. 12, Fig. 13, Fig. 14, Fig. 15). The patient and the dental team analysed the integration of the final restorations to make some corrections, being able to achieve the initial esthetic desires: the aspect of micro and macro textures and the shade chosen and its integration in the facial harmony. Also, the occlusal analysis was performed in order to assess the functionality of the final restorations.

Figure 12. Tried-in veneers – right view

Figure 13. Tried-in veneers – left view

Figure 14. Tried-in veneers – frontal view

Figure 15. Tried-in veneers – occlusal view

Finally, the ten upper veneers were bonded under rubber dam isolation using a single-component adhesive (Adhese Universal VivaPen, *Ivoclar Vivadent*). The bonding protocol included 4,5% hydrofluoric acid (IPS Ceramic Etching Gel, *Ivoclar VIvadent*) as etching agent, placing the restorations in sodium bicarbonate solution, using an ultrasonic bath and a bonding agent (Monobond Etch and Prime, *Ivoclar Vivadent*), before applying the cement material (Variolink Esthetic, *Ivoclar Vivadent*) (Fig. 16).

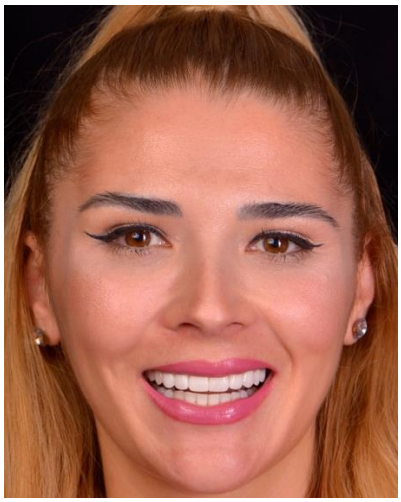

Figure 16. The ten final veneers bonded

DISCUSSIONS

The implementation of the full digital smile design protocol in these particular cases of maxillary veneers facilitated the previsualization of the aesthetic outcomes and helped to obtain minimal invasive preparations verified digitally. Maintaing the preparation design into the enamel is a fundamental parameter in assuring absence of infiltration and quality of bonding between tooth substrate, adhesive cement and restoration for the success of veneers, according to Verniani et al [2].

The patient gave positive feedback in terms of duration of the whole process – by scanning, realizing digital smile design and using the CAD-CAM system, the time spent for each clinical step was reduced, as the communication between the dentist and the technician was optimized, during the treatment, as Verniani et al presented [2].

Making intraoral and extraoral photographs initially, with the mock-up and with the final restorations, also with video documentation, permitted to make adjustments according to patient's desired in order to obtain an improved esthetic and functional outcome, as also mentioned by Stanley in his study [3].

Digital systems implies purchasing the CAD-CAM technology, the softwares and special-created materials, each of those mentioned increasing the overall cost of the treatment, compared to the conventional protocol. As presented by Sanchez-Lara et al [5], there exists a direct dependency between the cost-effectiveness of a digital workflow, the softwares used, and the skills and training level of the user.

The material used for the final veneers was leucite-reinforced glass-ceramic which provides good mechanical due to the 40-50wt% of leucite crystals evenly distributed that increase the mechanical properties in terms of crack deflection and energy dispertion. Also, good aesthetics are provided by having a similar level of material translucency as natural teeth, showing high patient satisfaction in terms of both esthetics and functionality, as presented by Zürcher et al [6].

CONCLUSIONS

The communication between the dentist, the dental technician and the patient was radically enhanced using the digital protocol, the Digital Smile Design system having a major role in augmenting patients' confidence in the dental team.

The efficiency of the workflow is gained by reducing the number of required sessions in the office, the discussions between the dental team and the patient via Smile Cloud

application are essential for choosing the proper project before any clinical irreversible procedure is done.

Another advantage conferred by the digital workflow is the achievement of a predictable outcome – the mock-up permits to see a preview of the final result and to evaluate the functional aspects, such as lateral and anterior guidance.

Potential errors that might occur during the treatment can be easily surpassed by using the saved files, as it is not necessary to repeat any clinical steps as in conventional method.

However, the initial investment for purchasing the CAD-CAM system and dedicated materials, the software updates required periodically, along with the permanent need of evolving professionally to keep up with the digital technology mush be taken into consideration financially, the final cost being dependent on these factors.

Each of these mentioned attributes presented are promising prospects in terms of aesthetic and functional outcomes for digital prosthodontic treatments.

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Interdisciplinary approaches to preventing oral complications in diabetic patients: a systematic literature review

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Received: 14 April 2024; Accepted: 5 June 2024; Published: 30 June 2024

Abstract

In the last three decades the number of people with diabetes has doubled. The global prevalence of diabetes mellitus (DM) is rapidly rising as a result of population aging, urbanization and associated lifestyle changes. Among the complications in the oral sphere of diabetes were reported: periodontal disease (PD) (the most important oral disease correlated with diabetes), xerostomia, oral candidiasis, glossodynia, slow healing of the tissues of the oral cavity, as well as other conditions for which it would be necessary to implement early prophylactic and therapeutic measures.

This systematic literature review was conducted to answer the following questions: The primary question: What are the ways to prevent periodontal disease and oral mucosal diseases in DM patients? And the secondary questions were: How were these methods evaluated in the studies included in the research? What is the level of knowledge of both patients and diabetologists regarding the prevention of these oral complications in diabetic patients?

436 bibliographic references were identified and were centralized in a file. The studies were evaluated according to their title and abstract, following the extent to which they correspond to the inclusion criteria. After analyzing the titles, 351 articles were excluded and the remaining 86 had their abstracts evaluated. 25 articles were selected and read in full, two of which were excluded because they proved not to be relevant to the chosen topic. Thus, finally, 23 studies were included in the systematic review.

The most important conclusion was that: an interdisciplinary collaboration is necessary between health specialists, dentists and diabetologists alike, with the aim of developing programs to educate diabetic patients about the oral complications of DM and their prevention.

Keywords: Diabet, prevention, oral diseases, parodontitis, gingivitis, xerostomia, oral cancer

INTRODUCTION

In recent years, researchers have closely studied the correlation between the state of oral health and systemic ailments, in the context of wanting to update the information already present in the literature. Thus, a special interest was given to diabetes, one of the most common ailments encountered in the general population, given the fact that the number of people with diabetes, worldwide, has doubled in the last three decades. The global prevalence of DM is rapidly rising because of population aging, urbanization and associated lifestyle changes [1].

Among the complications in the oral sphere of diabetes were reported: periodontal disease (the most important oral disease correlated with diabetes), xerostomia, oral candidiasis, glossodynia, slow healing of the tissues of the oral cavity, as well as other conditions for which it would be necessary to implement early prophylactic and therapeutic measures. Regarding periodontal disease, it is necessary for diabetic patients to be aware of the fact that maintaining oral health and good glycemic control contributes to reducing the progression of this disease. In this sense, both the dentist and the diabetologist must communicate effectively with the patient so that he understands the importance of prevention.

The chosen theme aims to better understand the effects of diabetes on the body, particularly in the oral cavity, with the objective of identifying ways to prevent periodontal disease and oral mucosal diseases and evaluating these methods. The research method employed in this paper is the systematic review. A synthesis of the most recent and relevant articles from the literature will be pursued.

Diabetes Mellitus (DM)

According to the IDF (International Diabets Federation), DM is a chronic condition that occurs when the pancreas is no longer able to produce insulin or when the body cannot properly use the insulin it produces [2]. In other words, diabetes is a metabolic disorder determined by multiple etiological factors. It is characterized by chronic hyperglycemia accompanied by disturbances in the metabolism of carbohydrates, fats and proteins resulting from defects in insulin secretion and/or reduced insulin sensitivity of some tissues [3]. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of pancreatic β-cells with consistent insulin deficiency to abnormalities leading to insulin resistance. Impaired insulin secretion and defects in insulin action frequently coexist in the same patient, and it is often unclear which, if any, abnormality is the primary cause of hyperglycemia [4].

Assigning a type of diabetes to an individual often depends on the circumstances present at the time of diagnosis, and many patients do not fit easily into a single class [4]. That is precisely why it is necessary to know the criteria on the basis of which a correct diagnosis can be made, as well as the types of DM. Over time there have been numerous attempts to classify DZ. In 1997, the American Diabetes Association (ADA) proposed a classification of DM. This was later taken over by the WHO in 1999 [5]. The most recent classification belongs to the ADA, in 2020 and is illustrated in table 1.

Table 1. DZ classification (ADA, 2020) [6]

Type 1 diabetes - due to autoimmune destruction of β-cells, which usually leads to absolute insulin deficiency
Type 2 diabetes -due to progressive loss of adequate insulin secretion by β-cells often in the setting of insulin resistance
Gestational diabetes - diagnosed during pregnancy, in the second or third trimester. Specific types produced by:

- genetic defects of beta cells.
- genetic defects of insulin action.
- diseases of the exocrine pancreas: pancreatitis, tumors, cystic fibrosis.
- endocrinopathies: hyperthyroidism, Cushing syndrome, aldosteronism, glucagonoma.
- induced by drugs or chemical substances: Dilantin, vacor, nicotinic acid, glucocorticoids, thyroid hormones, thiazides, alpha interferon, pentamidine.
- infections: congenital rubella, cytomegalic virus.
- rare autoimmune forms.
- genetic syndromes.

Type 1 diabetes, also called insulin-dependent diabetes, represents only 5-10% of all cases with this metabolic disorder. It is caused by cell-mediated autoimmune destruction of pancreatic β-cells, in which case the administration of exogenous insulin is mandatory [4].

Type 2 diabetes accounts for approximately 90% of all diabetes cases. This chronic condition is characterized by insulin resistance with relative insulin deficiency. (insulin is secreted, but not enough to overcome insulin resistance) [3]. In this condition, insulin is ineffective and is initially counteracted by an increase in insulin production to maintain glucose homeostasis, but over time, insulin secretion decreases, resulting in type 2 diabetes [7].

Diagnosing diabetes is particularly important because it influences the establishment of the appropriate treatment plan for each clinical case. If it is easier in symptomatic patients, in asymptomatic people once the test result is abnormal, it must be confirmed by an additional test. This is increasingly important as screening programs expand and also because 30-50% of people with diabetes are asymptomatic and do not know they have the disorder [3]. Complications of diabetes: Patients with diabetes have a high predisposition to a series of complications that constitute serious health problems [2]. High blood glucose levels can cause serious conditions such as cardiovascular diseases, neuropathy, retinopathy, nephropathy and complications in the oral cavity [10].

Oral complications of diabetes: Regarding the oral complications, they are the point of interest for the topic of this paper. The correlation between diabetes and oral diseases has been, in recent decades, an important topic for researchers given the increasing number of patients suffering from this metabolic disorder. In most studies, periodontal disease was highlighted as the most important oral complication of DM [10]. If blood glucose is not properly managed, there is an increased risk of inflammation of the gums (gingivitis) which can later evolve into periodontitis. Periodontitis is the main cause of tooth loss, being associated with an increased risk of cardiovascular disease. The prevention of this oral disease consists in performing regular dental consultation to ensure an early diagnosis, in the case of patients with previously undiagnosed diabetes, and also for the regular monitoring of any oral complications in people with diabetes [2]. Other potential oral complications described in the literature are: carious lesions, xerostomia, oral candidiasis, lesions of the oral mucosa, oral cancer, glossodynia, taste disturbances, delayed healing of oral lesions, apical periodontitis and peri-implantitis [10].

It should be mentioned that these changes are not always present, as they are not specific conditions nor pathognomonic for diabetes. In addition, they are unlikely to be seen in patients with well-controlled diabetes. Patients with controlled DM have a normal tissue response, a properly developed dentition with a reduced incidence of caries and a normal defense against infections [11].

