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CONTENTS

EDITORIAL

sciendo

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Materials and manufacturing techniques trends in prosthetic dentistry.

Cosmin M Cotruț

University Politehnica of Bucharest, Romania.

Introduction

Nowadays, the new and accessible technologies have made possible the development of new materials and methods for obtaining medical devices that are currently being used in the clinical practice of dental restorations.

In the past decade, prosthetic dentistry, along with the rehabilitation of edentulous patients, has been seriously impacted by the progress made in computer-driven technologies. According to literature reports [1,2], the fabrication of prosthetics devices using computer-aided design and manufacturing (CAD/CAM) or additive manufacturing (AM) technologies has proven to be feasible and reliable. Most materials used (metallic - Ti, Co-Cr, and Ti alloys; ceramics - ZrO_2; fiber-reinforced composite) in prosthetics dentistry devices manufacturing are also suitable to be obtained with the new technologies.

The help of the new technologies used in dental restorations that can support a more accurate fabrication of complex anatomical shapes, along with the new types of materials available, indicates that special attention must be given in accordance with the patient's needs and/or restrictions. For this purpose, many researchers are considering different ways of testing these new medical devices and the materials from which they are made to more accurately identify their usefulness. Moreover, new methods of increasing the biofunctionality through surface treatments of dental devices are being studied.

Corrosion behavior at various pH of Co-Cr alloys

Cobalt-chromium (Co-Cr) alloys are one of the most frequently encountered biomaterials in dentistry, being a good alternative to other dental alloys, and are used to obtain fixed dental prosthetic restorations. In terms of biocompatibility and feasibility of the dental prosthetic restorations fabricated from metallic dental alloys, it can be stated that the corrosion resistance of these biomaterials in the oral cavity, which is known to be a harsh environment that is characterized by pH and temperature variation, but also by the bacterial load [3,4], is of significant importance and should be addressed accordingly.

Thus, F. Bechir et al. [5] analyzed the corrosion behavior in Carter Brugirard artificial saliva with different pH values, of 3, 5.7, and 7.6, respectively, at human body temperature (37 ±1 °C) of two Co-Cr dental alloys commercially available, in order to establish the influence of gastroesophageal reflux disease (GERD) on the investigated alloys. The investigated samples of Co-Cr dental alloy were manufactured by casting and milling (CAM). GERD pathology is characterized by the pH variation of the oral fluid toward more acidic values, which can dramatically influence the characteristics, properties, and behavior of dental materials, including that of metallic dental alloys [5]. The corrosion tests highlighted that both Co-Cr dental alloys, which were cast and milled, have a better corrosion behavior at higher pH values of artificial saliva. Additionally, the authors have also observed that the milled Co-Cr alloy presented the lowest corrosion rates in acidic medium, suggesting that Co-Cr alloy manufactured by CAM technique could be a

proper option for the prosthetic treatment of patients suffering from GERD. The chemical composition analysis of the surfaces of the alloy immersed in artificial saliva after the corrosion tests revealed that the increment of the pH value of saliva leads to a higher quantity of oxygen, suggesting that the pH value influences the formation of oxides on the surface of the material and that by increasing the pH also the thicknesses of oxides increase, thus functioning as a kinetic barrier on metal ions.

In conclusion, F. Bechir et al. [5] showed that in an acidic oral environment, the Co-Cr dental alloys fabricated by milled technology showed the lowest corrosion rate, indicating this type of alloy, coupled with CAM technology, may be a suitable option for the prosthetic treatment of patients suffering from GERD.

Mechanical properties of zirconia-based ceramics

The fabrication of fixed dental prostheses using esthetic materials has become a routine in today's dentistry and the CAD-CAM technology is extensively used for full zirconia fixed prosthetic restoration manufacturing. The main reasons for using new types of zirconia-based materials are driven by aspects such as enhancing the appearance of restorations without altering the biomaterial strength and withstanding mechanical stress, while preserving the internal and marginal fit, the chemical stability, and biocompatibility in the oral medium which is known for its complexity [6,7].

Manufacturers have succeeded in enhancing the optical characteristics by introducing multilayer zirconia discs (for CAD-CAM manufacturing) with higher translucency, which, to a certain extent, has led to a reduction of the flexural strength [8], offering at the same time an acceptable fracture load compared to the maximum occlusal bite force [7]. Compared to other bioceramic materials such as conventional zirconia and lithium disilicate, the multilayered zirconia exhibits esthetic and mechanical properties in between, being recommended for individual anterior teeth restorations and full-mouth prosthetic rehabilitation [9,10].

To study the bending fracture of three-unit full zirconia fixed prosthetic restorations obtained by CAD-CAM technology, P. Fischer et al. [11] performed bending tests on different types of zirconia bioceramic (KatanaTM Zirconia HTML and KatanaTM Zirconia STML/Kuraray Noritake Dental Inc.; NOVAZir® Fusion float® ml/NOVADENT/Dentaltechnik; and 3D PRO Zirconia/Bloomden Bioceramics). The three-unit full zirconia fixed prosthetics obtained were codified by K-H, N, B, and K-S respectively. To establish if there are any correlations between the material structure and bending resistance, the authors have also investigated the morphology, grain size area distribution, and elemental composition of the zirconia-based materials in three different areas, namely the upper, middle, and lower areas. Following the mentioned investigations the study revealed the presence of defects, microcracks, and pores, as well as the fact that the grain size area and its distribution vary with respect to the manufacturer. The authors have shown that even though in terms of grain size distribution, all investigated zirconia-based materials followed the same trend when passing from the upper to the lower area, with no notable differences, in terms of defects, the B zirconia samples stand out as having only minor defects, irrespective of the examined area, compared to the other investigated materials, whose specimens presented noticeable defects.

After the mechanical tests were performed, P. Fischer et al. [11] emphasized that the bending strength of all three-unit dental prostheses tested is in correlation with the size, shape, and distribution of particles along with the presence of material defects. Nevertheless, the bending tests indicated that the highest forces at the failure values were registered for the B zirconia samples, followed by K-H and N samples, while the lowest values were obtained for the K-S specimens. The study

proved that the bending test is in correlation with the particle size and distribution, but also with the presence of certain defects in the zirconia-based material. Nevertheless, all investigated materials have exhibited higher fracture toughness values than the ones clinically accepted.

Fiber reinforced composite dental materials

Among the materials used in prosthetic oral rehabilitation are the fiber-reinforced composites (FRCs). This new class of dental reinforced composites was developed with the aim to design materials with enhanced mechanical strength, longer usage, and to acquire other important characteristics, such as specific weight and low cost. Even though they are still the most used materials in medicine due to their exceptional characteristics, metallic materials also present disadvantages such as allergic hypersensitivity, improper weight and/or density, long processing time and perhaps one of the most important factor, the possibility to release metallic ions due to metal corrosion in the oral cavity, an aspect that can alter the normal function of the prosthetic restoration. Dental reinforced composites can be thought of as a suitable substitute of the metallic one, especially since certain diseases can cause fluctuation of the pH of saliva (GERD) between values that can negatively impact the corrosion behavior of the latter one.

Taking these things into account, F. Bechir et al. [12] evaluated the behavior of two high-performance CAD/CAM milled FRC dental materials, namely Trinia and TriLor, in simulated saliva at pH values specific for patients affected by GERD, through immersion tests, in order to determine if there are any changes in terms of weight or surface morphology. The pH values of the Carter Brugirard synthetic saliva used for testing the materials were 5.7, 7.6, and a varied pH (two days immersion in pH 5.7 and one day in pH 3). The tests were performed for 21 days at a temperature of 37 ±1 °C, and at 3, 7, 14, and 21 days, the weight loss/ gain of the samples was assessed. The surface morphology of the samples at 3 and 21 days after immersion was evaluated with a scanning electron microscope.

According to the results obtained, it can be said that irrespective of the pH level, the two CAD/CAM milled FRC materials present a similar evolution of the weight after 21 days, highlighting proper stability when in contact with the synthetic saliva, as following. During the first 7 days of immersion, the weight of the samples decreases, while from day 14th the weight begins to increase, reaching a maximum after 21 days. Moreover, the surface morphology investigations have indicated that FRC biomaterials do not present notable differences and that the immersion tests did not alter the surface morphology regardless of the immersion time and/ or pH value of the medium.

The authors, who also refer to the limits of their study [12], concluded that FRC biomaterials can be seen as a suitable alternative to the metallic ones used for prosthetic frameworks, and represent a feasible alternative for the oral rehabilitation of patients suffering from GERD.

Techniques used to increase apatite formation

The need to enhance the behavior and performance of implantable biomaterials during their interaction and staying in the human body without affecting their properties, biocompatibility, and biomechanical characteristic has given rise to smart tunable surfaces [13]. Biological fixation is considered a pre-request for long-term success of any implant. The quality, efficiency, and healing period associated with the osseointegration process are intercorrelated with the surface properties of the implant, among which the surface chemical composition and roughness are key players in implant-tissue interaction and behavior [14].

Researchers around the world have focused on developing various surface engineering tools to obtain tunable surface properties of the implants. Of the methods used for this purpose, the following can be found machining/ micromachining, airborne-particle

abrasion, acid etching, electropolishing, anodic oxidation, electrochemical deposition, pulsed laser deposition, chemical and physical vapor deposition, and plasma spraying [15–17].

To increase the apatite formation ability of titanium (cp-Ti), well-known for its superior biocompatibility and excellent corrosion resistance, C. M. Cotrut et al. [18] evaluated the influence of different surface morphologies obtained by mechanical (grinding and polishing prepared (M) and airborne-particle abrasion also known as sandblasting (S)) and chemical (anodic oxidation (A)) surface modification techniques, on the biomineralization capacity and corrosion behavior. The obtained surface morphologies were as follows: (i) the grinded and polished materials present a smooth surface with some minor scratches; (ii) the surfaces prepared by airborne-particle abrasion reveal an irregular morphology with signs of plastic deformations; (iii) the surface that suffers the anodic oxidation treatment reveal a morphology consisting in aligned TiO_2 nanotubes (NT), vertically oriented, hollow, that can also be described as parallel tubular structures, uniformly distributed on the surface. The surface roughness investigation on the obtained morphologies showed that the sandblasted surfaces registered the highest roughness (approx. 3 μm) followed by the anodized one (180 nm) and the metallographically (80 nm) prepared ones. On the other hand, the contact angle revealed a hydrophilic character of M and A samples and a hydrophobic character of S samples.

The apatite formation ability (biomineralization) of the obtained surfaces was investigated through immersion in synthetic body fluid (SBF) at 37 ±1 °C for 14 days. The weight gain of the samples was monitored at 1, 3, 7, and 14 days along with the surface morphology and Ca/P ratio of the apatite deposited on the developed surfaces.