Periodontal disease has been described as the sixth complication of diabetes, in addition to microvascular disease and macroangiopathy. Many factors, such as increased numbers of specific glucose-demanding bacteria, neutrophil dysfunction, inhibition of

collagen synthesis, adipokines and advanced glycation end products (AGEs) have been associated with higher susceptibility to periodontal disease in diabetic patients [12]. Diabetes has been recognized as a risk factor for periodontal disease since the beginning of 1990, the chances of developing this oral disease being 2-3 times higher in patients with poorly controlled diabetes compared to healthy ones [13]. Reduced defense mechanisms and increased susceptibility to infections were the major changes observed in patients with uncontrolled diabetes [11]. The severity of periodontal disease was closely correlated with the degree of metabolism, control and duration of diabetes. Pathogenic mechanisms that establish the link between diabetes and periodontal disease: Impairment of neutrophil adhesion, chemotaxis and phagocytosis, can facilitate the persistence of bacteria in the gingival groove thus causing significant periodontal damage. While neutrophils are often hypofunctional in diabetes, patients may have a hyper-responsive monocyte/macrophage phenotype, resulting in significantly increased production of cytokines and proinflammatory mediators. This hyper-inflammatory response results in high levels of pro-inflammatory cytokines in the crevicular fluid. Elevated levels of inflammatory mediators, including PGE2, IL-1β and TNF-ά in gingival exudates, are associated with increased severity of periodontal disease in patients with diabetes and AGE-enriched gingival tissue, who exhibit greater vascular permeability, greater breakdown of collagen fibers and an accelerated destruction of connective tissue and bone [14]. Studies have shown that chronic periodontitis can induce an increase in the systemic chronic inflammatory state, reflected in increased serum C-reactive protein, IL-6 and fibrinogen levels [14]. The increased level of C-reactive protein (hsCRP) may be a stronger predictor of acute myocardial infarction than cholesterol, being an important index in the accurate assessment of cardiovascular disease risk [15].

Gingivitis is inflammation of the gingival tissues without loss of attachment or bone. Being the first stage of periodontal disease, gingivitis can also be influenced by systemic factors, one of them being diabetes. In many cases, the clear signs of gingival inflammation that occur in these patients are seen in the presence of relatively small amounts of bacterial plaque. Therefore, the long-term prognosis for these patients depends not only on the control of the bacterial plaque, but also on the control or correction of the systemic factor [11].

Periodontitis represents the inflammatory disease of the periodontal tissues, being caused by the presence of microorganisms or specific groups of microorganisms, resulting in the progressive destruction of the periodontal ligament and the alveolar bone accompanied by an increase in probing depth and the appearance of gingival recession [11]. In patients with type 1 diabetes, periodontitis begins after the age of 12, and is five times more common in adolescents than in children. Thus, in patients aged between 13-18 years, the percentage is 9.8% and increases to 39% in those older than 19 years [11]. The level of glycemic control is essential in determining the risk of periodontitis in DM patients.

Similar to the other complications of diabetes, the risk increases with poor glycemic control. Evidence has emerged to support a bidirectional relationship between diabetes and periodontitis; that is, diabetes increases the risk of periodontitis, and periodontitis increases the risk of complications of diabetes and makes glycemic control more difficult. Furthermore, it has been found that there is a possibility to improve glycemic control by treating periodontitis [13]. In diabetic patients, glycemic control is complicated by the constant reservoir of gram-negative anaerobic bacteria that are located deep in the gingival sulcus producing infection and inflammation throughout the body. An important aspect of the link between periodontal disease and DM is the fact that chronic periodontitis causes systemic inflammation, which results in increased insulin resistance and hyperglycemia.

Because patients with DM, especially those with poor glycemic control, accumulate high levels of AGEs in tissues, including the periodontium, this interaction may account for the marked increase in crevicular fluid levels of IL-1β and TNF observed in patients with

diabetes compared to those without diabetes and may contribute to the increased prevalence and severity of periodontal disease in diabetics [14]. It should be mentioned that the sites affected by periodontitis in diabetic patients contain the same bacterial species as the sites affected in patients without metabolic disorders. The similar composition of the subgingival flora could indicate that the increased prevalence and severity of periodontitis in DM patients is influenced by the host response [14]. Periodontal treatment aimed at eliminating periodontal pathogens and reducing inflammation has been shown to have a positive impact on glycemic control by restoring insulin sensitivity in patients with poorly controlled diabetes. Also, an effective control of periodontal infection in patients with diabetes can reduce the level of AGEs in the serum. Thus, it can be concluded that the prevention and control of periodontal disease should be considered an integral part of diabetes [14].

Xerostomia: Patients with diabetes, especially those with poor glycemic control, can present, as an oral complication, damage to the salivary glands. This complication manifests itself clinically through reduced salivary secretion thus causing xerostomia with an impact on hard and soft oral tissues [16]. Xerostomia is the subjective sensation of dryness of the mouth, this definition being based on the absence or presence of the individual sensation of dry mouth and not on precise measurements of saliva flow. Compared to xerostomia, hyposalivation is an objective decrease in salivary flow [17,18]. Both type 1 DM and type 2 DM have been associated with xerostomia. A series of studies have highlighted a decrease in salivary flow in diabetic patients compared to clinically healthy patients. Changes in the microcirculation of the salivary glands, damage to the gland parenchyma, dehydration and disturbances in glycemic control could be some causes of low salivary flow [17]. The consequences of xerostomia on the oral cavity are: disturbance of masticatory function and speech, inflammation of the oral mucosa, accumulation of bacterial plaque, decrease in the buffering capacity of saliva, fungal infections (Candida Albicans) and, last but not least, severe degradation of oral tissues [18].

Glossodynia and taste disorders: Glossodynia or Burning Mouth Syndrome is an oral complication found in patients with DM and not only, being described as an oral burning sensation lasting at least 4-6 months. Most commonly involving the tongue, sometimes it can also extend to the lips or in certain areas of the oral mucosa. It can be accompanied by dysgeusia (taste alteration) and subjective xerostomia (dry mouth) [19]. In patients with diabetes, burning sensation in the mouth has been attributed to poor glycemic control, metabolic changes in the oral mucosa, angiopathy and neuropathy. Thus, it is believed that a good control of the metabolism could lead to amelioration of symptoms. According to studies, the correlation between diabetes and glossodynia has been considered quite controversial. It has been suggested that type 2 diabetes plays a role in the development of BMS (Burning Mouth Syndrome). In contrast, other studies reported a lack of association between these two conditions [20].

Oral candidiasis: The correlation between candidiasis and diabetes has been much studied over time, especially due to the increased susceptibility of diabetic patients to fungal infections compared to those without DM [21,22]. Oral candidiasis is an opportunistic, common infection of the oral cavity caused by the overgrowth of Candida species, particularly Candida albicans. Numerous risk factors such as poor oral hygiene, tongue lesions, sex, age, smoking, unbalanced diet, salivary pH disturbance, xerostomia and wearing dental prostheses contribute to the occurrence of oral candidiasis in patients with diabetes [21,22]. In the last decade, the large number of immunocompromised patients has led to an increase in the prevalence of oral candidiasis, which is one of the most common fungal infections. The diagnosis of oral candidiasis is based on changes in the oral mucosa in the form of erythematous, pseudomembranous (oral thrush) or hyperplastic plaques [21,22]. The dorsal surface of the tongue is the point of initiation of infection for most clinical forms of oral

candidiasis [23]. Among the reasons why diabetic patients are more susceptible to oral candidiasis are high salivary glucose levels, reduced salivary flow, impaired chemotaxis and defective phagocytosis due to the deficiency of polymorphonuclear leukocytes [21]. Oral manifestations of oral candidiasis can generally be classified into three main categories, namely: acute manifestations, chronic manifestations, and chronic mucocutaneous candidiasis syndromes [23].

Stomatitis, glossitis and angular cheilitis. Denture-induced stomatitis is mainly observed in ill-fitting full denture wearers, with diabetes being a systemic contributing factor. The clinical manifestations are represented by erythema, edema, decubitus lesions, with deposits of Candida albicans present on the oral mucosa. Median rhomboidal glossitis represents the chronic inflammation of the tongue manifested by the atrophy of the filiform papillae located on the midline of the lingual dorsal surface. It appears as a well-defined, symmetrical, rhomboid-shaped area, red in color, with a smooth and shiny appearance. Angular cheilitis can be seen at the level of the oral commissures as an erythematous lesion. The lesion has been reported to occur in diabetic patients with poor glycemic control [24].

Lesions with malignancy potential, premalignant oral lesions and oral cancer.

Oral **lichen planus** is a chronic inflammatory disease with a higher incidence among women than men. The prevalence of this potentially malignant lesion in the general population varies from 1% to 2% [25]. The relationship between oral lichen planus and diabetes was first described in 1966, and since then numerous epidemiological studies have demonstrated this association. It has been highlighted that endocrine dysfunction in DM patients can be a determining factor of immunological changes. These changes contribute to the development of oral lichen planus [26]. According to studies, oral lichen planus occurs more frequently in patients with type 1 diabetes compared to patients with type 2 diabetes. The argument is that type 1 diabetes is considered an autoimmune disease, and oral lichen planus is based on a whole mechanism autoimmune In addition, acute hyperglycemia alters the immune response. Atrophic-erosive forms of oral lichen planus are the most common in patients with diabetes [24].

Leukoplasia is the most common premalignant lesion of the oral mucosa. The WHO defined it as a white spot or plaque that cannot be removed by wiping and that cannot be classified under any other pathology. The etiology of this lesion is not very clearly established, however, there are certain risk factors such as: smoking, HPV-16 and HPV-18, Candida albicans or certain localized traumas. Most leucoplakias (80%) are benign; the remaining 20% are malignant or premalignant and only 3% of these progress to carcinoma [11].

Patients with DM have a higher risk of developing oral cancer compared to subjects without DM [10]. Oral cancer which is a subtype of head and neck cancer and is defined as any cancerous tissue with localized development in the oral cavity. Except for the already known risk factors (smoking, alcohol and infection with the oncogenic human papillomavirus (HPV)), certain studies have shown that glucose metabolism abnormalities and diabetes can also have an influence on the development of neoplasia's. In conclusion, if DM is associated with an increased risk of oral cancer, it is very important to focus on prevention [27].

Aim and objectives

The purpose of this paper is to identify, through a systematic review, the methods of preventing periodontal disease and oral mucosal diseases, the evaluation of the effectiveness of these methods, as well as the evaluation of the level of information of both patients and diabetes specialists regarding the prevention of these oral complications in diabetic patients.

MATERIAL AND METHODS

This systematic literature review was conducted to answer the following questions:

The primary question:

What are the ways to prevent periodontal disease and oral mucosal diseases in DM patients?

Secondary questions:

- How were these methods evaluated in the studies included in the research?
- What is the level of knowledge of both patients and diabetologists regarding the prevention of these oral complications in diabetic patients?

Given the fact that numerous relevant articles were found for this study, it was decided to perform a systematic review in order to find answers to the questions formulated above.

The review followed a clear protocol, detailed in the article by Shamseer L. et al (2015) entitled "Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation" [28].

Search strategy for bibliographic sources

For the systematic search of the scientific literature, the following electronic databases were used: ScienceDirect, PubMed, Google Scholar and SpringerLink. Initially, a search was performed in the PubMed database applying the search terms "diabetes mellitus", "prevention of oral manifestations", "prevention of periodontal disease", "gingivitis", "gingival bleeding". With the help of the "Publication Date" filter, the 10 years option was chosen, in the search result only studies from the last 10 years (published between 2011 and 2021) are present.

Another search was then performed using the Google Scholar database. Combinations of keywords such as: "awareness", "diabetic patients", "periodontal therapy", "oral mucosal diseases", "xerostomia", "oral candidiasis", "taste disturbance", "oral cancer" or "burning mouth syndrome" were used to ensure a more objective and comprehensive search. Studies published since 2011 were selected.

Other scientific articles were identified through the Science Direct and SpringerLink databases using the same search terms. Also, some studies were obtained from the reference lists of review articles. The keywords used were identified following a random literature search.

Criteria for selecting scientific articles.

The selection of specialized articles was made based on the inclusion and exclusion criteria. The studies included in this paper met the following criteria: (1) studies published between 2011 and 2021 in scientific journals, (2) studies conducted on more than 20 subjects with diabetes diagnosed at least 6 months before, (3) age of participants over 14 years, (4) participants with DM type 1 or 2, (4) studies evaluating the level of knowledge of medical specialists regarding the oral complications of DM. Studies older than 10 years, animal studies, in vitro studies, studies performed on less than 20 patients, studies on pregnant women or patients with uncontrolled systemic diseases or mental illnesses were excluded.