The study has shown that all three surface modification techniques can improve the bioactive character of cp-Ti through simple and cost-effective methods that can be successfully implemented to obtain medical devices with enhanced features. As a general remark of the study, it can be said that a contact angle lower than 90°, which indicates a hydrophilic surface coupled with a roughness in the nanometric scale (under 200 nm) favors the nucleation and growth of a newly apatite layer, thus indicating an enhanced bioactive character and higher osseointegration. Thus, the highest weight gain of apatite was found for the surfaces modified with TiO_2-NT. All the aforementioned were observed for the anodized surfaces, with poorer results being noted for the group which was exposed to airborne particle abrasion [18].

The authors conclude that the presented modification techniques are very friendly and they can be used, adjusted, adopted or coupled with respect to the implantable device design, which can either present a more or less complex geometry in order to obtain biomaterials with advanced and tunable surface properties that can be easily implemented in the medical device market.

Conclusions

This editorial has barely managed to bring into question a small part of the numerous current directions of interest in dental prosthetics regarding the usage of new materials and manufacturing processes. However, it can be said with certainty that the new materials developed along with the advances in the obtaining and processing techniques of dental prosthetic devices are the subject of many ongoing research studies which aim to identify their precise role as accurately as possible in order to improve the life quality and to increase patient satisfaction.

Conflict of interest: None to declare.

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REVIEW

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The influence of smoking on the periodontal biome. A review.

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Abstract

Periodontal disease is believed to be an opportunistic infection due to the interaction of bacterial plaque and the patient's response that may be influenced by environmental, genetic, and other risk factors. In addition to the fact that smoking is considered a risk factor in many systemic diseases, it has also been associated with the initiation of periodontal disease. Smoking is one of the modifiable risk factors and has a significant influence on the development, progress, and results of the treatment of periodontal disease. The current state in the field of study suggests that smoking aids the colonization of periodontal microorganisms, accelerating the onset of periodontal disease. Biological modifications in pathogens, such as Porphyromonas gingivalis, along with poor immune response, influence the variations of subgingival flora in smoking patients. Only with an individual approach can the risk factors of each patient be identified and satisfactory results obtained. The aim of this paper is to present a comprehensive review of the influence of smoking on periodontal microbiome and the importance of adopting the appropriate treatment method according to the influence of this risk factor on healing.

Keywords: smoking, periodontal disease, dental plaque, bleeding, teeth.

Introduction

Periodontitis is a group of inflammatory conditions that affect the components of the periodontal complex: gingiva, periodontal ligaments, and alveolar bone. It affects more than 90% of the population globally, being one of the most prevalent conditions in adults [1]. Besides tooth decay, periodontal disease is the main cause of tooth loss in adults [2].

A review of the current literature was commenced in order to debate the influence of smoking on the periodontal biome. Electronic searches were performed in PubMed, Embase, and Scopus in order to identify and include articles regarding this subject using the keywords "smoking", "dental plaque", "tobacco" and "periodontal disease". Manual searches of published articles and related reviews were performed as well for completing the research necessary in writing this paper. Only original prospective longitudinal observational studies up to April 2022 that investigated the association between smoking and the onset and progression of periodontal disease were included in this research. Articles that did not meet the inclusion citeria were not considered for our paper. Seventy-three articles were identified in our research, of which, 33 were included in the writing of this review.

The initial symptoms are pre-existing erythema, hypertension, and gingival bleeding. However, gingivitis does not affect the supporting structures of the teeth and is reversible. When gingivitis is not correctly treated, it progresses to periodontitis [3].

Despite all the campaigns carried out to raise awareness of the harmful effects of smoking on general health, it still remains a widespread addiction around the world. The number of smokers exceeds 1.1 billion worldwide, killing about 8 million people yearly. Smoking is a risk factor in the onset of various conditions such as cardiovascular, lung, and periodontal disease, as well as cancer. [4].

Smoking is considered, after dental plaque, an important risk factor in the occurrence of periodontal disease, influencing its prevalence, progression, severity, and response to treatment. Epidemiological studies have shown a considerably higher risk of periodontal disease for smoking patients. This is linked to the duration and frequency of smoking [5]. In addition, smoking has a negative influence on

surgical and non-surgical treatments, with tissues having a much slower healing rate [6].

Given the harmful effects of tobacco on periodontal health, it is important to comprehend the basic mechanisms by which smoking affects the normal structure of periodontal tissues. It was accepted that both the host's response and the periodontal microflora play essential roles in the onset, severity, and evolution of periodontal disease. Numerous studies discuss the consequences of smoking on the host's response, demonstrating that smoking increases the risk of infection and susceptibility of the host by inducing immune dysfunction [7]. However, further research into the effects of smoking on the periodontal complex is needed, with some mechanisms still being unclear.

Smoking and subgingival microflora

The complex mixture generated by burning tobacco consists of more than five thousand chemicals with mutagenic, cytotoxic, carcinogenic, and antigenic properties [8]. Nicotine is the best known constituent. It is considered to have an important contribution to the development of addiction. Thus, nicotine and its main metabolite called cotinine have been utilized to research the influence of smoking on periodontal microbiome. Smoking acts locally by depositing nicotine, combustion products and hydrocarbons on dental and root surfaces, facilitating the formation of dental plaque [9, 10].

Pathogens found in smokers

The bacterial etiology of periodontal disease has been the main focus, over the last decades, with numerous suppositions being postulated.

The main pathogen involved in the onset and evolution of periodontal disease was considered to be Porphyromonas gingivalis. As recent studies have shown, Porphyromonas gingivalis has an increased impact on the oral microbiota, being able to influence the host's immune response through various pathways, eventually inducing periodontal disease [11, 12]. Streptoccocus gordonii plays a key role in initiating the formation of dental biofilm allowing its attachment to dental surfaces, and generation of mature film. Recent studies have shown that tobacco can increase the growth of Candida albicans, all these effects stimulating the subsequent attachment of pathogenic microorganisms, the formation of dental tartar and the progression of periodontal disease in smoking patients. The main pathogens found in the crevicular fluid of smokers are presented in Table 1 [13].

Table 1. Main pathogens found in smoker's crevicular fluid

YEAR	RESEARCHER	PATHOGENS
1917	Meyer	Spirochetes, Fusiforms, Streptococci
1956	McDonald	Mixed anaerobic bacteria
1988	Holt	Porphyromonas gingivalis, Treponema denticola, Tanerella forsithensia
2009	Zeller	Fusobacterium nucleatum, Filifactor alocis
2009	Cogo	Actinobacillus actinomycetemcomitans
2010	Tymkiw	Candida albicans
2011	Bagaitkar	Streptococcus gordonii
2014	Guglielmetti	Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, Treponema denticola, Tanerella forsithensia
2017	Karasneh	Treponema amylovorun
2022	Xu	Dialister, Selenomonas, Leptotrichia

The impact of nicotine on the periodontal defense system

The defense systems of the periodontal complex are represented by the epithelial barrier, saliva, immune cells and crevicular fluid. All of the above have a significant role in the conservation of the periodontal tissue against bacterial invasion and destruction. The first line of defense against bacterial aggression and harmful environmental stimuli is constituted by epithelial cells. Despite the fact that numerous studies have been performed on the effects of tobacco on the host cell, these have still not been fully elucidated. Porphyromonas gingivalis has been found to induce low levels of IL-8 and IL-1β on epithelial cells, leading to increased neutrophil levels. Exposure to tobacco reduces the proinflammatory burden of cytokines, which may promote invasion and survival of Porphyromonas gingingivalis [14].

One hypothesis for increasing periodontal changes in smokers is that periodontal pockets tend to be more anaerobic compared to non-smokers. However, studies have failed to show a significant difference in subgingival flora in smokers and non-smokers. Some researchers have suggested that smoking can influence the host's response in two ways: smoking could alter the host response by neutralizing the infection and can alter the host's response by destroying surrounding healthy tissues.

Numerous studies have shown that the effect of smoking on the periodontium may involve both processes. Smokers tend to have a low number of T-helper lymphocytes, which are important cells for the immune system with a role in regulating cell-mediated immunity and activating B lymphocytes [15]. Several studies have shown that tobacco has a detrimental effect on neutrophil function. Smoking has been shown to affect phagocytosis and chemotaxis of both oral and peripheral neutrophils. Neutrophils can be found in inflammatory lesions, especially acute lesions, and are chemically attracted to a process called chemotaxis. Once the neutrophils have reached the site of the lesion, they absorb and destroy microorganisms and can neutralize other harmful substances. The low number of neutrophils has been shown to contribute to severe periodontal destruction [16].

Smoking also causes decreased blood flow and damage to tissue revascularization, resulting in delayed healing. Nicotine generates contraction of vascular endothelial cells, making gingivitis less clinically evident furthermore it reduces crevicular fluid and immune cells. Untreated, gingivitis easily passes into the periodontitis stage [17].

While tobacco cigarette smoking has been proven to be a risk factor for periodontitis, limited information is available regarding e-cigarettes, a new alternative to smoking that has been branded as less harmful. Recent studies have proved that e-cigarette smoking increases oxidative stress, inflammatory responses, change in pulmonary cellular behavior, and stimulates DNA injury. Moreover, in vitro studies demonstrate that the flavoring agents that are combined with the aerosol of e-cigarettes have been shown to enhance DNA injury and the increase of several inflammatory proteins such as cyclooxygenase and prostaglandin E2 in gingival cells. [18, 19]

Chewable tobacco products such as pan, guthka, mawa, khaini, zarda, and quimam are popular. Long-term studies are required to be performed in such patients to evaluate the effects of tobacco on periodontal tissues and also to determine response to non-surgical therapy. [20]

The effects of smoking on alveolar bone

Smoking alters the metabolism of the alveolar bone and induces bone loss. Nicotine has been shown to significantly reduce trabecular bone volume, trabecular thickness, bone mineralization and can cause bone destruction, bleeding and even necrosis. Tobacco also reduces angiogenesis, affects bone remodeling during orthodontic tooth movement, and delays the pairing process of collagen in the bone matrix.

Osteoclasts and osteoblasts play a vital role in bone remodeling. Tooth loss is mainly the

result of bone resorption, which indicates increased activity of osteoclasts. The formation of osteoclasts in periodontal tissue is performed in several stages led by osteoclast genesis, which supports cells such as periodontal ligament cells CD4 + T cells, and inflammatory cytokines that induce osteoclast genesis [21]. Nicotine can also inhibit osteoblast differentiation. Furthermore, nicotine can speed up the metabolic rate of the bone matrix, can alter the migration and adhesion of osteoclasts and can generate osteoblast apoptosis, thus destroying the balance of bone resorption and apposition [22].

The effects of smoking on periodontal treatment

As a result of smokers having different clinical expression of periodontal disease compared to non-smokers, there is no surprise that they react differently to treatment.