Data collection. 436 bibliographic references were identified and were centralized in a file. The studies were evaluated according to their title and abstract, following the extent to which they correspond to the inclusion criteria. After analyzing the titles, 351 articles were excluded and the remaining 86 had their abstracts evaluated. 25 articles were selected and read in full, two of which were excluded because they proved not to be relevant to the chosen topic. Thus, finally, 23 studies were included in the systematic review. The graphical representation of the data collection protocol was illustrated in Fig. 1

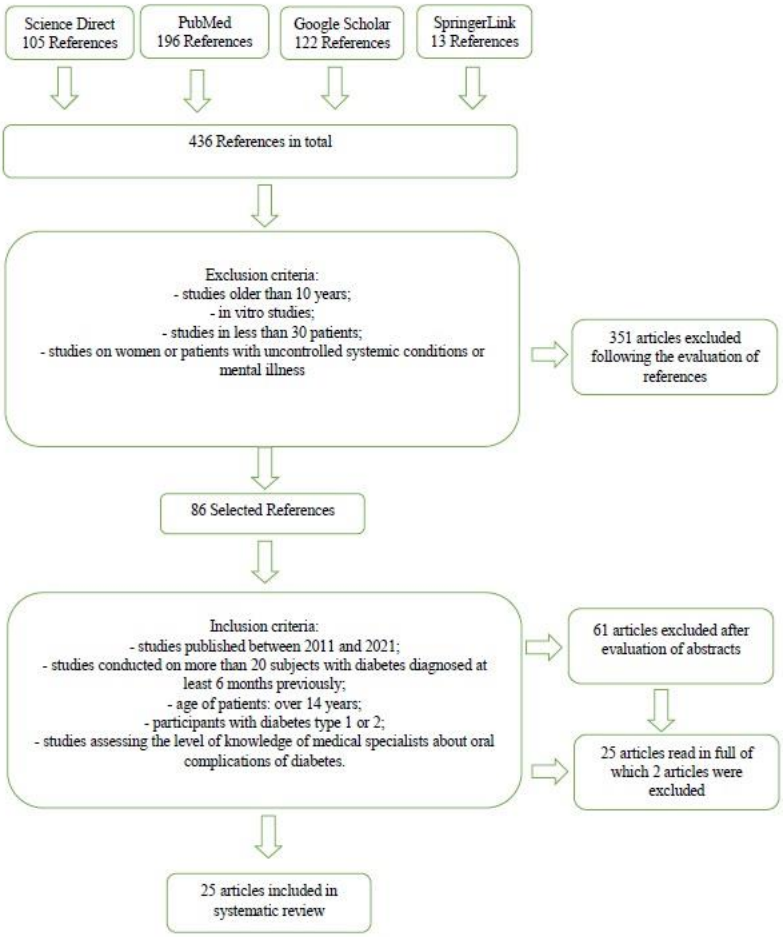

Figure 1. Data collection protocol

Data analysis: After analyzing the data from the 23 selected articles, we obtained the following results.

RESULTS

Following the selection of studies based on the inclusion and exclusion criteria, 23 articles resulted that were analyzed in the systematic review. Of these, 74% were cross-sectional studies, 8.7% randomized clinical trials and 17.3% in vivo experimental studies. The articles were published in English. A large part of the studies (60.8%) was carried out in Asian countries, 19.6% in Europe, 15.3% in America and 4.3% in Africa. Two studies were conducted among family doctors [46] and endocrinologists and diabetologists [44].

In 66% of the articles, the participants were selected from the Diabetes Centers or from the Departments of Diabetes, Nutrition and Metabolic Diseases of the Regional Hospitals, and in 34% of the articles, the participants were in the records of the Periodontology Departments of the Universities.

Regarding the type of DM of the participants, in 36.7% of the studies patients with type 1 and 2 diabetes were included, in 4.3% only DM, type 1 and in 59% only DM, type 2. In two studies [15,22] patients had uncontrolled diabetes.

Fourteen (14) studies were conducted based on a questionnaire. Of these 8 studies [29,30, 40, 42,43,45,49,50] aimed to evaluate the level of knowledge of diabetic patients regarding periodontal disease and other oral complications. Two (2) studies [31, 39] focused

strictly on the changes occurring in the oral mucosa, 2 studies [32, 38] addressed xerostomia and 2 studies [44, 46] evaluated the attitude of family doctors and diabetologists towards oral health of diabetic patients. The rest of the studies [33,34,35,36,37,41,47,48,51] were based on different specific therapies for periodontal disease and for the other oral complications of DM.

Assessment of patients' knowledge level: Many patients with DM were not aware of the bidirectional relationship between DM and periodontal disease [30, 40,43]. However, Al Amassi B. Y. et al, 2017 highlighted in his study that 75.9% of participants knew that diabetes is an important risk factor in the onset of periodontal disease [42]. Regarding the signs of gingival diseases, bleeding during brushing and gingival inflammation were frequently mentioned by patients [29,30].

Xerostomia was one of the most recognized oral complications of DM. In the study conducted by Kakooei S. et al, 2020 on a sample of 433 diabetic patients from Iran, 90% of them mentioned xerostomia as one of the main oral complications of diabetes [50]. Similar results were obtained in the studies of Bowyer V. et al, 2011 [30] and Çankaya H. et al, 2018 [45].

Regarding visits to the dentist, in the study conducted by Bahammam M. A., 2015, only 12.6% of patients went to the dentist in the last year, although 80.2% went to the diabetologist in that year [40]. Similar results were obtained in other studies included in the systematic review [29,42,43]. The participants came to the dental office only if they had a problem.

Regarding oral hygiene, the results of the studies were divided. In a limited number of studies [30,43,50], more than 50% of the participants answered that they brush their teeth twice a day, and regarding the use of dental floss and mouthwash, the percentage was in average below 20% in most items.

Evaluation of the level of knowledge of health professionals

In the study conducted by Obulareddy V. T. et al, 2018, all participants (specialists in endocrinology, general medicine and diabetology) agreed that there is a correlation between oral health and general health, but only 43.2% were aware of the relationship bidirectional, and the remaining 56.4% reported diabetes as a risk factor for periodontitis. However, only 17.8% of participants refer patients to dentists. Almost 90% of the practitioners showed their willingness to enrich their knowledge regarding the prevention of oral complications in diabetic patients [44].

Sut Yee Tse, 2018 [46] conducted a study including family physicians in Hong Kong. The results of the study showed that 99% of the participants were aware of the relationship between DM and periodontal disease. 90% of the participants knew that poor DM control can be a predisposing factor for periodontal disease, but only 76% knew that there is a bidirectional relationship between the two conditions. Only 2/3 of the participants knew the effect of periodontal treatment on DM.

5.7% of the doctors were interested in the dental history of the patients, 7.1% examined their oral cavity and 12.1% recommended them to go to a regular dental consultation. Among those who recommended their patients to go to the dentist, only 38.6% referred them to the periodontist [46].

Results of specific therapies for periodontal disease and oral mucosal diseases in DM patients. Regarding the therapies used in periodontal disease, the study by Chandra S. et al, 2019 in which diabetic patients with chronic periodontitis were divided into two groups (group A (control): only SRP and group B (test): SRP followed by the application of the dental diode laser) highlighted the improvement of clinical, microbiological and glycemic parameters in both group A and group B. [48].

Favorable results were also obtained in the study conducted by Preshaw P.M. et al, 2020 where periodontal treatment resulted in significant improvements in clinical status and

reductions in crevicular fluid biomarkers from baseline to 12 months. There was a greater reduction in systemic inflammation after periodontal treatment in patients with diabetes and periodontitis compared to those with periodontitis but no DM [51].

Regarding xerostomia, Malickaa B. et al, 2014 observed on the basis of the study that the sensation of dry mouth was diagnosed much more frequently in type 1 diabetics than in patients in the control group [38]. Similar results were obtained and, in the study, conducted by Saes Busato I.M. et al, 2012[32]. On the other hand, Dalodom S. et al, 2016 highlighted the beneficial effects of moisturizing oral jelly in reducing xerostomia symptoms [41].

As for the presence of changes in the oral mucosa in DM patients, in the study conducted by Alves Silva M. F. et al, 2015, the prevalence of oral lesions was 78.4%. Traumatic ulcers and actinic cheilitis were the most common lesions, with the lips and tongue being the most frequent locations [39]. Also, the results of the study conducted by Bastos A.S. et al, 2011 highlighted that there was a higher prevalence of oral mucosal changes in patients with DM, especially regarding potentially malignant lesions and fungal infections [31].

DISCUSSIONS

The progressive increase rate of diabetes among patients is not only due to genetic factors, but also to environmental factors as a result of an unbalanced lifestyle [29]. The results of this systematic review confirm previous evidence supporting the bidirectional relationship between periodontal status and glycemic control of diabetes and reinforce the idea that successful periodontal treatment can improve glucose metabolism [34,48,51]. In this sense, it has been proven that periodontal health can be restored through different types of surgical or non-surgical therapies (SRP), associated or not with antibiotics, the result of which led to the reduction of probing depths and HbA1c values [33 ,34,36].

The interdisciplinary collaboration between the diabetologist and the dentist is essential because it contributes to the general good condition of the patient. It is important for healthcare professionals to have knowledge about the oral complications of DM in order to provide preventive information to patients. Normally, they should have an important role in diagnosing and referring patients to the dentist [44].

In the studies included in this paper, a very small percentage of participants received oral health advice from a health professional [29,30,40]. The sources of information were mostly TV and the Internet. However, in the study conducted by Bowyer V. et al, 2011, only 30.2% of respondents stated that they had discussed diabetes with their dentist.

Diabetic patients do not have sufficient knowledge about the oral complications of DM and, regarding oral hygiene, it has not been categorized as an important personal care task [30]. Patients' knowledge of oral health in relation to diabetes was also associated with time since diagnosis. Thus, those who had DM for several years were more informed than those who had not received the diagnosis for a long time [35,40, 43, 45]. On the other hand, patients with uncontrolled DM were not concerned about their oral health [50].

Participants who had not been diagnosed with periodontal disease in the past had less knowledge about the correlation between periodontal disease and diabetes and how to prevent this oral complication. Also, they did not attend regular check-ups at the dentist [49].

The limitations of the systematic review assumed the fact that most of the studies were carried out only in certain medical units and regarding risk factors such as smoking, alcohol consumption or the administration of certain drugs, many studies did not mention their presence or absence.

CONCLUSIONS

The review concludes that diabetes significantly impacts all body tissues, including those in the oral cavity. Diabetic patients generally have less knowledge about the oral complications of diabetes compared to other systemic complications. To address this, interdisciplinary collaboration between health specialists, dentists, and diabetologists is essential for developing educational programs about these oral complications and their prevention. Maintaining oral hygiene and regular dental consultations are crucial for preventing periodontal disease and diseases of the oral mucosa. Additionally, there is a bidirectional relationship between diabetes mellitus (DM) and periodontal disease, where periodontal treatment can help reduce biomarkers in crevicular fluid and HbA1c values, thereby improving glucose metabolism.

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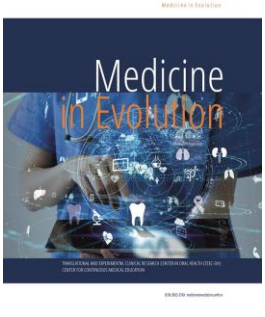
The aesthetic impact of black stains in paediatric patients - a study of chemical and microbiological composition



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Received: 19 April 2024; Accepted: 3 June 2024; Published: 30 June 2024

Abstract

The present study aims to present the clinical implications of black stains but also their microbiological and chemical components. The study involved three paediatric patients divided into two groups on which samples were taken and through specific tests the presence of extrinsic chromogenic bacteria as well as metals and sulfuric components was demonstrated. The microbiological and chemical evaluation provides additional information that can be used by clinicians to improve the treatment protocol by knowing the bacteria involved and their specifics.

Keywords: chromogenic bacteria, paediatric dentistry, microbiology, chemical composition

INTRODUCTION

By way of life, the vast majority of chromogenic bacteria are saprophytic, but some have the ability to cause putrefaction and fermentation, being therefore not only chromogenic, but at the same time saprogenic.

It is known that chromogenic bacteria cells are completely colorless, but pigments appear and accumulate outside the cells, alongside them, deposited in the form of small droplets, grains or even crystals that dissolve and diffuse into the environment, coloring it for a considerable length [1].

BS (black stain) are caused by anaerobic chromogenic bacteria. The species predominantly responsible for these are actinomyces spp. (Gram-positive: Actynomyces israelii, Actynomyces naeslundii, which produce hydrogen), very rarely, Porphyromonas (Gram-negative) and Prévotella melaninogénica (Gram-negative).

After years of observation, epidemiological studies in the 1950s and subsequent decades showed an association between black spots (BS) on permanent teeth and a decrease in dental caries [2], as this staining is thought to unbalance the microbial flora, thus reducing the number of cariogenic bacteria, and increases the number of chromogenic bacteria responsible for tooth pigmentation. They affect both temporary and permanent dentition. These discolorations often begin in early childhood and peak by puberty or adolescence, and can be seen even in young adults [2].

From an aesthetic point of view, dental staining caused by chromogenic bacteria belongs to an extrinsic staining, which is deposited on the surface of the teeth and does not involve the internal structure of the tooth, found predominantly at the cervical level of the enamel and follows the gingival contour and can also form on all surfaces of the tooth (vestibular, oral, proximal and incisal/occlusal). BS may appear either as dark lines with 1 mm margins parallel to the gingival margin, as incomplete coalescence, or in the form of dark spots that rarely extend above the cervical third, and appear especially in the primary dentition. Sometimes it can also appear in the grooves or pits of the teeth. This brownish-black coloration is very adherent to the tooth and has a high chance of recurrence [3].

Aim and objectives

This study aims to identify the chromogenic bacteria potentially involved in tooth staining and to stop their growth and biofilm formation capacity, with the help of different non-toxic and easily available compounds, without unwanted side effects and financial constraints, to find both preventive methods as well as curative, and to apprehend the consequences of their presence in the oral cavity.

The microbiological and chemical evaluation provides additional information that can be used by clinicians to improve the treatment protocol by knowing the bacteria involved and their specifics.

MATERIAL AND METHODS

The research protocol provides a sample of two subjects that present the colourings (study group) and one subject that does not present the colourings (control group). Three children between the ages of 2 and a half and 12 years were selected, of which, two female subjects and one male subject, all living in Timiș county, of Romanian nationality, patients from the Department of Paediatric Dentistry, suffering from BS.

The criteria for including patients in the study are:

✓ Patients with oral manifestations of chromogenic staining

✓ Patients aged between 2.5 and 18 years

✓ Patients who have not benefited from professional dental cleaning in the last 6 months

✓ Clinically healthy patients

✓ Patients who do not have dental anomalies of number, shape and volume, MIH, amelogenesis imperfecta, dentinogenesis imperfecta, as well as other oro-dental anomalies.

✓ Patients regardless of their background.

Three patients were selected:

1. Male patient aged 9 years, part of the study group.
2. Female patient aged 12 years, part of the study group.
3. Female patient aged 6 years, in the control group, the last two being sisters.

1. BACTERIOLOGICAL TEST

Two of the three subjects were selected for bacteriological testing, patient number 2, aged 12 years, BS positive (+), and patient number 3, aged 6 years, BS negative (-). The analysis was performed by approaching the traditional method of growth and identification of oral microorganisms, by growing a bacterial culture.

Samples were collected with a sterile ESwab™ swab from COPAN, which is a patented liquid-based collection and transport system for microbiology samples.

The collection was carried out by circular tamping movements, strictly on the hard surfaces of the teeth (vestibular, palatal, lingual), without touching other surfaces or objects, in order not to compromise the results obtained (Fig.1). After collecting the samples, the sterile swab was immediately immersed in the plastic tube, and kept at room temperature at 21°, for ~12 hours from the time of collection, until they were handed over to the accredited laboratory for processing the microbiological samples.

Figure 1. Sample collection from the BS positive (+) patient with the sterile swab from the eSwab™ system on the vestibular surface of the lower and upper teeth

2. COLLECTION OF SAMPLES FOR QUANTITATIVE AND QUALITATIVE CHEMICAL ANALYSIS OF COLORED DEPOSITS

Black spot samples were scraped using a sterile scalpel port and a 12D type blade. After scraping, from the areas where the coloured deposits were more abundant, and more precisely from the level of the lingual surface of the lower incisors, of the lingual surface of the lower premolars, and from the level of the mesial and vestibular surfaces of the upper first permanent molars (1.6 and 2.6), an amount of about 1-2 mg of coloured deposit was obtained (Fig. 2). Before scraping, the tooth surface was first cleaned and then wiped with a sterile gauze soaked in physiological solution.

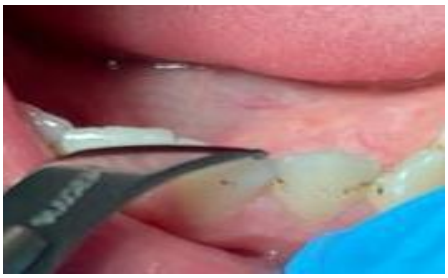


Figure 2. The colored deposits that can be seen on the tip of the 12D blade, resulting from their scraping

Dental plaque was collected along with black stain (BS) and then the blade was detached and placed it in a suitable 12x100mm transparent glass transport medium, from the GLASSCO company.

The collected sample was treated with concentrated HCl (concentration 37%) in order to solubilize the salts of the species of interest. When adding the reagent, the obtained solution turned yellow, indicating the possible presence of ferric ion salts (Fe3+) which in aqueous solution causes the formation of a yellow coloration (Fig. 3).

Figure 3. Solubilization of the collected sample in concentrated HCl (37%)

All ionic species identification reactions were performed from a qualitative perspective, using approximate reagent volumes ranging from 0.5 to 10 mL. In order to be able to confirm with certainty the presence of the ferric cation, two identification reactions were carried out, both of which were positive.

✓ First reaction: in the presence of potassium ferrocyanide (potassium hexacyanoferrite) K4[Fe(CN)6] of 0.1M concentration, the Fe3+ ion precipitates in acidic medium, ferric ferrocyanide or ferric hexacyanoferrite, also called Berlin blue or Prussian blue (reaction 1, Fig. 4).

$4\ Fe3{+}{+}\ 3\ \boldsymbol{K{+}14[Fe{+}2(CN{-}1)6]} \rightarrow Fe{+}\mathbf{3}4[Fe{+}\mathbf{2}(CN{-}1)6]3\downarrow{+}\ 12\ K{+}$ (Reaction 1)

Figure 4. Identification reaction of Fe3+ ion in the presence of potassium ferrocyanide on the well plate

✓ Second reaction: identification involved the use of ammonium sulfocyanide NH4SCN. In the presence of the sulfocyanide anion, the ferric cation forms a reddish color

due to the formation of the complex ion hexasulfocyanoferrate (III) (reaction 2, Fig. 5). The reaction shows a high sensitivity, and the intensity of the color is influenced by the concentration of the analytical species, the orange-reddish coloration obtained upon the addition of ammonium sulfocyanide of concentration 0.1 M indicating the presence of Fe3+ ions in relatively low concentration. At high concentrations, the colour of the sample becomes blood-red.

$Fe3+ + 6\ \boldsymbol{NH4SCN} \rightarrow K+13[Fe+3(SCN-1)6] + 3\ NH4+$ (Reaction 2)

Figure 5. Identification reaction of Fe3+ ion in the presence of ammonium sulfocyanide on the well plate

The analysis of the ferrous cation (Fe2+) also confirmed its presence, two distinct identification methods being used during the experiment.

✓ The first involves the use of potassium ferricyanide (potassium hexacyanoferrate) K3[Fe(CN)6] of 0.1 M concentration as a specific reagent. In its presence, the ferrous cations in the sample precipitate, in an acidic medium, the blue-green ferrous ferricyanide, the ferrous hexacyanoferrate, also known as Turnbull blue (Reaction 3, Fig. 6).

$3\ Fe2++ 2\ \boldsymbol{K+13[Fe+3(CN-1)6]} \rightarrow Fe+23[Fe+3(CN-1)6]2\downarrow + 6\ K+$ (Reaction 3)

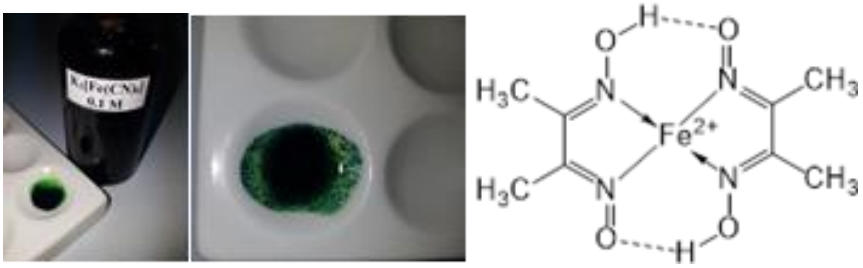
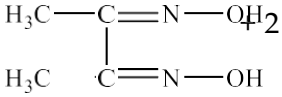


Figure 6. Identification reaction of Fe2+ ion in the presence of potassium ferricyanide on the well plate

✓ The second reaction to identify the ferrous ion was carried out by using a 1% ethanolic solution of dimethylglyoxime (DMG) which, in a basic environment provided with a NH3 2N ammonia solution, causes the formation of a red-carmine color, due to the formation of a complex combination, ferrous dimethylglyoximate (Reaction 4, Fig. 7)

Fe_{2+} + 2  + 2 $NH_3 \rightarrow$ $\downarrow$ + 2 NH_{4+}

(Reaction 4)

Figure 7. Fe2+ ion identification reaction in the presence of dimethylglyoxime on the well plate

The presence of calcium ions (Ca2+) was identified using ammonium oxalate as a specific reagent (concentration 0.1 M) after neutralizing the sample with 2 N NaOH and bringing it to pH 7 (value checked using pH indicator paper). In the presence of ammonium oxalate ((NH4)2C2O4), Ca2+ ions form a white, crystalline precipitate, calcium oxalate (Reaction 5) which in the yellow sample is visible with a yellowish coloration (Fig. 8).

$Ca2+ + (NH4)2C2O4 \rightarrow CaC2O4 \downarrow +2\ NH+$ (Reaction 5)

Figure 8. Ca2+ ion identification reaction in the presence of ammonium oxalate

The presence of Cu2+ ions (cupric cation) could not be identified in the sample solubilized with either of the two tested reagents (ammonia NH3 and ammonium tetrasulfocyanomercurate (NH4)2[Hg(SCN)4]), most likely due to the pH- of the strong acid of the sample obtained during solubilization, even after attempts to neutralize it.

The presence of the phosphate anion (PO43-) was also impossible to detect (silver nitrate AgNO3, barium chloride BaCl2 and ferric chloride FeCl3 were tested as reagents) due to the same pH considerations, since all potential reaction products are solubilized with ease in the acidic medium generated by the HCl used to solubilize the sample.

Instead, the presence of sulfur in the form of sulfate ion (SO42-) and sulfite (SO 2-) could be detected. Thus, in the presence of silver nitrate AgNO (0.1 M), sulfite ions precipitate in neutral solution, with the formation of silver sulfite, a white, crystalline precipitate (Reaction 6, Fig. 9). The neutral solution was obtained after adding 2 N NaOH until reaching pH 7 checked with pH indicator paper.

$SO23- + 2\ AgNO3 \rightarrow Ag2SO3 \downarrow +2\ NO3-$ (Reaction 6)

Figure 9. Identification reaction of the SO32- anion in the presence of silver nitrate

The sulfate anion (SO42-) was identified following the reaction with barium chloride (BaCl2) of 0.5 M concentration. In the presence of the reagent, the sulfate anion reacts with the formation of a blue-white, crystalline precipitate, barium sulfate, visible at the optical microscope in the form of prismatic crystals (reaction 7, Fig. 10).

$SO2- + BaCl2 \rightarrow BaSO4 \downarrow +2\ Cl-$ (Reaction 7)

Figure 10. Crystallographic identification reaction of the SO42- anion in the presence of barium chloride performed on a glass slide and evaluated with a Nikon E100 optical microscope (10x objective)

RESULTS

1. BACTERIOLOGIC RESULTS

Following the bacteriological examinations, the analysis bulletin was drawn up, in which Neisseria sicca, having as its natural habitat the upper respiratory tract, considered a commensal species of the oral cavity, was found to be present in the processed samples from patient number 2, aged 12 years, BS positive (+) patient. The sample taken from patient number 1 aged 6 years BS negative (-) confirmed the absence of Neisseria sicca (Fig.11).


Adresa:
Id proba: 16977870
Cod proba: 316977870
16977870
Denumire
MICROBIOLOGIE
EXAMEN ALTE PRODUSE BIOLOGICE (MICROSCOPIC, B
Rezultat:
Streptococcus spp. - Absent
Staphylococcus aureus - Absent
Enterobacteriaceae – Absent
Enterococcus spp. – Absent
Pseudomonas spp. - Absent
Acinetobacter baumannii – Absent
Neisseria sicca - Prezent
Candida spp. – Absent
produs biologic specific, metoda culturilor bacteriene pe medii selective,
ANTIBIOGRAMA NEISSERIA SICCA
Ampicilina - rezistent
Amoxicilina - rezistent
Amoxicilina + acid clavulanic - sensibil
Tetraciclina - rezistent
Eritromicina - sensibil
Ciprofloxacina - rezistent
Colistin - sensibil
Adresa:
Id proba: 16977863
Cod proba: 316977863
16977863
Denumire
MICROBIOLOGIE
EXAMEN ALTE PRODUSE BIOLOGICE (MICROSCOPIC, BA
Rezultat:
Streptococcus spp. - Absent
Staphylococcus aureus - Absent
Enterobacteriaceae – Absent
Enterococcus spp. - Absent
Pseudomonas spp. - Absent
Acinetobacter baumannii - Absent
Candida spp. - Absent
produs biologic specific, metoda culturilor bacteriene pe medii selective,

Figure 11. The analysis report

2. CHEMICAL COMPOSITION RESULTS

Following chemical analysis, the deposits proved to be strongly acidic and difficult to dissolve. However, the presence of ferric ion (Fe3+), ferrous cation (Fe2+), calcium ions (Ca2+), sulphur in the form of sulphate ion (SO42-) and sulphite (SO32-) was identified in the deposits.