Although clinical parameters, such as probing, bleeding index, and periodontal pocket depth, improved after non-surgical and/ or surgical treatment, a higher prevalence of periodontal pathogens was observed in smokers. It has also been found that smokers are more vulnerable to the restoration of a microbial subgingival plaque after scaling and root planning [23, 19].

Smoking endangers numerous aspects of innate and adaptive immune mechanisms. The general impression is that smoking affects the protective response and stimulates the inflammatory response, hence accelerating the evolution of periodontal disease. Both in vivo and in vitro studies have shown that smoking affects phagocytosis of neutrophils in periodontitis, which leads to inadequate elimination of microorganisms and increases bacterial colonization. Smoking has been demonstrated to have an inverse correlation with the level of G immunoglobulin (IgG) antibodies specific to certain periodontal agents. Low levels of IgG antibody can affect the host's immune response and may have a protective effect on periodontal microorganisms.

Discussion

A study conducted in New York on 1361 participants, aged between 20 and 74 years, showed that severe bone loss is more common in smoking patients than in non-smokers [24].

Another study in Sweden, with 540 subjects aged between 20 and 70 years, concluded that smoking, high bacterial plaque index, and old age are important risk factors for periodontal disease [25].

A longitudinal study of 273 Swedes over a 10-year period found that the risk associated with tooth loss was 78% for subjects who smoked more than 15 cigarettes a day [26].

Smoking was found to be the most important factor affecting the course of periodontal disease in a study of 499 Finnish men [27].

A study was conducted in India involving 400 men (200 smokers, 200 non-smokers) between the ages of 18 and 65, proving that periodontal disease showed statistically significant changes in smokers, with diminished gingival bleeding and deeper periodontal pockets. [28].

Some studies found a significant difference in the subgingival microbial flora present in smokers compared to non-smokers [29, 30], while others did not find statistically significant differences in the occurrence of periodontal disease-associated bacteria between smokers and non-smokers [31, 32, 33].

Conclusion

In conclusion, smoking is a dominant risk factor associated with the evolution of periodontal disease. Smoking can create a pathogenic subgingival microbiota in the periodontal complex, can reduce the host's resistance against gingivitis, and can aggravate the condition of the periodontium by turning gingivitis into periodontitis. The subgingival biome responds poorly to periodontal treatment in smokers, with a significant improvement in periodontal status with smoking cessation.

The treatment of patients with periodontal disease should be focused on understanding the relationship between environmental and genetic factors. An individual approach is required, tailored to each clinical case, to identify the patient's risks and to obtain satisfactory results.

Although much research has been done on the effects of smoking in periodontal disease, further research is needed to provide serious evidence about the underlying mechanisms.

Conflict of interest: None to declare.

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Use of different matrix systems in the treatment of simple caries.

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Abstract

Dental matrix systems are instruments used in the treatment of simple caries which replace the missing wall of the tooth during restoration. The aim of the study is to evaluate, using a questionnaire-based survey, the most used matrix systems among dentists and dentistry students. Materials and methods: Two hundred and fifty questionnaires containing 8 questions were distributed in electronic and printed format to dentists in Mureș and Harghita countries and dentistry students from 4th to 6th year of study at George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș. The obtained data were then analyzed using Microsoft Excel and SSPS 20.0.0. Statistical analysis was performed using the one tailed ANOVA and Tukey/ Kramer test. Significance level was set at a value of $p<0.05$. Results: Of the persons who completed the questionnaire 97.78% consider it important to use a matrix system during tooth restoration, 98.25 % use it when restoring class II Black cavities. Sectional matrixes are used most commonly during class II Black cavity restoration, for MOD cavities the circular matrix systems are the preferred ones. During class V Black cavity restoration only 5.45% of the doctors and students use a matrix system. Wooden wedge is used most frequently in combination with a matrix system. Only 3.3% always ask for a control X-ray after a tooth restoration. Conclusion: The use of matrix systems is considered to be very important by both dental students and dentists in the restoration of simple caries lesions and are most commonly used for a Black class II, III, IV, and MOD cavity. More importance should be given to follow-up X-rays after tooth restoration.

Keywords: dental matrix systems, tooth restoration, dental wedges, control X-ray.

Introduction

During teeth restoration three important rules should be followed by every practitioner. The first objective should be the optimization of tooth crown anatomy and function, followed by the conservation of tooth structure utilizing minimal preparation techniques, and finally the esthetical improvement of the restored tooth.

During mastication, deglutition, and phonetics there is a constant transposition of the dentition which results in increased attritional forces and alterations of the proximal contact surface positions. An acceptably restored dentition mandatorily requires that the teeth which come in contact to be in close approximation to each other, thereby the optimum protection of the oral tissues is maintained.

Absent or incorrect proximal contact points/ surfaces may result in a poorly aligned dentition. Displacement of teeth may cause food impaction, secondary caries formation, and periodontal disease [1].

Dental matrix systems are instruments used in the treatment of simple caries which replace the missing proximal wall of the tooth during restoration. Thereby the aim of the matrix systems is to restore the integrity of the tooth or replace the missing part, which includes establishing the appropriate interproximal contact point [2-4]. Interproximal contact points are essential elements that preserve the integrity of dental arches and stabilize teeth [5,6].

The aim of the study is to evaluate, using a questionnaire-based survey, the most used matrix systems during proximal wall restorations in simple caries treatment among dentists and dentistry students.

Material and methods

The research was carried out on a prospective basis based on questionnaires [7]. The questionnaires were completed by dentists in Harghita and Mureş countries. Also, students studying dentistry (4-6th year) at George Emil Palade University of Medicine,

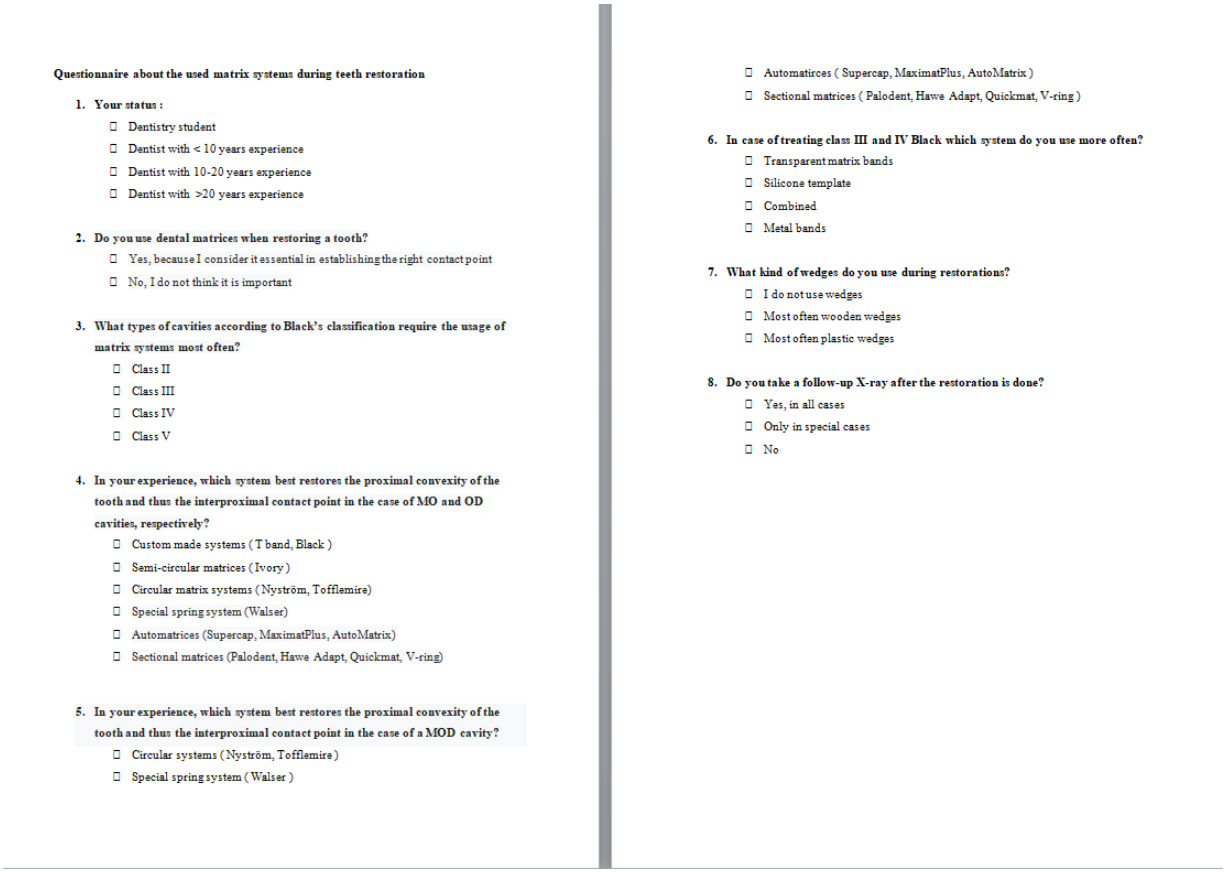
Pharmacy, Science, and Technology of Târgu Mureş, Romania were included in the study.

The questionnaires were distributed in electronic and printed forms. The electronic form was edited with the help of Google Forms which was then distributed to the doctors with the help of social media. The printed questionnaires were used to assess the professional knowledge of dental students as well as the knowledge of dentists in Mureş and Harghita counties.

Two hundred and fifty questionnaires were distributed in Romanian, Hungarian, and English languages.

The questionnaire contains 8 questions. The first question, regarding the status of the persons who completed the questionnaire, and the second, which refers to the responder's habit regarding matrix system usage are single answers. The next four questions, from 3rd to 6th, had to be answered only by those who used matrix systems in their daily practice. In this case responders could choose multiple answers. The last two questions, about the used wedges and control X-ray request, had only one possible answer (figure 1).

While 4 respondents answered that they did not use matrices during teeth restoration, they were excluded from the following 4 questions regarding the matrix system usage in their daily practice.



Questionnaire about the used matrix systems during teeth restoration

1. **Your status :**
   - ☐ Dentistry student
   - ☐ Dentist with < 10 years experience
   - ☐ Dentist with 10-20 years experience
   - ☐ Dentist with >20 years experience

2. **Do you use dental matrices when restoring a tooth?**
   - ☐ Yes, because I consider it essential in establishing the right contact point
   - ☐ No, I do not think it is important

3. **What types of cavities according to Black's classification require the usage of matrix systems most often?**
   - ☐ Class II
   - ☐ Class III
   - ☐ Class IV
   - ☐ Class V

4. **In your experience, which system best restores the proximal convexity of the tooth and thus the interproximal contact point in the case of MO and OD cavities, respectively?**
   - ☐ Custom made systems (T band, Black)
   - ☐ Semi-circular matrices (Ivory)
   - ☐ Circular matrix systems (Nyström, Tofflemire)
   - ☐ Special spring system (Walser)
   - ☐ Automatrices (Supercap, MaximatPlus, AutoMatrix)
   - ☐ Sectional matrices (Palodent, Hawe Adapt, Quickmat, V-ring)

5. **In your experience, which system best restores the proximal convexity of the tooth and thus the interproximal contact point in the case of a MOD cavity?**
   - ☐ Circular systems (Nyström, Tofflemire)
   - ☐ Special spring system (Walser)
   - ☐ Automatirces (Supercap, MaximatPlus, AutoMatrix)
   - ☐ Sectional matrices (Palodent, Hawe Adapt, Quickmat, V-ring)

6. **In case of treating class III and IV Black which system do you use more often?**
   - ☐ Transparent matrix bands
   - ☐ Silicone template
   - ☐ Combined
   - ☐ Metal bands

7. **What kind of wedges do you use during restorations?**
   - ☐ I do not use wedges
   - ☐ Most often wooden wedges
   - ☐ Most often plastic wedges

8. **Do you take a follow-up X-ray after the restoration is done?**
   - ☐ Yes, in all cases
   - ☐ Only in special cases
   - ☐ No

Figure 1. The questionnaire about the matrix systems used during teeth restoration

The obtained data were then processed using Microsoft Excel and SSPS 20.0.0. Statistical analysis was performed using one-tailed ANOVA and Tukey/Kramer Test. Significance level was set at a value of $p<0.05$.

Results

The questionnaire was answered by 183 persons (73.2%).

According to figure 2, 48 questionnaires (26.23%) were completed by dentistry students, 51 questionnaires (27.87%) by dentists with under 10 years of experience. Forty-five questionnaires, 24.59 %, were answered by dentists with 10 to 20 years of experience, and only 39 questionnaires, 21.31%, by dentists with over 20 years of professional experience.

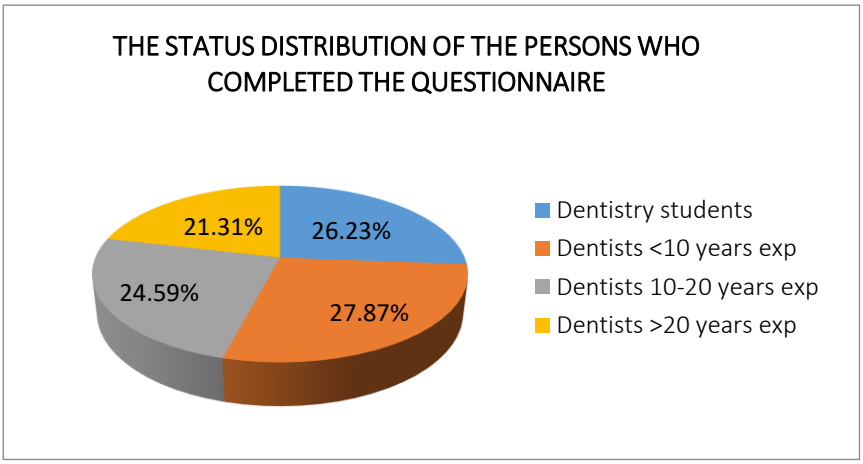


Figure 2. Status distribution of the persons who completed the questionnaire

Matrix systems in everyday restorative treatments are used by 180 students and doctors (97.78%), while 2.22%- 4 persons- do not use matrices during proximal wall restoration as they do not consider it to be important (figure 3). Two students, 1 doctor with less than 10-year experience and 1 doctor with an experience between 10-20 years do not use matrix systems in their practice so they omitted the questions regarding the matrix systems.

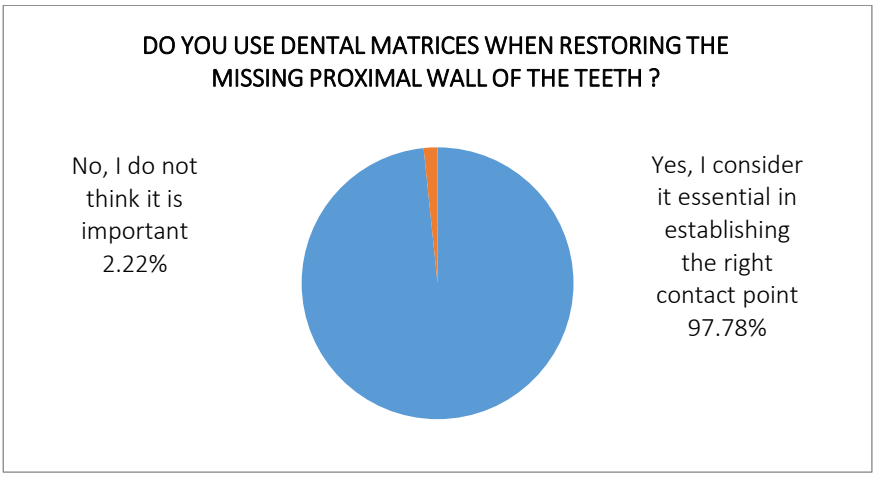


Figure 3. Percentage composition of the matrix system usage during restoration of missing proximal contact points

Of the respondents, 98.25 % use matrix systems during restoration of Class II Black cavities, followed by 68.02% for Class III Black cavities, 61.81% for Class IV Black cavities, and only 5.45% use matrices to restore the Class V Black cavities (figure 4).

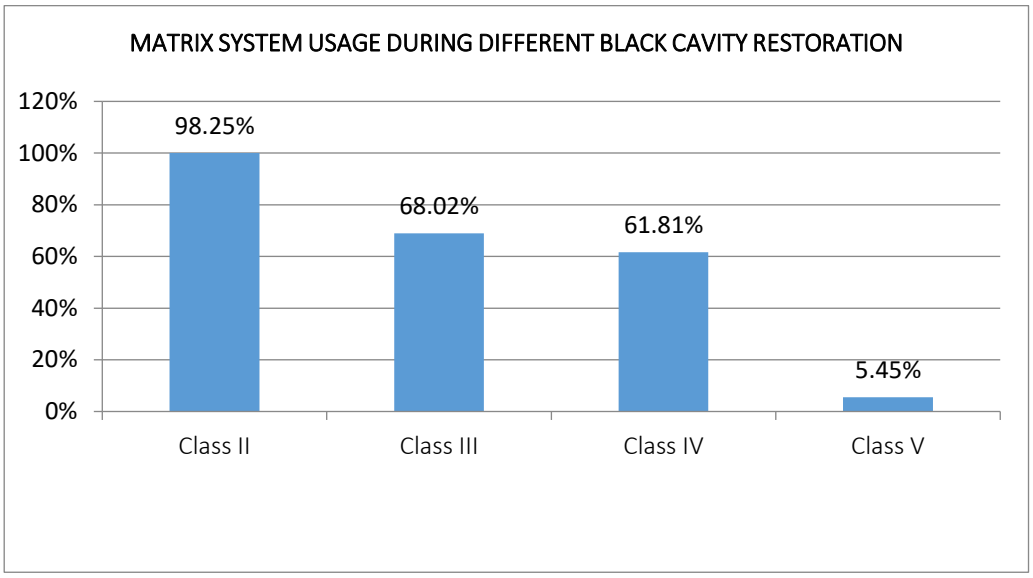


Figure 4. Matrix system usage during different Black cavity restoration

When restoring Class II cavities, dentists with more than 20 years of experience use matrix systems in 100% of the cases, followed by doctors with less than 10-year experience with 98%, doctors with an experience between 10-20 years-97.7% and students, 97.1%.

During Class III cavity restoration, matrix systems are used most frequently by doctors with less than 10-year experience (78.43%), followed by doctors with over 20-year experience and dentists with 10–20-year experience with 69.23% and 68.18%. Students use matrix systems when restoring frontal proximal cavity in only 56.25% of the cases.

In case of Class IV cavity restoration, matrix systems are used more frequently, in 70.59% by doctors with less than 10 years of experience, followed by dentists with more than 20 years of experience in 66.66%, dentists with 10-20 years of experience-60% and less frequently by students, in only 50% of the cases.

When restoring a class V Black cavity, matrix systems are rarely used - in 4.16% by students, 5.88% by doctors with less than 10-year experience, 6.66% by dentists with 10-20-year experience and 5.13% in case of doctors over 20-year experience (figure 5).

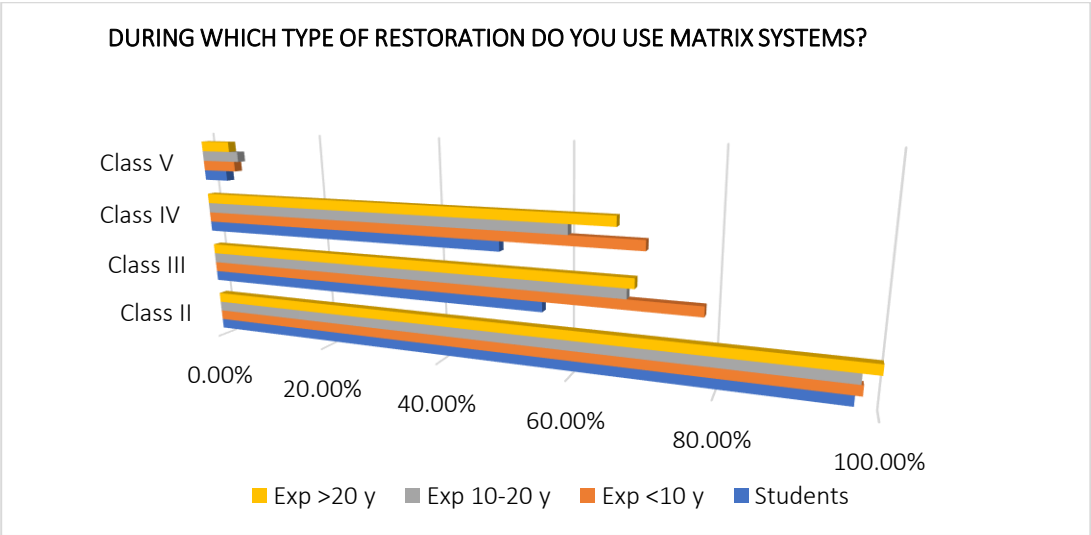


Figure 5. Distribution of the matrix system usage during different Black type cavity restoration in the 4 groups

Statistical analysis showed no significant differences between the 4 groups according to the matrix system usage frequency during restoration of different classes of cavities (figure 6).