Clinical implications of the identified chemical substances:

- their strong stability and increased insolubility explain the very high adhesion to dental surfaces and the persistence of black stains including airflow procedures

- the inorganic chemical composition indicates the presence of numerous strongly acidic ions

- the presence of ferric ion (Fe3+) and ferrous cation (Fe2+) was proven in the sampled deposits, which suggests a clear involvement of the gingival bleeding index and the ferric component in the blood with the deposition and extension of the stains, also the characteristic colour of the stains, may be directly related to the presence of ferric ion and ferrous cation in the blood and in the collected samples.

- the presence of calcium ions (Ca2+) is attributed to explaining the fact of adhesion to the dental structures and the impermeable structure of the stains

- sulphur, which is an essential ingredient in bone minerals, favouring balance between them, again being found considerably in all the mineralized structures in the body as well as in the deposits taken from the teeth.

DISCUSSIONS

The results of some studies suggest that black deposits are iron deposits formed as a result of the chemical interaction on the surface of the teeth between the hydrogen sulphide formed by the action of anaerobic bacteria and the iron contained in saliva. The proportions of hydrogen can vary from one individual to another. Iron is contained in the saliva of people with a normal diet or is released from red blood cells during gingivorrhea [2]. Epidemiological studies by REID et al. in 1976 and 1977 compared to those of THEILADE et al. since 1973, confirmed that BS is a form of dental plaque, characterized by flora with a tendency to calcify. It contains an insoluble iron salt, and a high content of inorganic phosphorus and calcium [2].

According to articles published between 2001 and 2014, the prevalence of BS varies from 2.4% to 18% with equal gender distribution. Most confirm the correlation between the presence of BS and the lower cariogenic activity in the oral cavity, and at the same time mention Actinomyces spp., as being directly involved in the mechanism of the appearance of BS. [4].

Theliade et al. demonstrated that BS is a dental deposit, formed by microorganisms embedded in an intermicrobial substance, with a tendency to calcify [5]. Thus, it can be considered a type of dental plaque, although it is composed of other types of bacteria. Comparing unstained plaque and BS, the former contains a lower number of potentially cariogenic bacteria [4].

At the BS level, the presence of gram-positive, anaerobic and facultative anaerobic bacteria is mainly reported [4].

Different studies mainly mark the direct involvement of actinomyces spp. [5,6] - gram positive, anaerobic bacteria, with a diameter of 0.2 - 1.0 micron, being the largest morphological group found at the level of black spots, the latter being different from other bacteria by its ability to form a well-developed mycelium. For example, in the study by C. SABA et al. [7] Actinomyces spp. could be involved because its presence was demonstrated in

5 out of 10 patients with specific black deposits (50%) and in only 2 out of 10 control patients (20%).

Another study carried out by SLOTS, found that the predominant microorganisms in the formation of BS are actinomyces [8]. Also, the research done by Reid et al. is consistent with that of Theilade et al., which confirmed the involvement of actinomyces species in the formation of BS [5].

The most recent PCR study found, confirmed this, Actinomyces naeslundii is more prevalent in patients with BS, Instead Lactobacillus spp. and Fusobacterium nucleatum can be found in greater numbers in subjects without dark spots [9].

A relevant study on the chemical composition of BS was carried out by Parnas et al. He took samples from two groups of patients: from study group A, samples were taken with metallic instruments, while from study group B, samples were taken with non-metallic instruments and the chemical composition was assessed using energy dispersive spectrometry (EDS). No differences were found between the amounts of carbon, oxygen, sodium, magnesium, silicon, sulphur, chloride and potassium present in group A compared to group B. Instead iron, copper, titanium, aluminum and zirconium were detected in the samples scraped with the metal instrument. This fact suggests that the results obtained may be influenced by the instrumentation used in sampling [4].

To circumvent this problem, Tantbirojn et al. performed a study on extracted teeth that had naturally deposited black deposits. Chemical analysis of the deposits showed the presence of areas of high concentration of iron and copper, which correspond to areas of high concentration of sulphur [4]. This finding suggests that the metal ions and the sulphur complex are responsible for the black colour of the spots [10].

An analysis of the black material that forms this colouring found that it consists of iron salts (Fe+) and an increased content of calcium (Ca) and inorganic phosphorus (F). The stains represent deposits of ferrous sulphates, they appear as a result of chemical interactions on the tooth surface between the hydrogen sulphide produced by the anaerobic bacteria present in the saliva that produce hydrogen (including actinomyces, lactobacillus sp, phorphyromonas, prevotella melaninogenica [7]) and existing salivary or gingival exudate iron, resulting in chromogenic insoluble ferrous deposition and blackening of the teeth, but the exact mechanism is not yet known (this includes electrostatic forces, van der Waals, hydration, hydrophobic interactions and hydrogen bonds) [3].

CONCLUSIONS

Although black stains are present in a large number of paediatric patients, the present study revealed, in accordance with the international literature, the following conclusions:

✓ correct information on the problem plays the main role, avoiding the confusion between BS and carious lesions

✓ chromogenic staining affects all teeth and all their surfaces

✓ gingival inflammation caused by plaque, in association with frequent gingival bleeding, are a basic nutritional substrate in the evolution of the amount and speed of staining deposition

✓ the BS manifest clinically identically in both sexes

✓ dietary pattern rich in iron associated with unsatisfactory hygiene, directly influences the speed of deposition of black stains

✓ the presence of ferric ion (Fe3+), ferrous cation (Fe2+), calcium ions (Ca2+), sulphur in the form of sulphate ion (SO 2-) and sulphite (SO 2-) was identified in the deposits, which explains the adhesion and the increased insolubility of the dyes

✓ metal ions and sulphur complex are responsible for the black colour of the stains
✓ transmission of BS between family members has not been proven
✓ Neisseria sicca is found to be present in the processed samples

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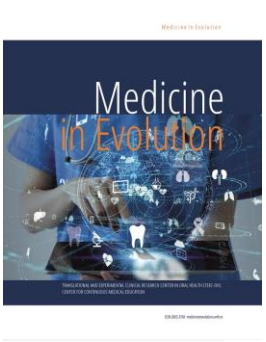
Radiographic Imaging for the Diagnosis of Patients with Class III Malocclusion: Skeletal and dental changes



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Received: 14 March 2024; Accepted: 3 May 2024; Published: 30 June 2024

Abstract

Aim and objectives: The main purpose of this study was to reveal the main skeletal and dental changes in patients with type III Malocclusion. **Material and methods**: 42 patients were enrolled in this study (21 girls and 21 boys) aged 8 to 38 years. An analysis of the lateral cephalometric radiographs was made by manual tracing of the cephalometric points and planes. **Results**: Measurements of the main distances and angles were made. Different correlations between cephalometric parameters were made between girls and boys or between children/adolescents under and older than 17 years. Girls seem to be more affected than boys. **Conclusion**: Since many and important changes were found, starting treatment as soon as possible becomes a top priority.

Keywords: Class III malocclusion; diagnosis; radiographic imaging; dental changes; skeletal changes

INTRODUCTION

Edward Hartley Angle classified malocclusions in three different classes based on the position and relationship between the upper and lower first molars [1]. Angle Class III malocclusion is an antero-posterior dental discrepancy characterized by the mesial position of the lower first molar's buccal groove in relation to mesiobuccal cusp of the maxillary first molar [2]. The prevalence of Class III Malocclusion varies from 0.7% in Israel, 3-5% in UK, USA and Scandinavian countries to 10-15% in Turkey and Iran or 15-17% in Southeast Asian countries (for China even 20%) [1,3].

Skeletal and dental characteristic features of Class III malocclusion are retroclined mandibular incisors, anterior cross-bite, retrognathic and/or micrognathic maxilla, prognathic and/or macrognathic mandible, changes in the length or inclination of the cranial base, greater mandibular length or smaller cranial base angles [1,4].

Aim and objectives

This study aims to conduct a cephalometric analysis in patients with Class III malocclusion and identify the sagittal and vertical changes of the maxillary and mandibular parameters for this group of patients. Based on these results, a comparative analysis by age and gender was also made together with an analysis between different parameters measured in this study.

MATERIAL AND METHODS

42 patients with a class III malocclusion were included in this study. The inclusion criteria for this particular study group were age of the participants (minimum 8 years old), no previous orthodontic treatment, complete eruption of the upper and lower first molars and the presence of a dental and skeletal class III malocclusion. The patients were selected following a thorough evaluation which consisted of intraoral examination, radiographic and dental casts analyses. Informed consent was obtained for all patients involved in the study and for patients younger than 18 years old, parental permission for including in the study was reached.

All the data were collected on an examination form and then transferred into an Excel document in order to assist the statistical analysis which was done by using StataIC software, version 11 (StataCorp. 2009. Stata: Release 11. Statistical Software. College Station, TX, USA). t Student tests were used for comparing parameters from different groups and a value of $p < 0.05$ was considered statistically significant.

The lateral cephalometric radiographs were analysed by manual tracing of the cephalometric points and planes which are shown in Figure 1 and Table 1.

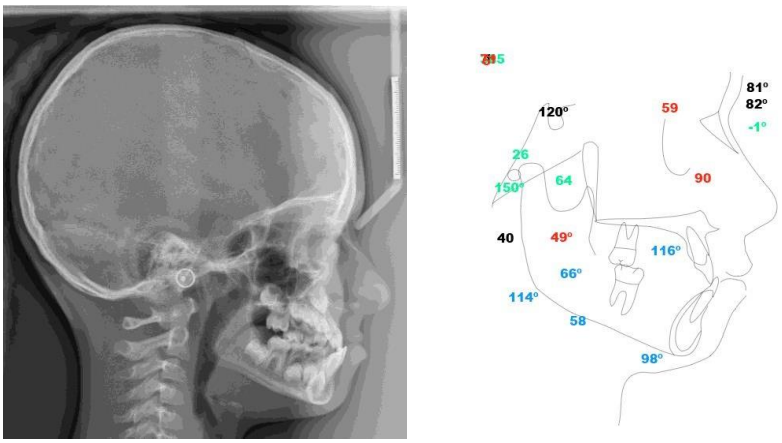

Figure 1. The cephalometric landmarks used in the study: Sella (S), Glabella (G), Nasion (N), Bolton (Bo), Basion (Ba), Porion (Po), Condylion (Co), Articulare (Ar), Gonion (Go), Orbitale (Or), Pterygomaxillary fissure (PTM), Posterior Nasal Spine (PNS), Anterior Nasal Spine (ANS), Point A (A), Point B (B), Prosthion (Pr), Infradentale (Id), Pogonion (Pog), Menton (Me), Gnathion (Gn)

Table 1. Cephalometric planes used in the study

Cephalometric plan	**Definition***
Anterior cranial base (Planum)	S-N
Anterior cranial base (Clivus)	S-Ba
Frankfurt horizontal	Or-Po
Palatal plane	ANS-PNS
Occlusal plane	The tip of the mesial cusp of the mandibular first permanent molar and halfway between the upper and lower incisal points
Mandibular plane	Tangent at the lower edge of the mandibular angle and Gn
A_o-B_o	Distance between projections of points A and B on the occlusal plane
Incisale superior	Longitudinal axis of the central upper incisor
Incisale inferior	Longitudinal axis of the central lower incisor
Upper anterior facial height	N-ANS
Upper posterior facial height	S-PNS
Posterior facial height	The distance in millimeters measured tangentially to the posterior border of the ascending mandibular ramus, from Ar to the mandibular plane
Anterior facial height	The distance in millimeters measured perpendicular to the palatal plane, from this one to the Me
Z line	The line from soft tissue Pogonion (Po) to the most prominent lip

**The abbreviations for the cephalometric landmarks are presented in Table 1*

Using these points and planes, we have measured several linear and angular cephalometric parameters in order to evaluate the dentoalveolar changes in the anterior segment and the skeletal implications of the malocclusion (Table 2).