Expected values	Students	Doctors 10y exp	Doctors 10-20y exp	Doctors >20y exp
100 100 100 100	97.1 56.25 50 4.16	98 78.43 70.59 5.88	97.7 68.18 60 6.66	100 69.23 66.66 5.13
Skewness:	-0.194636	-1.493339	-0.896119	-1.101232
Excess kurtosis:	1.387382	2.671302	1.745393	2.17268
Normality	0.992	0.4256	0.9139	0.6573
Outliers				
Mean	51.8775	63.225	58.135	60.255
S	38.05557	39.92988	37.9449	39.74924

p=0.9794

Figure 6. Statistical analysis of the distribution of matrix system usage during restoration of different Black type cavities in the 4 groups

According to figure 7, the system that best forms the interproximal contact point and most faithfully returns the anatomical contour of the tooth is the sectional matrix system and this represents 35.6% (94 answers), followed by semicircular systems in 25.76% (68 answers), the third in circular system which is 14.78% (39 answers), automatrices 14.01% (37 answers), special spring systems 6.06% (16 answers) and the last one is custom made systems in 3.7% of the cases (10 answers).

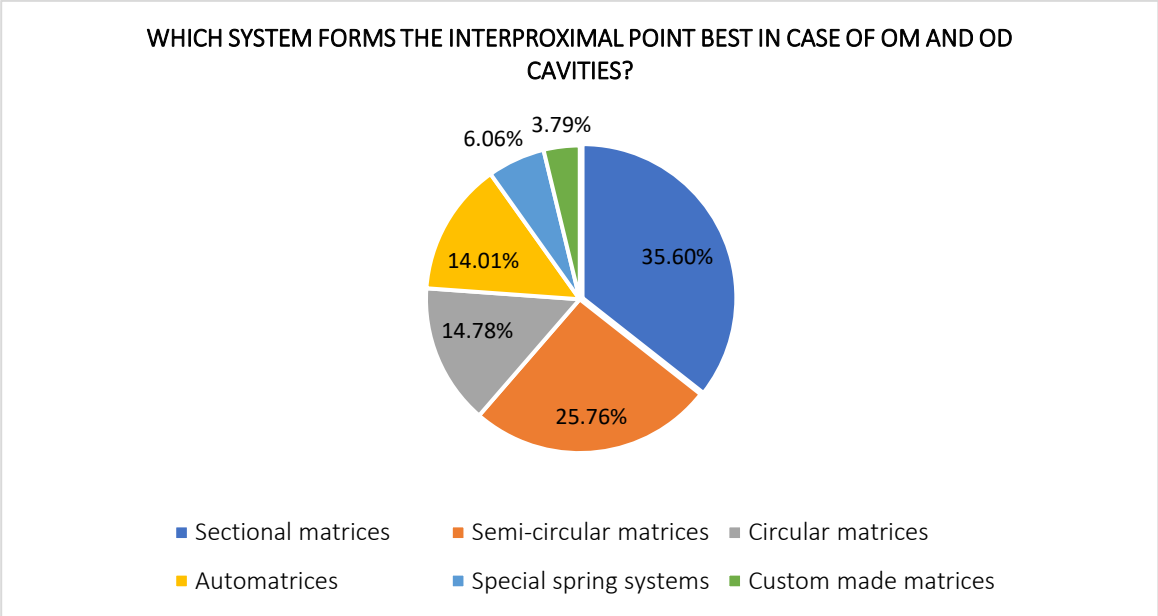


Figure 7. Answer distribution about the matrix system which forms the best interproximal contact point when restoring OM and OD cavities

According to figure 8, the most commonly used system for MOD cavities is circular in 36.32% and sectioned in 34.90%. automatrices are used in 22.18% and less used is the special spring system, which reached 6.60%.

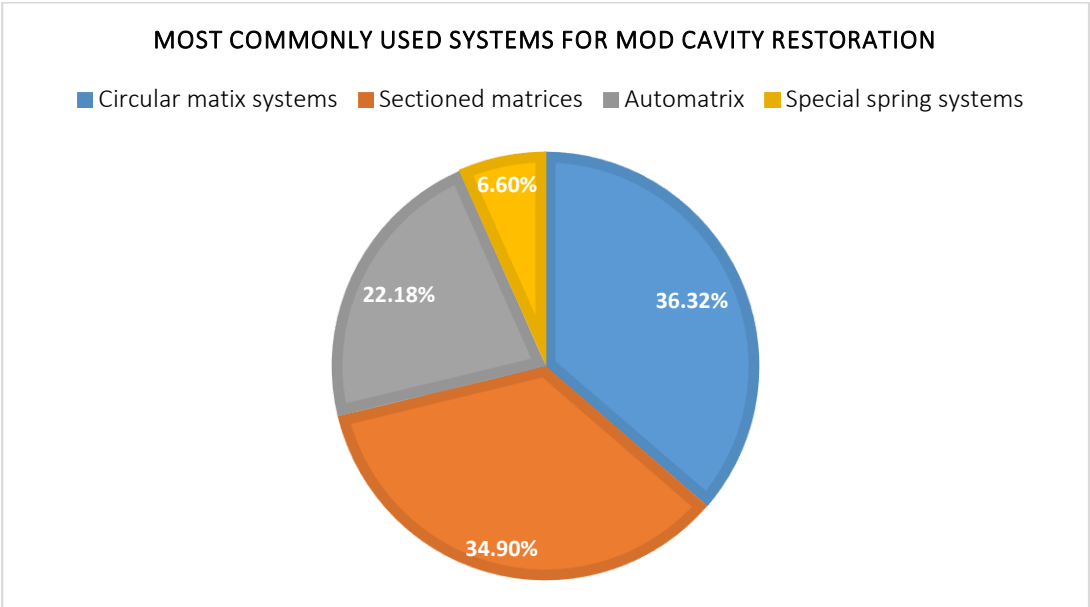


Figure 8. Most commonly used matrix systems for MOD cavity restoration

In case of restoring type III and IV cavities according to Black, celluloid matrices are most often used in 75.51%, followed by mock-ups in 14.79%. A combination of transparent sticker and silicone mock-up is used in 6.63% and less used are the metal matrices in 3.07% (figure 9). As shown in figure 10, 68.3% use a wooden wedge, 26.7% a plastic wedge, and 5% no wedge during the making of the fillings.

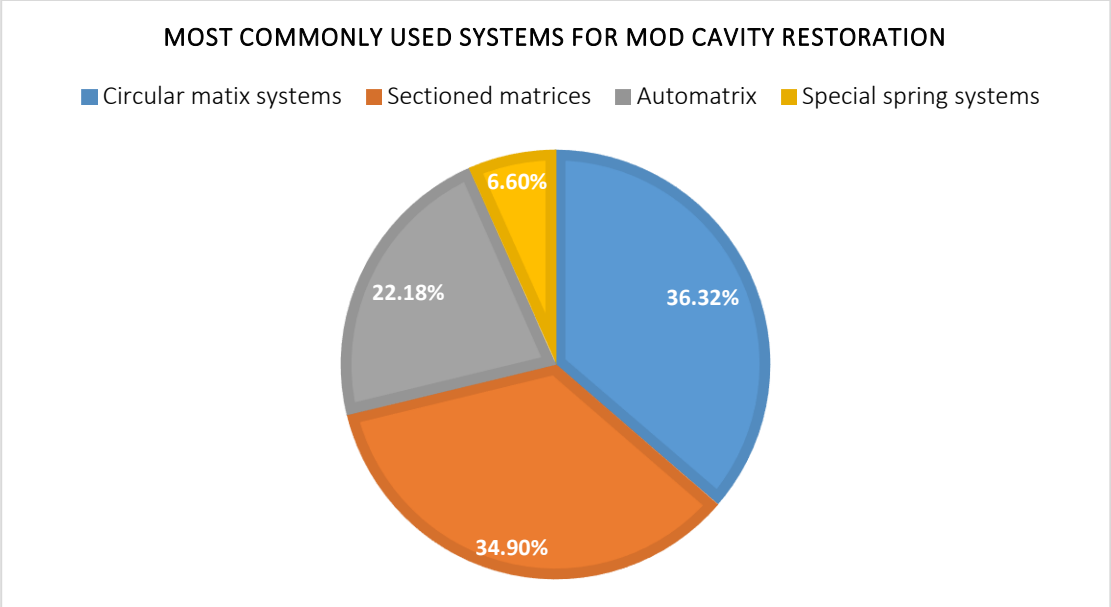


Figure 9. The used matrix systems for class III and class IV Black cavity restoration

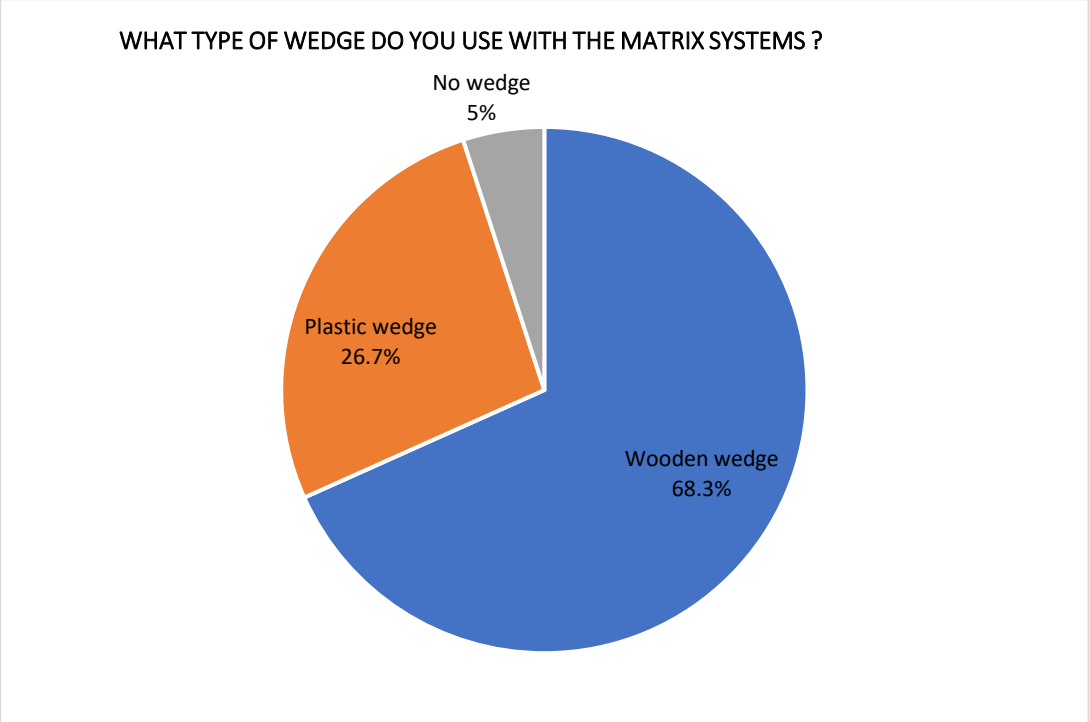


Figure 10. The used wedge types during restoration

Figure 11 shows that 49.2% take control X-rays only in exceptional cases, 47.5% do not take control X-rays, and 3.3% take control X-rays in all cases.

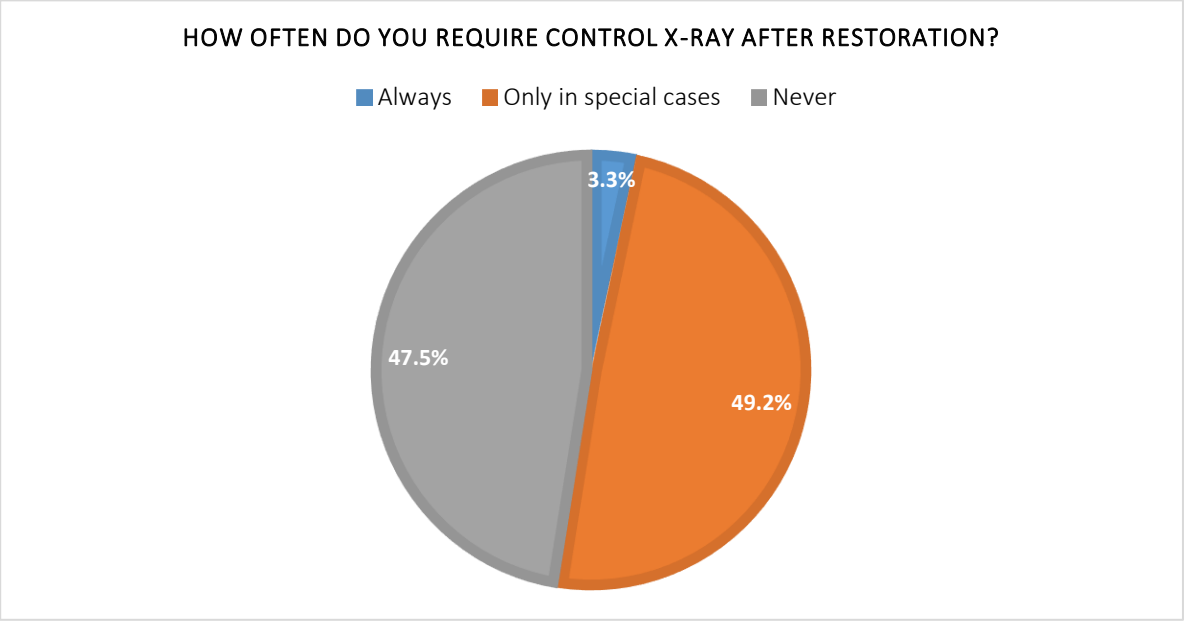


Figure 11. Frequency of requiring control x-ray after simple caries treatment

Discussions

Based on the processed questionnaires, it can be stated that 97.78% of the dentists in Mureş and Harghita counties and the fourth, fifth, and sixth year students of the Faculty of Dentistry studying at the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureş who completed the questionnaire consider the use of matrix systems important during restoration of missing proximal wall.

For Black cavity types, most of the respondents use a matrix system for the Class II cavity and least for the Class V cavity.

The systems considered to form the best interproximal contact points and most faithfully return the anatomical convexity of the tooth in MO and OD cavities are the sectional matrix systems, followed by semicircular systems, and the circular system. The less used matrices are custom made ones.

Similar results were stated by Loomans et al. where sectional systems were compared with circular systems [8].

According to Hua et al., sectional matrix systems formed better contact points and better end strips than the circular systems [9]. Sadaf et al. found in their research that using a sectional matrix band system is considered rather than using a circumferential matrix band system [10]. The results are similar to what we found in our research.

The best system for MOD cavities proved to be the circular system followed by the sectioned ones. There is no significant difference between the two types of systems, but we believe that we obtained false results here because the sectional system is not as well known among dental students as it is among practicing dentists. This is due to the fact that there is no sectioned system available at the faculty of dentistry, thereby students are unfamiliar with it and have no experience in using it.

Similar results were found by Wirsching et al. in their study where MO, OD, and MOD cavities were examined. The results showed that for the 2-surface cavities there was a significant difference between sectioned and circular systems in favor of the sectioned one, but, in contrast for the 3-surface cavities, there was no significant difference between the two types of vignettes [11]. We found comparable

results to our findings in other studies as well [12,13].

The most commonly used systems for Black Type III and Type IV cavities are transparent matrices, followed by a combination of transparent matrix and silicone template, and least often metal matrices.

For the Class V cavity according to Black, most of the persons who completed the questionnaire do not use any system or perhaps very rarely. Here again, we may come across false results because there is no possibility to use matrices among dentistry students for V-class cavities.

Wedging is considered to be essential during proximal wall restoration [14]. Regarding the use of wedges, most people use wooden wedges during proximal wall restoration, followed by plastic wedges. Only a small percentage of those who completed the survey do not use any wedges.

Opinions are divided on control X-rays also. Almost half of the dentists and students require control X-rays only in exceptional cases, the other half do not routinely take control X-rays. Control X-rays are required after simple caries treatment in all cases only by few persons.

Conclusions

1. Sectioned matrix systems are most commonly used during MO and OD Black Class II cavity restoration.

2. For MOD cavities, circular and sectional systems are used most frequently.

3. Celluloid matrices are most commonly used for Class III and IV Black cavities restoration.

4. For Class V Black cavity restoration matrix systems are used only rarely.

5. The most commonly used wedge is the wooden wedge.

6. A higher importance should be given to follow-up X-rays after tooth restoration.

Conflict of interest: None to declare.

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ORIGINAL RESEARCH

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The behavior of aesthetic restoration materials under extreme conditions: in vitro study.

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Abstract

Introduction: Aesthetic materials for direct restorations can suffer changes in the oral cavity due to multiple factors acting at this level. The aim of the study was to demonstrate that aesthetic materials undergo structural changes in texture and chemicals, depending on the nature of the extrinsic factor, concentration, and exposure time. Material and methods: We used 3 types of composites, a self-polymerizing composite, two photo-polymerizing composites, and a glass ionomer. 210 teeth were initially immersed in artificial saliva as a control solution and afterwards immersed into artificial gastric juice, ethyl alcohol, energy drink, and distilled water. With the help of a pH meter, we determined the pH of the substances both before and after immersing the teeth in solutions. The teeth were monitored for 24-48 hours in a thermostat bath at 37 degrees Celsius, after which they were analyzed with the help of a rough meter that measures the smallest surface changes. Results: Significant changes in pH occurred in alcohol, where a considerable decrease was observed after 48h. Also, the alcohol produced the most aggressive changes of texture in the composites, and the smallest changes occured in the composite with nanofiller. The glass ionomer was the most affected of all the materials due to the exposure to both alcohol and artificial gastric juice, respectively energy drinks so that the surface analysis could not be performed. Conclusions: The results of the in vitro study are clinically important because the glass ionomer is much too rotten in these extreme situations. Thus, its use is not recommended both in patients with gastroesophageal reflux as well as in alcoholics and persons consuming energy drinks.

Keywords: aesthetic-materials, roughness, pH, resistance.

Introduction

The diet plays a decisive role in the lifetime of direct restorations. Dental erosion results from the loss of mineral salts from the tooth surface as a result of a chemical process of acid dissolution, with no microbial factor, involved [1]. According to new studies, the term erosion is being replaced with the term corrosion. The Chemical or electrochemical action is called “corrosion", due to both endogenous and exogenous factors [2]. One of the most essential endogenous sources of corrosion is bulimia, which produces a unique pattern of enamel loss. 'Perimolysis' is a type of corrosion marked on the palatal surfaces of the anterior maxillary teeth and, in more severe cases, on the buccal surfaces of the posterior teeth. The location on certain dental veneers highlights the position of the head during vomiting [3]. At the same time, in the case of the patient with gastroesophageal reflux disease, there is a loss of hard substance, but in smaller quantities. Demineralization of the tooth surface can also occur due to excessive consumption of acidic foods and sour drinks such as mangoes, citrus fruits, energy drinks, and sucking sour candies [4-6]. Alcohol abuse is also a factor that can not be neglected as it causes more significant corrosion following regurgitation and vomiting from gastritis associated with alcohol abuse [7,8].

Erosion is dependent on the action of the salivary glands respectively, on the production of saliva, which depending on the quantity and quality, influences the severity of demineralization [9].

Restorative materials used in dentistry must have long-term durability in the oral cavity, this is a complex environment in which the material is in constant contact with saliva and oral fluids. The most important physical properties of restoration materials are surface hardness, which correlates with compressive strength, abrasion resistance, and erosion [10].

The aim of the study

The aim of the study is to demonstrate that aesthetic materials undergo structural changes

in texture and chemicals, depending on the nature of the extrinsic factor, concentration, and exposure time.

Material and methods

In the first part of the study, we analyzed three types of composite from a biochemical point of view, respectively Estelite Quick, Estelite Asteria OcE, and Evicrol. Estelite Quick is a light-curable composite indicated in anterior direct restorations, and composite veneers due to the nanofiller that gives it unique aesthetic qualities. Estelite Asteria OcE is also a light-curable composite, with superior resistance to Estelite Quick and improved aesthetic qualities, thus being indicated both in anterior restorations and in the posterior areas subjected to masticatory stress. Evicrol is part of the category of self-curing composites, with a low resistance to masticatory stress, so it is indicated only in the cavities of class III and V, respectively for certain defects of class IV.

We made a total of sixty perfectly adapted and calibrated tooth samples using a conformer that mimics the dental vestibular surface and allows the correct application of the composite in a uniform layer of 2mm. The composite resin was adapted in the conformer with a unique spatula from LM Dental, which does not allow the gluing of the material, respectively does not influence the chromatic stability of the composite resin. The light-curing was performed with the Bluphase Style lamp by Ivoclar Vivadent. From each type of resin were made twenty samples, ten with oxygen barrier, and ten without the oxygen barrier. The oxygen barrier is essential to prevent the over polymerization of the outer layer of the composite. In the case of the self-curing composite, we followed the manufacturer's instructions regarding the doses and the setting time. The composite samples were kept in distilled water to avoid dehydration of the resin until their application in substances.

The aggressive substances used to immerse the composite teeth were gastric juice and 90% pure alcohol and the, control solution used was artificial saliva (Figure 1). In six calibrated glass tubes, we added the composite samples, ten from each category, respectively with oxygen barrier and without barrier. In each tube we added 5 ml of aggressive solution, subsequently, all the tubes were incubated at 37 degrees Celsius (Figure 2).

For the biochemistry determinations, it was necessary to measure the initial pH of the substances used, respectively of the artificial saliva, of the artificial gastric juice, and of the pure alcohol, to have a standard. Subsequently, we performed dosing at 24h, 48h, and 96h from the immersion of the composite samples in substances, analyzing the pH changes obtained. The pH was determined using a pH meter (Figure 3).