Table 2. The dentoalveolar and skeletal measurements used for the cephalometric analysis

Dentoalveolar cephalometric parameters	IMPA, FMIA, id-B-M, PrA-F, IF, Ii, Z
Skeletal cephalometric parameters	SNA, SNB, ANB, Ao-Bo, Nsa-Nsp-M (Margolis angle), FMA (Tweed angle), N-S-Ba, Occlusal plane angle (Tweed-Merriefield), N-Nsa, S-Nsp, Ar-Nsp, HFP, HFA, HFP/HFA

RESULTS

The average age of our patients (21 girls and 21 boys) was 16.1 years with a minimum age of 8 and maximum of 38 years.

Parameters for all the patients involved in the study are shown in Table 3.

Table 3. Descriptive analysis of the study group with class III malocclusion

Parameter	Normal average	Average in this study	Standard deviation	Minimum	Maximum
N-S-Ba	130°	126.38	4.5	116	135
FMA	25°+/- 3°	28.14	6.58	9	44
Nsa-Nsp-M	25°	26.76	8.41	7	49
O	10°+/-3°	9.21	3.8	1	17
SNA	82°+/- 2°	78.98	3.25	72	87
SNB	78°-80°	81.02	4.75	70	90
ANB	2°+/- 2°	-2.31	3.22	-9	4
Ao-Bo	0-4 mm	-5.9	4.33	-20	1
IMPA	88°-92°	87.19	7.75	71	101
FMIA	64°-70°	65.33	8.04	51	80
Ii	130°	132.1	10.36	116	160
PrA-F	110°	100.31	10.94	73	120
id-B-M	90°	79.48	8.46	55	102
IF	105°-110°	113.31	6.92	97	128
N-Nsa	48+/- 1 mm	54.07	5.23	45	67
S-Nsp	42+/- 1 mm	48.79	3.98	40	57
Ar-Nsp	45 mm	37.29	3.8	29	45
HFA	65 mm	68.26	7.88	52	82
HFP	45 mm	48.64	7.29	34	67
HFP/HFA	0.69	0.7	0.1	0.5	0.96
Z	78°	78.7	6.48	62	94

The patient group was divided and analyzed separately based on two other criteria related to gender and age, respectively. For the first of them, the results of the descriptive analysis are included in Table 4, which presents the means, the standard deviation and the minimum and maximum values for all the parameters included in this study, separately for girls and boys.

Table 4. Descriptive analysis of the groups of girls (n=21, left) and boys (n=21, right) with Class III Angle anomaly

Parameter	Average		Standard deviation		Minimum		Maximum	
	♀	♂	♀	♂	♀	♂	♀	♂
N-S-Ba	126.14	126.62	5.07	3.96	116	121	135	134
FMA	28.1	28.2	5.8	7.42	20	9	39	44
Nsa-Nsp-M	26.62	26.9	7.65	9.3	14	7	41	49
O	9.33	9.1	3.77	3.91	1	3	17	16
SNA	78.57	79.38	3.78	2.65	72	76	87	86
SNB*	79.38	82.66	4.85	4.14	70	72	87	90
ANB	-1.38	-3.24	3.15	3.08	-9	-7	3	4
Ao-Bo*	-4.29	-7.52	3.48	4.58	-15	-20	1	1
IMPA*	89.48	84.9	7.11	7.85	75	71	101	101
FMIA*	62.86	67.81	8.22	7.22	51	59	78	80
Ii	133.1	131.1	10.96	9.88	116	117	160	148

PrA-F*	96.81	103.81	7.39	12.84	82	73	109	148
id-B-M*	82.1	76.86	7.84	8.42	70	55	102	93
IF*	110.81	115.81	6.56	6.49	97	104	123	128
N-Nsa*	55.76	52.38	6	3.76	46	45	67	62
S-Nsp*	50	47.57	4.34	3.26	41	40	57	52
Ar-Nsp	38.05	36.52	4.19	3.3	29	40	45	52
HFA	69.14	67.38	8.14	7.7	52	53	82	82
HFP	48.14	49.14	7.86	6.84	34	41	61	67
HFP/HFA	0.69	0.71	0.11	0.1	0.5	0.56	0.87	0.96
Z*	76.38	81	4.97	7.07	62	70	83	94

*p < 0.05

The next criterion taken into study refers to the age category. For this analysis, the group of patients with Angle class III malocclusion were divided in two subgroups: subjects under 17 years of age (in which it is considered that there is still a possibility of growth) and over 17 years (with little probability of growth). The results of the descriptive analysis for these age groups can be found in Table 5, which presents the averages, the standard deviation and the minimum and maximum values for all the parameters.

Table 5. Descriptive analysis of the group of patients younger than 17 years old (n=29) and older than 17 years old (n=13)

Parameter	**Average**		**Standard deviation**		**Minimum**		**Maximum**	
	< 17 y	> 17 y	< 17 y	> 17 y	< 17 y	> 17 y	< 17 y	> 17 y
N-S-Ba	126.66	125.77	4.62	4.32	116	122	134	135
FMA	29	26.23	6.24	7.15	18	9	44	37
Nsa-Nsp-M	27.38	25.38	8.22	9	14	7	49	44
O	9.34	8.92	4.13	3.07	1	3	17	14
SNA	78.52	80	3.25	3.14	72	76	87	86
SNB	80.28	82.69	4.82	4.31	70	74	87	90
ANB	-1.93	-3.15	3.47	2.48	-9	-7	4	2
Ao-Bo	-5.34	-7.15	4.06	4.83	-15	-20	1	-2
IMPA	86.62	88.46	7.49	8.46	72	71	101	101
FMIA	65.45	65.08	8.06	8.33	51	53	80	79
Ii	133.07	129.92	10.6	9.84	116	116	160	145
PrA-F	98.52	104.3	10.18	11.91	73	82	114	120
id-B-M	78.86	80.85	7.98	9.65	67	55	102	94
IF	112.28	115.62	7.24	5.75	97	107	128	125
N-Nsa	53.72	54.85	5.48	4.76	45	48	67	62
S-Nsp*	47.9	50.77	4.07	3.06	40	46	57	57
Ar-Nsp*	36.52	39	3.95	2.89	29	32	45	43
HFA	67.79	69.31	7.41	9.08	52	53	82	82
HFP*	46.41	53.62	6.26	7.17	34	41	61	67
HFP/HFA	0.69	0.75	0.1	0.1	0.5	0.62	0.92	0.96
Z	78.97	78.08	6.41	6.85	62	70	92	94

*$p < 0.05$

The significant statistically correlations were marked in Tables 4 and 5 taking into account a value of $p < 0.05$.

DISCUSSIONS

The lateral cephalometric radiographs analysis of the patients enrolled in this study highlighted in some cases that the class III Malocclusion involves changes within the skull base, and for other cases, in addition to this, a lot of maxillary/mandibular disorders including the dento-alveolar segment have been found leading to compensatory or aggravating conditions.

The descriptive analysis revealed the following main findings:

- the value of the N-S-Ba angle is reduced leading to an anterior position of the mandible in relation to the skull base;
- the SNA angle is less than 80° (which reveals a retrognathic maxilla) and the SNB angle is higher than 78° (which demonstrates the presence of a prognathic mandible). These findings correlate with the negative values of the ANB angle and the Ao-Bo distance. In the comparative analysis by gender, a higher value of the SNB angle was observed in girls ($p < 0.05$) in addition with the Ao-Bo distance, which also presents a higher negative value in girls than in boys ($p < 0.05$);
- FMA (Tweed angle) medium value was higher than normal advocating for greater vertical changes in the anterior sector and, at the same time, for the posterior rotation of the mandible. This result correlates with the increased value of the bispino-mandibular angle (angle B).
- the increased values of the anterior-superior facial height (N-Nsa) and of the posterior-superior height (S-Nsp). Also, the value of the Ar-Nsp distance was calculated in order to analyse the changes in the posterior facial height because this parameter also brings additional information about the anterior position of the maxilla on the skull base. The value of this distance was increased for the study group.
- the inclination of the occlusal plane with reference to the Frankfort Horizontal plane showed a reduced value;
- assessments related to changes in the dento-alveolar in the sagittal plane show an interesting evolution in patients with a class III malocclusion. In the maxilla, the changes in the two sectors appear in the opposite direction, the retroalveolia being associated with the protrusion, which means that the alveolar process aggravates the changes, and the teeth tend to compensate for the deficit. The lower arch presents more constant characteristics: the average obtained for the study group demonstrates the presence of inferior retroalveolodontia, which can be interpreted as a compensatory phenomenon in cases with sagittal inocclusion.
- the analysis of the facial profile Z angle reveals normal limits for the study group, which is not characteristic of a class III malocclussion. However, taking into account, the increase in FMA and, on the other hand, the anterior position of the mandible, the two effects neutralize the value of the Z angle within normal limits. The comparative analysis by gender reveals differences with a statistically significant probability ($p=0.0188$); thus, in girls, the average Z angle has significantly higher values (81°) compared to boys (76°).

Usually, in type class III Malocclusion the SNB angle is higher than SNA angle. We found the same results in our analysis. There are also other studies that confirm this finding [5]. In general, the cephalometric parameters that define the position of the maxilla and mandible in relation to the skull base (SNA and SNB angles) were different compared to normal. These findings are sustained by many studies [6, 7, 8].

The statistical correlations of our analysis revealed the following findings:

- SNB > SNA is a trend among these patients;

- a strong relation between angles Nsa-Nsp-M and FMA, which means an equal involvement of the maxillary and mandibular to the facial hypodivergent skeletal pattern;
- no correlation was found between changes in the sagittal plane of the upper and lower alveolar process, as well between upper and lower incisors relationship;
- the ratio of the facial heights (HFP/HFA) is in relation with the sagittal position of the mandible (SNB) as well as with the position of the lower incisors (IMPA).

CONCLUSIONS

We can strongly conclude that**:**

- vertical changes of the maxillary bases were higher in the anterior sector;
- decreasing of the sphenoidal angle leads to a sagittal intermaxillary gap;
- upper facial height was higher, especially in boys and over 17 years old;
- girls seem to be more affected than boys.
- the analysis of the cephalometric parameters must always be interpreted in the individual context of each case because the function can greatly influence the changes in the skeletal or dento-alveolar sectors.

Because of so many changes present in patients with type III malocclusion starting the orthodontic treatment as soon as possible becomes a priority.

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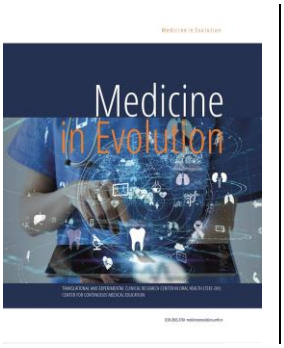
Cemented vs. screw-retained restorations on dental implants



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Received: 24 April 2024; Accepted: 15 June 2024; Published: 30 June 2024

Abstract

Aim and objectives: Implants represent a growing business all over the world. As more and more dentists tend to treat patients using this kind of treatments, the complications are also much more common as time goes by. The prosthetic solutions are various, they include single/multi-unit restorations, cemented or screw-retained on a variety of abutments and ti-bases. The aim of this study is to compare the two choices - cemented vs screw-retained and follow up the tissue response after replacing an old cemented restoration with a screw-retained one.

Materials and methods: A patient with cement-related peri-implantitis was treated and followed over a period of time. Tissue response was analysed as healing and bio-integration of the new restoration occurred.

Results: Tissue healing and maturation progressed very well after the irritation caused by the cement was removed.

Conclusions: Cemented implant restoration pose a higher threat of peri-implantitis compared to the screw-retained ones due to the risk of cement overpass into the peri-implant space.

Keywords: Implants, Peri-implantitis, Screw-retained restorations

INTRODUCTION

The history of the modern implant has seen countless changes, beginning in 1913 when Dr EJ Greenfield implanted an artificial root made from a "hollow 24 mm diameter hollow latticed cylinder of multi-unit iridbond, which compensates for the angulation of implants and allows precise screwing through a circular incision. In the 1940s, Formiggini, considered the "father of modern implantology", and Zepponi developed an endosseous implant with a stainless steel spiral design that allowed bone to grow into the metal [1].