In the second part of the study, we used three types of composite and glass ionomer cement. The samples (Figure 4) were perfectly adapted and calibrated, with a size of 10x10 mm and a thickness of 2 mm, made with the help of a silicone shaper. For the samples, we chose three types of composite and glass ionomer cement, respectively:

- Evicrol - self-curing composite with macro-filling;
- Filtek Z550 - light-curing composite with nanofillers;
- Estelite Quick - photo-polymerizable composite with nanofiller;
- Kavitan Plus - self-curing glass ionomer cement.

An essential step in obtaining the samples is the stage related to, the observance of the working protocol, respectively the correctness of performing the necessary steps. To fulfill this stage, we observed the doses recommended by each manufacturer regarding the powder: liquid ratio, respectively the time required for photo-polymerization.

The total number of composite tooth samples was 150, which were kept in distilled water to prevent dehydration until the moment of introduction into the substances. As in the case of biochemical dosing, we divided the samples into calibrated glass tubes, finally obtaining 24 tubes. 12 tubes have been preserved for 24 hours, and the other half for 48 hours. Each type of composite was assigned to three tubes, for gastric juice, alcohol, and energizer. In each tube, a quantity of 5ml of substance was introduced. After 24-48h incubation in the aggressive substances, the

samples were attached to metal support to be analyzed. With the help of a rough meter, we analyze the composite sample on its entire surface. As a principle of operation, the rough-meter consisted of a fixed device with a movable metal rod that at the end had a fine blade, capable of recording the slightest changes in the surface. The specific unit of measurement used by the rough meter is RA 0.8x2 [Fig. 5].

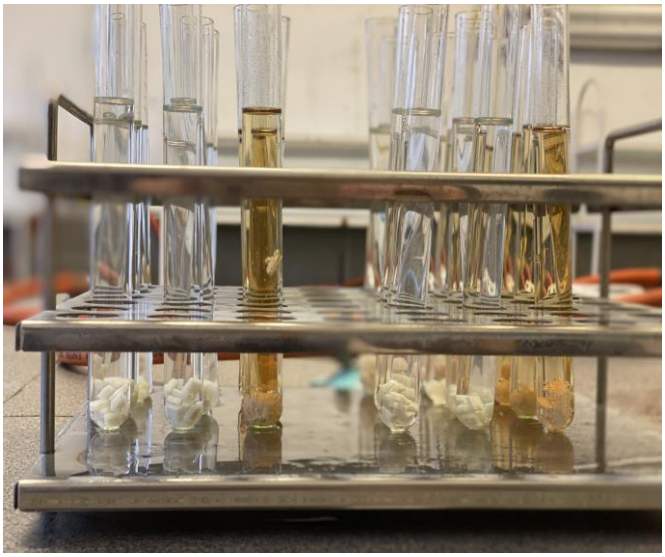

Figure 1. Samples in aggressive substances

Figure 2. Samples in the thermostatic bath at 37°C

Figure 3. pH determination

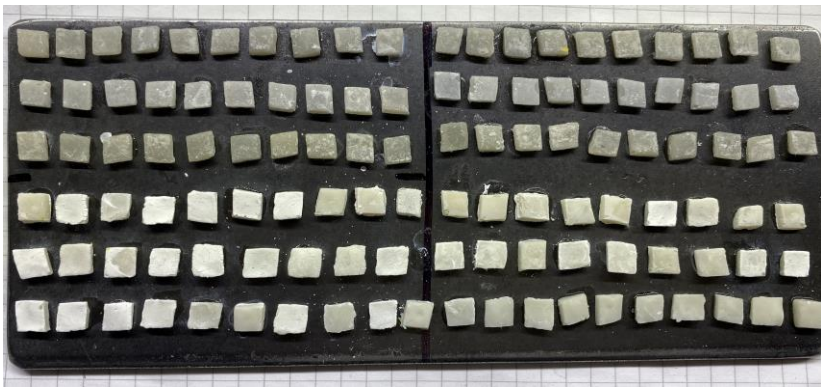

Figure 4. Composite samples

Figure 5. Rough-meter analysis

Results

The results can be divided into two categories, the results following the biochemical analysis with the help of the pH meter and the surface analysis with the help of the rough meter. Before the actual analysis, we determined the initial value of the pH of substances in which composite samples were introduced and we obtained the following values: saliva - 5.42, gastric juice - 2.26, alcohol - 8.7.

The pH analysis after 24 hours from the immersion of the samples in solution shows in the case of gastric juice a value of 2.60, reflecting a slight increase compared to the initial value, which reveals the stability of the sample in the aggressive solution in all 3 types of composites used, both with and without the oxygen barrier. In the case of samples introduced in alcohol, a drastic decrease is observed for the O2 barrier-free composite of 7.56, respectively a less marked decrease for the samples with oxygen barrier. After 48 hours from the immersion of the samples in solution, the analysis shows in the case of gastric juice the constant preservation of the pH value compared to the initial determination for Estelite Astera, respectively a slight decrease in pH in the case of the other 2 types of composite, the barrier of oxygen not influencing the values. In the case of alcohol, there is again a marked decrease in pH for samples without an oxygen barrier, which becomes a protective factor against alcohol. The pH analysis after 96h from the immersion of the samples demonstrated the preservation of the constant value compared to the previous analysis.

The analysis of the surface with the help of the roughness meter revealed the following changes:

- In the case of the Estelite Quick composite introduced in the gastric juice, we found minimum destruction of 1.33 RA 0.8x2 at 24h, respectively maximum destruction of 4.98 RA 0.8x2 at 48h. The samples introduced in alcohol suffered more significant destruction than those in gastric juice, with minimum destruction of 1.49 RA 0.8x2 at 24h and maximum destruction of 14,01 RA 0.8x2 at 48h. The energy drink had the mildest action on the samples with a change of 0.82 RA 0.8x2 at 24h, respectively maximum destruction of 3.96 at 48h.
- In the case of the Filtek Z550 composite introduced in the gastric juice, we found minimum destruction of 1.8 RA 0.8x2 at 24h after immersion, respectively maximum destruction of 10.88 RA 0.8x2, at 48h after immersion. The samples introduced in alcohol underwent minimum destruction of 2.78 RA 0.8x2 at 24h and maximum destruction of 10.77 RA 0.8x2 at 48h. The changes produced by the energizer were the smallest with minimum destruction of 0.39 RA 0.8x2 in 24 hours and maximum destruction of 3.14 RA 0.8x2.
- In the case of the self-curing composite Evicrol, the changes were significant both in the case of samples introduced in gastric juice and alcohol. High values were

recorded both 24 hours and 48 hours after immersion. The minimum destruction recorded was 3.53 RA 0.8x2, and the maximum 12.36 RA 0.8x2. Unfortunately, the glass ionomer samples introduced into the substances were very destroyed and could not be determined, due to the too rough surface.

Discussions

Contraction by the polymerization and the stress associated with them is a major factor governing the success of composite resin restoration. The stresses generated inside the composite resin due to the contraction polymerization process lead to the formation of microcracks on the surface of the composite [11]. The polymerization stress is considered one of the biggest disadvantages of the composite, which emphasizes the destruction of the surface at which it acts [12]. The results of this in vitro study support the hypothesis that the composite resins suffer changes caused by the storage environment and duration, which have a negative influence on the clinical performance and longevity of composite dental resin [13]. Two drinks with a high consumption rate - alcohol and energy drinks - respectively a product of an increasingly common pathology among the population - artificial gastric juice - were selected for the experiment. Significant differences in the micro-hardness and roughness of glass ionomer cement and composite resin immersed in various beverages were identified. Samples immersed in gastric juice and alcohol have undergone the most significant changes, which consist with the results of a similar study [14,15]. The decrease in surface microhardness observed after immersion of the samples (glass ionomer and composite resin) in alcohol, gastric juice, and energy drink may be associated with the hydrolytic degradation caused by these drinks. Water absorption causes a space between the linear chains of the expanding polymers and causes the loss of the chemical bond between the filler and the matrix. Thus, the nanoparticles move from the outer surface, causing a decrease in microhardness [16,17,18]. The increase in surface roughness, observed in glass ionomer cement, can increase bacterial infiltration and adhesion, allowing rapid colonization of microorganisms. Maturation of oral biofilm is associated with increased susceptibility to periodontal disease and dental caries, while color changes affect the aesthetics of restorations [19].

Filtek, a composite resin with nanofiller, with a particle size between 4-20nm compared to Ketak Applicable Universal resulting from mixing the powder with the liquid is much more resistant to bacterial infiltration and roughness is more limited due to its profilometric changes [20]. This study allows a better understanding of the effects of acidic beverages on dental materials, which specifies a certain limitation of them. The results are consistent with other studies, which evaluated different drinks with a low pH, thus proving the importance of this feature in the integrity overtime of dental restorations using direct aesthetic restoration materials. The composition of the materials is also a factor that should not be neglected when talking about the severity of the changes caused by acidic solutions, but other factors such as the presence of alcohol and oral hygiene must also be taken into consideration [21]

Conclusions

1. Direct restorative materials, despite the increased resistance, change as a result of the action of gastric juice, a clinically important aspect in people suffering from bulimia, or gastroesophageal reflux disease;

2. People consuming alcohol have an increased risk to develop chronic gastritis with increased gastroesophageal reflux, so at the level of the oral cavity two aggressive factors, alcohol and gastric juice will simultaneously act on the restorative materials;

3. Energy drinks produce a less significant change on the surface of restoration materials;

4. The restorative material used for people with different pathologies must be chosen with great care, the glass ionomer being contraindicated due to its low resistance.

5. The clearance of saliva influences the severity of the destruction of the surfaces of the restoration materials.

Conflict of interest: None declared.

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CASE REPORT

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The impact of covid-19 on a patient with a severely compromised permanent maxillary central incisor.

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Abstract

The SARS-CoV-2 pandemic situation led to public health measures that forced patients to remain isolated and take steps to prevent the dissemination of the virus. Many of these patients were unable to attend to the dental services or delayed seeking dental care due to a lack of private services and concerns about the SARS-CoV-2 outbreak, which in many cases complicated their situation.

This case report describes the long-term clinical outcome of an endo-periodontal periapical lesion with associated bone defect of a maxillary central incisor in an esthetically demanding, systemically healthy patient, who neglected dental treatment during the pandemic outbreak. Treatment procedures included primary endodontic treatment of the periapical lesion and cause-related therapy aimed to control the infection in the rest of the mouth. Clinical examination at the 1-year recall revealed clinical attachment gain with shallow residual probing pocket depths and a slight increase in gingival recession. The esthetic appearance of the treated tooth was improved via a zirconia-ceramic crown. The present case report suggests that successful periodontal and esthetic results can be accomplished and maintained for at least 2 years after treatment of an apparently hopeless tooth with extremely compromised endo-periodontal conditions.

Keywords: endo-periodontal lesion, oral rehabilitation, COVID-19 pandemic, zircon-ceramic crown.