An endosseous dental implant is designed for placement in the alveolar bone of the mandible or maxilla, with the body of the implant embedded in the bone [2]. Two basic types of endosseous implants are described in the literature, blade and root form. Regardless of shape, modern implants undergo a series of surface treatments: After processing a titanium or titanium alloy implant, contact with air causes immediate development of a titanium oxide on the implant surface. Until the late 1980s, additional procedures to surface treat the implant were rarely performed. Since then, numerous implant surface modifications have been developed to adjust the texture of the implant surface to encourage the osseointegration process, especially in cases of low bone density. Modifications can be classified into additive and subtractive procedures, if the substance is removed or added to the implant surface during implant surface treatment. Subtractive procedures include the following: acid etching; blasting with an abrasive material such as silica or HA; blasting with HA, is particularly advantageous because unlike sand, any or laser treatment [3]. Additive procedures have the same purpose of modifying the implant surface to a moderate degree and include: coating with HA, anodizing to thicken the titanium oxide surface [4], [5], [6].

The prosthetic connections of implants can be divided into internal and external (older). External hex connections have the disadvantage of screw loosening, as they bear more horizontal forces on the connecting screw [7]. There are numerous studies in the literature on marginal bone loss comparing the two types of connections, most of them showing that implants with internal connection resulted in a more favourable response from the alveolar bone with respect to marginal bone loss in the posterior areas without periodontal or peri-implant damage, unlike implants with external connection [8].

Cemented restorations feature a conventional design to connect a restoration (crown, bridge) to an implant-supported bridge. This process is similar to cementing a crown onto a natural tooth. Conventional casting techniques have a relatively low fidelity, this has been one of the drawbacks to achieving the passive fit required for multi-unit restorations on implants. CAD/CAM scanning and milling of the restoration provides high accuracy and passive fit.

These restorations are mainly used in the esthetic area, in cases where a significant angle is present between the implant and the axis of the prosthetic restoration, because the screw hole that secures the restoration will appear on the visible surfaces of the restoration (buccal), which makes cemented restorations the preferred choice, because the screw hole that secures the restoration will not affect the appearance of the restoration, as the restoration is cemented to the abutment [9], [10].

Although cemented restorations have many advantages, they also have many disadvantages, which should be taken into account when deciding on a cemented restoration. The main complication of this type of restoration is the residual cement left in the sulcus, which can lead to peri-implant disease.

Screw-retained restorations are designed to be screwed either directly onto the implant or onto a screw-retained abutment positioned on the implant (multi-unit abutments). Screw-retained restorations are a safe and easy way to maintain a prosthetic restoration

because the restoration can be unscrewed at any time by the clinician, both for sanitation of the restoration and for maintenance of the implant [10].

Screw-retained restorations can also be used for angled implants, as these restorations can also be screwed onto multi-unit abutments, which compensate for the angulation of the implants and allow the restorations to be screwed straight.

Aim and objectives

The aim of the present study is to evaluate peri-implant tissue responses after modification of the prosthetic restoration aggregation method and to follow their stability over time.

MATERIAL AND METHODS

The evolution of a patient with peri-implantitis caused by excess peri-implant cement resulting from the cementing of the prosthetic restoration was followed.

The patient's implant was explanted, a bone augmentation was performed with different bio-materials, and then the lost implant was replaced. Afterwards, a new screw-retained restoration was set in place, and the follow-up of the tissue healing begun.

Clinical protocol and stages:

After the patient presented to the clinic and following the clinical examination, in conjunction with complementary examinations (radiological examination), a fistula was observed in the implant at the 3.6 position (Figure 1).

Figure 1. Initial appearance of peri-implant restoration and mucosa

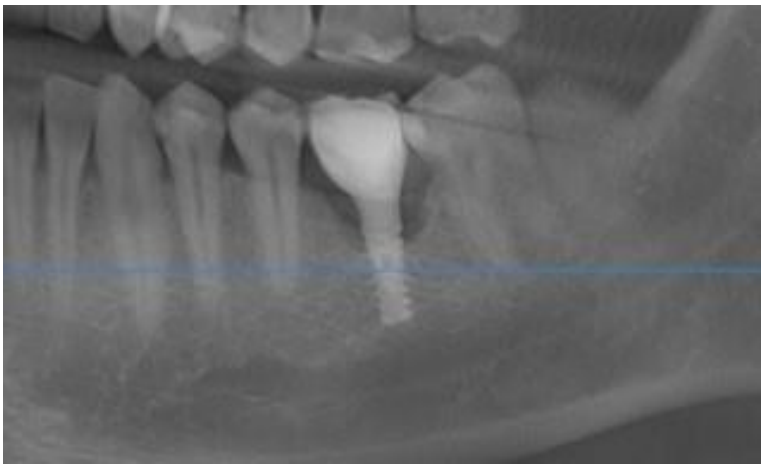

Figure 2. Initial radiological appearance (section from OPG) of the implant

Following radiographic analysis, vertical defects were observed mesial and distal to the implant (Figure 2), and the patient was referred for a CBCT radiographic examination to observe the status of the buccal and lingual cortical bone.

After performing and analyzing the CBCT examination, it was observed that the implant also shows vertical defects in the lingual and buccal cortices (Figure 3).

Figure 3. Sagittal section from CBCT

After the diagnosis was established, the fistula at the implant was inspected and this fistulous path was curettage (Figure 4). During the curettage of the fistula, a hard mass was detected and removed with the curettage, this hard mass, which turned out to be residual cement remaining at the implant sulcus, which led to the formation of the fistula, but also to the formation of peri-implant vertical bone defects.

Figure 4. Intraoperative appearance during curettage - removal of a residual cement mass

After curettage of the fistulous tract and removal of residual cement, the affected implant was uncovered and explanted by unthreading it (Figure 5).

Figure 5. Appearance of the explanted implant

After the explantation was performed, the implant socket (Figure 6) remained and was cleared to provide the necessary support for a future bone graft, with which the bone augmentation will be performed.

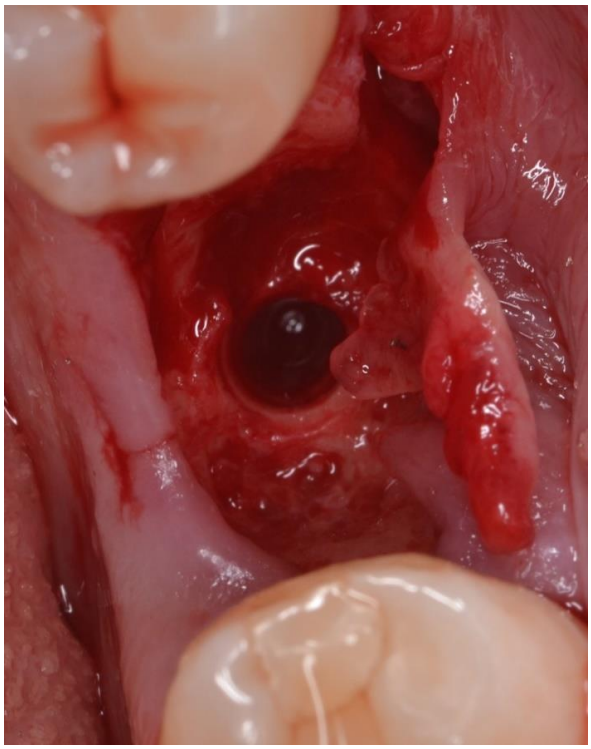

Figure 6. Appearance of the implant socket - after explantation

Once the alveolar curettage was completed and all residual cement was removed, bone augmentation was performed with a xenograft made of bovine bone combined with autologous bone harvested from the patient. This bone graft, was protected with a PRF membrane, obtained after centrifugation of blood collected from the patient, to allow osteosynthesis and subsequent wound healing (Figure 7).

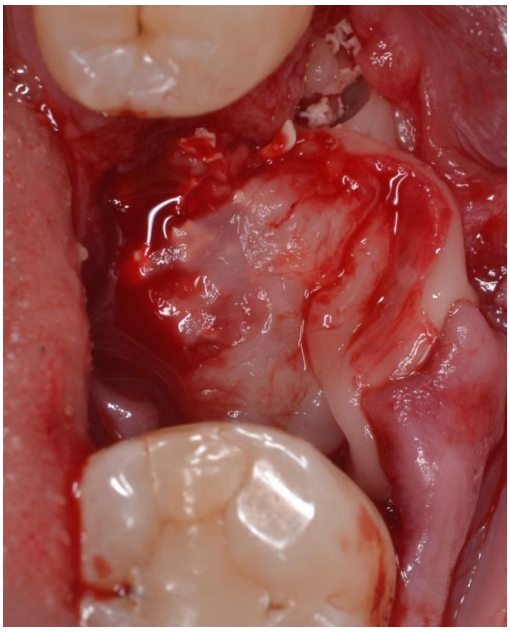

Figure 7. Appearance of xenograft protected with PRF membrane

After a period of 6 months a new implant was inserted (Figure 8), in the same position as the old implant, this time a screw-retained restoration was chosen to avoid the risk of peri-implantitis due to residual cement.

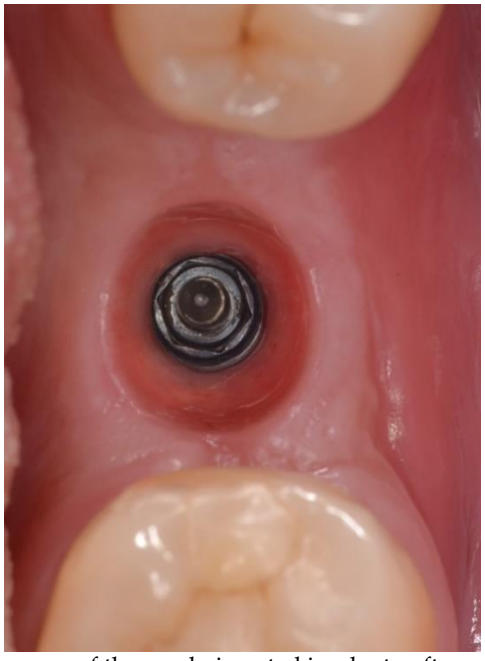

Figure 8. Appearance of the newly inserted implant - after osseointegration

The emergence profile of the new restoration can be seen (Figure 9) which ensures optimal closure of the peri-implant soft tissues and implant sulcus. The mucosal face of the restoration has been finished and polished to block the possibility of bacteria adhering to it.

Figure 9. The appearance of the screw-retained restoration - emergence profile and mucosal face

RESULTS

After the application of the restoration, the peri-implant soft tissues conformed to the contour and emergence profile of the restoration, with complete healing of the soft tissues (Figure 10) (Figure 11). The tissues remained healthy with no signs of inflamation over the next 6 months.

Figure 10. Occlusal aspect

Figure 11. Buccal aspect

Excess cement is a real risk factor when it comes to implant restorations. Screw-retained restorations are more predictable to fix than cemented restorations, as there is no risk of residual cement remaining in the peri-implant space and thus the risk of peri-implantitis is lower than with cemented restorations. The only major problem with screw-retained restorations is achieving complete passivity when they are fixed into the implant.

DISCUSSIONS

As can be seen in this case, cleaning the cement around an implant restoration is often a problem. The only major problem related to screw-retained restorations is achieving complete passivity, when it is established that the main cause of peri-implantitis in implants with cemented restorations is the residual cement left unremoved by the clinician during the cementing of the restoration [11], [12]. Even in implants with a smooth surface, it has been shown that complete removal of a resin cement was not possible. In newer implant surfaces, which are intentionally rougher to ensure better healing, the cement is expected to have even greater adhesion and cleaning becomes significantly more difficult [13] [14], [15].

CONCLUSIONS

There are different philosophies about the ideal type of restoration. The truth is that most decisions are based on the personal preference of the clinician and the actual clinical situation. The literature shows advantages and disadvantages for both implant-screwed and cement-retained restorations.

An understanding of how each type of prosthesis influences the aesthetics, occlusion and longevity of the restoration is essential in selecting the best case for a screw-retained or cement-retained restoration.

None of the fixation methods is clearly perfect, but cemented restorations have biological complications more often (bone loss >2 mm).

Excess residual cement remaining in the peri-implant space is one of the main causes of peri-implant soft tissue inflammation and peri-implant vertical bone resorption in implant cemented restorations.

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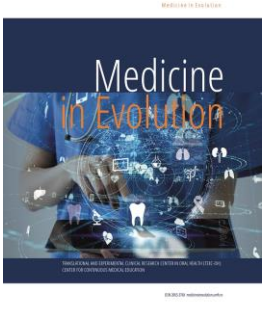
The influence of fixed orthodontic treatment on the microbiology of bacterial plaque



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Received: 10 May 2024; Accepted: 20 June 2024; Published: 30 June 2024

Abstract

Dental plaque is a complex biofilm organization and is considered to be the primary causal factor of dental caries and periodontal diseases. Fixed orthodontic tretatmentis a risk factor in bacterial plaque accumulation. The purpose of this study was to detect pathogenic bacteria in dental plaque using laboratory tests. The selected patients were in numerr of 48, aged between 11 and 49, both male and female who required orthodontic treatment. After reciveing orthodontic braces, using a manual toothbrush, patients were thaught the correct brushing technique. After 6 months of orthodontic appliance use, plaque samples were collected from the surface of the teeth, and some elastic ligatures. The samples were collected using a transport medium swab, and the analyses were performed at a medical analysis laboratory (Synevo). Analyzing all the data from the tests, it is concluded that orthodontic treatment has a significant impact on the microbiology of bacterial plaque.

Keywords: Orthodontic treatment, dental plaque, oral hygiene, bacteria

INTRODUCTION

The preventive measures for dental caries are well-known both nationally and internationally, for orthodontic appliances as well as other patients. To enhance the effectiveness of individual preventive measures, clinical or laboratory tests are necessary to assess an individual's risk of dental caries, which is very common today. There are numerous studies showing the involvement of certain bacteria, such as Streptococcus mutans, Lactobacillus, and other pathogens in the plaque that develops in caries and in increased numbers in patients with orthodontic appliances, mainly due to dental crowding in these patients, but also due to orthodontic treatment itself, as the tooth surface is covered by the appliance, making optimal hygiene much more difficult. (1)

Aim and objectives

The purpose of this study was to detect pathogenic bacteria in dental plaque using laboratory tests. Additionally, combating bacteria is a top priority for oral health.

The scientific objectives of this work are: Identifying pathogenic changes in the oral flora; discovering and attempting to reduce the number of these parthogens by educating patients about proper oral hygiene techniques.

MATERIAL AND METHODS

Material: The subjects who participated in this study numbered 48, aged between 11 and 49 years, of both male and female genders, who required the initiation of orthodontic treatment. The subjects who participated were from a private environment, from a dental office.

Inclusion Criteria: All subjects presented a very good state of health, without any other medical problems that could influence. They did not receive any antibiotics before or during orthodontic treatment. At the beginning of the study, patients did not show signs of gum inflammation. The study population had permanent dentition, without plaque or tartar, and were eager to maintain adequate hygiene.

Exclusion Criteria: Subjects excluded from this study were those who received treatment for chronic diseases, those who received periodontal treatment at least 3 months before the start of this study, or those with systemic disease that could affect oral microbiology.

The selected patients recived fixed orthodontic appliances. Using a manual toothbrush, patients were taught the correct brushing technique and were motivated to maintain adequate hygiene throughout the study and during orthodontic treatment. After 6 months of orthodontic appliance use, samples were collected from the patients from the surfaces of the teeth, plaque samples, and some elastic ligatures. These samples were collected using a transport medium swab, and the analyses will be performed at the Synevo medical analysis laboratory.

Collection Technique: Patients presented for the control and replacement of elastic ligatures, a control that must be performed every month, using a tissue separator for soft tissue, for better control and visualization of dental tissues. The dental units to be sampled are dried with an air jet. Before sampling, we must check the expiration date of the container to be used for collection. The sterile collection swab container is opened, the cap must be removed, plaque collection from the gingival level is done with the help of a sterile swab, and then it is placed in the transport medium container. The sterile swab and a few elastic ligatures from the patient are also added with the help of sterile forceps. The patient's name,

personal numeric code, the physician who sent the sample to the laboratory for testing, the date and time of collection, and the type of sample collected (in this case, dental plaque) are added to the label on the container. Samples for testing must be sent to the laboratory within a maximum of 24 hours of collection. The most commonly used media for bacterial isolation is 5% Columbia agar. It is incubated aerobically at 37°C in air for 24 hours, which can be extended up to 48 hours if the characteristics of bacterial colonies are not observed on the first plate read. The media were tested to observe the absence or presence of Staphylococcus aureus, beta-hemolytic streptococci, non-fermenting gram-negative bacilli, Enterococcus spp., Enterobacteriaceae. Then, based on the results obtained from the tests, ABG is also performed.

RESULTS

The study began with the collection of patients prior to the initiation of orthodontic treatment, as they did not present pathological changes in plaque. The patients we collected were women and men aged between 11 and 49 years old. After wearing the orthodontic appliance for 6 months, the patients were called back to the clinic for the replacement of elastic ligatures, during which bacterial plaque was also sampled with a swab. The collected samples were sent to the Synevo laboratory within a maximum of 24 hours. From the analyses collected and studied in the laboratory, we had both positive and negative results. Table 1 presents the results of bacteriological analyses of the subjects before orthodontic treatment and at 6 months after the initiation of orthodontic treatment, as well as the percentage results of these tests. Microorganisms were discovered: Klebsiella oxytoca, Staphylococcus aureus, and Group G Streptococcus. Figure 2. shows the results from laboratory tests according to the age of the patients. With the help of the antibiogram, we can discover each microorganism's susceptibility or resistance. In our case, Klebsiella Oxytoca is resistant to ampicillin in some patients, while in others, all diagnosed with the same microorganism, it is sensitive to ampicillin. In the case of the microorganism Staphylococcus aureus, it was found to be resistant to ampicillin, while the Group G Streptococcus microorganism is sensitive to all antibiotics.

Table 1. Bacteriological analysis results performed before and 6 months after orthodontic treatment

Name of the patient (initials)	Results before the orthodontic treatment	Results at 6 months after the initiation of orthodontic treatment
P.A.	NEGATIVE	NEGATIVE
N.K.	NEGATIVE	NEGATIVE
L.P.	NEGATIVE	POSITIVE KLEBSIELLA OXYTOCA
E.P.	NEGATIVE	POSITIVE STREPTOCOCCUS G
D.R.	NEGATIVE	NEGATIVE
T.N.	NEGATIVE	POSITIVE STAPHYLOCOCCUS AUREUS
R.T.	NEGATIVE	NEGATIVE
B.E.	NEGATIVE	POSITIVE KLEBSIELLA OXYTOCA
S.P	NEGATIVE	POSITIVE STAPHYLOCOCCUS AUREUS
M.A.	NEGATIVE	POSITIVE STREPTOCOCCUS G
E.N.	NEGATIVE	NEGATIVE
I.R.	NEGATIVE	NEGATIVE
R.G.	NEGATIVE	POSITIVE KLEBSIELLA OXYTOCA

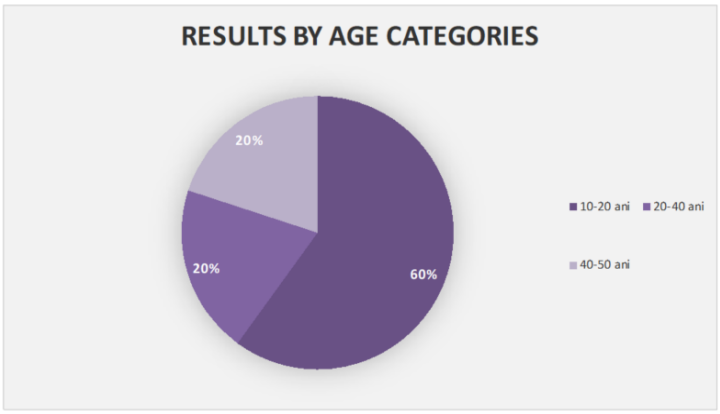

Figure 1. Laboratory Analysis Results by Age

Table 2. ABG (Antibiogram) of Klebsiella Oxytoca Microorganism

Antibiogram of Klebsiella Oxytoca	PATIENT P.A	PATIENT L.P	PATIENT B.E.	PATIENT R.G
AMIKACIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
AMPICILIN	**SENSITIVE**	**RESISTANT**	**RESISTANT**	**RESISTANT**
AMOXI/CLAV	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
CEFTAZIDIME	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
CEFUROXIME	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
CEFAZOLIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
CEFOXITIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
CIPROFLOXACIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
GENTAMICIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
MOXIFLOXACIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
PIPERACILIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
TRIMETROPRIM+SULFAMETOXAZOL	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
PIPERACILIN+TAZOBACTAM	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
METROPENEM	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
LEVOFLOXACIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**
TETRACYCLIN	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**	**SENSITIVE**

Table 3. ABG (Antibiogram) of Group Streptococcus G Microorganism

Antibiogram **of** Streptococcus grup G	PATIENT E.P.	PATIENT M.A
AMPICILIN	**SENSITIVE**	**SENSITIVE**
AZITHROMYIN	**SENSITIVE**	**SENSITIVE**
CEFTRIAXONE	**SENSITIVE**	**SENSITIVE**
CEFEPIME	**SENSITIVE**	**SENSITIVE**
CEFOTAXIME	**SENSITIVE**	**SENSITIVE**
CLINDAMICYN	**SENSITIVE**	**SENSITIVE**
CHLORAMPHENICOL	**SENSITIVE**	**SENSITIVE**
ERYTROMYCIN	**SENSITIVE**	**SENSITIVE**
LEVOFLOXACIN	**SENSITIVE**	**SENSITIVE**
PENICILIN	**SENSITIVE**	**SENSITIVE**
TETRACYCLIN	**SENSITIVE**	**SENSITIVE**
VANCOMYCIN	**SENSITIVE**	**SENSITIVE**

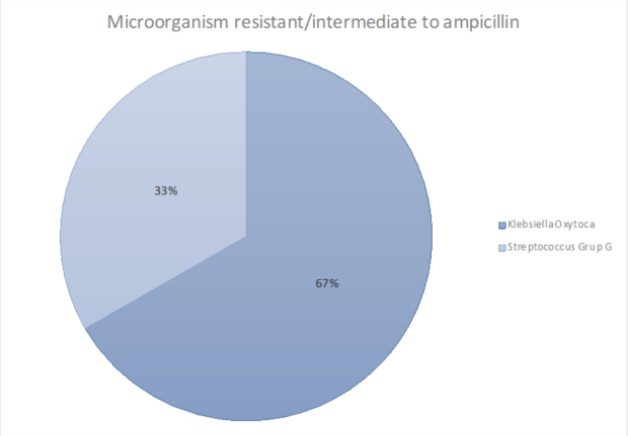

Figure 2. Microorganisms resistant/intermediate to ampicillin

DISCUSSIONS

The application of orthodontic appliances in young patients can lead to adverse reactions such as gingival inflammation, sometimes gingivitis, and late-onset periodontitis. (2) Clinical studies have shown that, in the absence of adequate oral hygiene, periodontal pockets can form due to the increased number of bacteria in dental plaque when fixed orthodontic appliances are used, especially in children. Therefore, plaque microbiology induces not only the onset of caries but also the onset of periodontal diseases, even among young individuals. (3)

The periodontal-orthodontic interrelationship has been subject to numerous investigations to date and remains a controversial issue. It has been demonstrated that malocclusion affects periodontal health, and one of the objectives of orthodontic treatment is to promote better dental health and prolong the lifespan of dentition. (4)

Although orthodontic treatment alleviates dental and osseous problems, placing an orthodontic appliance in the patient's mouth is often associated with changes in oral hygiene habits and periodontal health. Orthodontic appliances, as well as mechanical procedures, are predisposed to evoke local responses of soft tissues at the gingival level. The proximity of orthodontic appliances to the gingival sulcus, plaque accumulation, and the impediments they pose to oral hygiene habits further complicate the process of efficient and healthy orthodontic care. (5)

Closing the orthodontic space of extraction sites can lead to gingival invagination or gingival tissue accumulation.

Dental plaque is an extremely complex biofilm organization and is considered the primary causal factor of dental caries and periodontal diseases. Fixed orthodontic treatment is a risk factor in bacterial plaque accumulation. (6)

Fixed orthodontic appliances have long been associated with increased plaque accumulation, bacterial colonization, and resulting enamel decalcification. These appliances could alter the coronal anatomy of the tooth, leading to an increased number of retention surfaces and positions, difficulty in controlling plaque formation and adherence. They could exacerbate pre-existing periodontal disease, cause enamel decalcification, and develop bacteremia or unwanted infections. (7) Physiochemical characteristics of orthodontic appliances are known to determine the effectiveness of bacterial species in terms of quality and quantity. (8)

CONCLUSIONS

Analyzing all the data from the patients tests, it is concluded that fixed orthodontic treatment has a significant impact on the microbiology of bacterial plaque. As a result of this study, we have reached the conclusion that fixed orthodontic treatments are capable of modifying the composition of bacterial plaque. Even though at the beginning of fixed orthodontic treatment, patients did not present changes in bacterial plaque, after its application, the microbiology of the bacterial plaque changes. Most patients showed pathological changes in the plaque as well as resistance to certain antibiotics.

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