Introduction

The SARS-CoV-2 outbreak began at end of 2019 in China and quickly spread around the world, officially COVID-19 pandemic was announced in March 2020. Therefore, at the beginning of the COVID-19 pandemic in Romania, most of the private dental practices suspended their activities, which led to a reduction in the delivery of dental care [1, 2].

The outbreak disrupted the delivery of non-essential services on a global scale, leading to more serious and complex problems at a later date. Despite the consequences, private dental practices were obligated to close, to prevent the development of the pandemic, and only in public care were dental emergencies treated. Where the dental procedures were classified according to the risk of infection for the staff and the patients, the key factors influencing the possibility of SARS-CoV-2 infection during a dental visit are aerosol-generating procedures [3-5].

Reduced service availability had a negatively impact on both the acceptability of the service (patients waiting with pain and infection) and long-term oral health of affected patients (the inability to provide continuous care). The pandemic situation forced healthcare decision makers to end all routine, private practices and only urgent dental care was available. In most cases, following triage, the dentists offered self-care advice, or prescribed analgesics or antibiotics, only the most severe acute dental problems were offered emergency dental care [6].

The effects of reduced access to dental care on population will fully show only in the future, and will shed light on the role of dentistry in healthcare. However, dental conditions must not be neglected given the fact that their prevalence has increased and influences general health, the psychological state of the individual, therefore the quality of life and well-being of the patient. [7-10].

Case presentation

A 46-year-old woman presented to our care. Dental history revealed that three months prior the patient presented to the emergency care, where pulp necrosis with acute apical

periodontitis was established in the upper right central incisor. After extraoral access cavity preparation and pulp extirpation, in the root canal devitalizing paste was placed and closed with provisional filling. Due to the COVID-19 pandemic, the patient did not feel comfortable seeking dental care. The patient came to our dental department in May 2020, asking for further evaluation of the possibility of saving the maxillary right incisor and management of the esthetic problems. Since the neighboring teeth showed no defects, the request of the patient was to treat the tooth with a single-tooth supported restoration. Her medical history was noncontributory.

The periapical X-ray revealed evidence of external root resorption with periapical radiolucency and an apparent periodontal ligament space (figure 1A). Intraoral clinical examination showed discoloration on the tooth surface, and excessive mobility of the tooth (fiure. 1B).

A B

Figure 1. A-Radiography shows extensive periapical and lateral translucency; B-Discoloration of central incisor is clearly visible

The tooth was diagnosed as a primary endodontic lesion with secondary periodontal involvement. The patient was informed that the tooth had poor to reserved prognosis due to severe periodontal attachment loss. Following a discussion of the benefits, risks, and alternative treatment options, she decided to keep her tooth. She approved of the dental treatment through written informed consent.

On the same day access was reopened, the working length was determined with an electronic apex locator (Dentsply International Inc., Philadelphia, Pennsylvania) and then confirmed radiographically. Root canals were shaped with the crown-down technique using rotary nickel-titanium instruments (Dentsply International Inc., Philadelphia, Pennsylvania) Solutions of 3% sodium hypochlorite (NaOCl; Sainsbury plc, London, UK) and 17% EDTA (Prevest Denpro Ltd, Jammu, India) were used as root canal irrigants. Root canals were dried with paper points (Dentsply International Inc., Philadelphia, Pennsylvania) and were then filled with calcium hydroxide paste (Ivoclar Vivadent AG, Schaan, Principality of Liechtenstein). Intermediate restorative material (Dentsply Ltd., Weybridge, UK) was used for a temporary filling.

The patient was recalled to finish the final root canal treatment after approximately 3 months. The paste was removed with drills (DENTSPLY Maillefer, Tulsa, Oklahoma), and 3% sodium hypochlorite and 17% EDTA were used as root canal irrigants. Root canals were dried with paper points and were obturated with gutta-percha (Dentsply

International Inc., Philadelphia, Pennsylvania) and Endomethasone (Septodont, France) using lateral condensation technique and the correct and complete root-canal filling was confirmed on a radiograph.

The patient was recalled after 1 week. A temporary splint was made to control tooth mobility and improve the patient's comfort and function, as the occlusal forces were directed away from the teeth to other areas of the oro-facial system (figure 2).

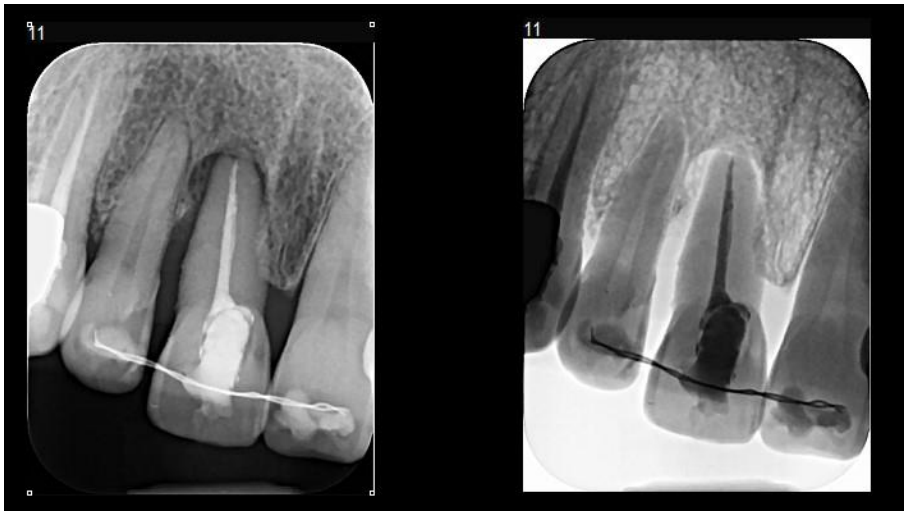

Figure 2. 1 week follow-up radiography, with the complete root-canal filling and the temporary splint

After the 1 month follow-up radiograph, the tooth was prepared for a crown and a conventional impression was taken and a zirconia single crown-frame was fabricated using CAD/CAM technology (DCS Dental) and veneered with a veneering ceramic (Vitadur D, Vita), Finally, the single all ceramic crown was cemented using a glass-ionomer cement (Ketac Cem,3M/ESPE) (figure 3).

Figure 3. Cemented crown in situ

After setting of the cement, remnants were removed and the patient was instructed in proper soft tissue and tooth cleaning. The patient was very satisfied with the esthetic appearance of the treated area.

The 18-month follow-up radiograph showed resolution of most of the periradicular lesions (figure 4). Clinically, the buccal defect healed after one year and the pocket probing depth was normal, except for the distal aspect of 11. The endodontic treatment alone did not

influence the complete healing of the defect, a periodontal treatment is necessary for the further healing of the periradicular area.

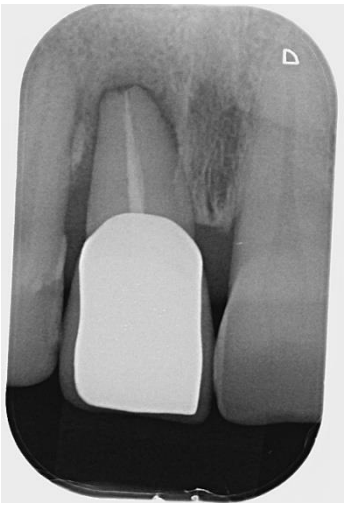

Figure 4. Follow-up radiograph, 18 months after root canal therapy, the resolution of the periradicular bone lesions is evident

Discussions

The COVID-19 pandemic lasted for more than one year and discontinuing dental services for such a long period of time in some cases is threatening for patient's oral health, as such behavior is associated with the appearance of further dental problems or exacerbation of the complications. The ignorance of a continuous treatment can also result in more acute oral problems, which in turn require more expensive, complicated and extended treatment. A study showed that the change in patient behavior was statistically significant during the lockdown period, there was a significant increase in the number of cancelled visits and in the number of patients discontinuing treatment as compared to the year preceding the pandemic. The presumably reason for patients' lack to continue dental care is the fact that during the COVID-19 pandemic, and in line with the guidelines introduced, patients only had the emergency services available. In the emergency care the most important was to reduce pain and protect the patient, and this in turn influenced the attitude towards dental services. The most important in this period was to encourage the public to reduce social contacts and avoid leaving home for unnecessary reasons [8].

Endo-periodontal lesions have been characterized as bacterial infectious diseases that lead to considerable periodontal tissue damage and pulp necrosis. These lesions exist simultaneously in the periodontal and endodontic tissues of the same tooth and can occur because the periodontium and the pulp communicate through different pathways. The primary endodontic lesion with secondary periodontal involvement must first be treated with a root canal therapy to eliminate the ethio-patological factors and to allow the healing of the periapical tissues. This combined endo-periodontal situation becomes a challenge for the clinicians and requires extra considerations. Managing this lesions involves treating both endodontic and periodontal components. Some cases require surgical interventions or even extraction because of poor prognosis. Clinically, when a tooth is diagnosed as having endo-periodontal lesion, the correct assessment of the prognosis of the involved tooth is in adopting a reasonable treatment plan, but, currently, clinicians usually base their diagnostic and treatment plan on their own practical experience [11].

In our case, the endodontic treatment results were evaluated after 2 years, and only then, was the need to apply periodontal treatment considered. Sufficient evidence in the literature reports that this treatment sequence allows enough time for initial tissue healing and better assessment of the periodontal condition. A retrospective study concluded that the endodontic infection stimulates periodontal pocket formation and is a risk in the evolution of periodontitis, thus, a primary endodontic lesion draining through the attachment apparatus should be immediately treated, since an aggressive removal of the periodontal ligament unfavorable affects periodontal healing [12].

Correct root canal treatment controls intrapulpal bacteria and stops the resorption process. In endo-periodontal lesions, infection originates also from the periodontal sulcus and stimulates the pathological process. As proper infection control in the sulcus is unlikely, removal of granulation tissue and sealing are necessary for repair. [13].

The pathogens present affect the integrity of the periodontium, they have to be removed during root canal treatment, so it is critical to control the pulpal bacteria, and calcium hydroxide (CH) appears to be a good choice for treatment when used for several months as medicine. The antibacterial and anti-inflammatory properties and low solubility create a long-term effect in the root canal, and remove the stimulation factor from the main canal, at the same time prohibiting the resorption and the periodontal contamination. [14-16]

Endo-perio lesions may seriously compromise the longevity of a tooth to such an extent that it may result in its early loss. It is, therefore, important to diagnose and remove the intracanal infection that occurs in the initial phase. As first step, the removal of the infected tissues should be initiated prior to any periodontal therapy. This order avoids several complications and helps to create a more advantageous environment for the periodontal recondition. In the combined lesions a periodontal treatment is also important to influence the secondary periodontal disease, because of the communication between the endodontic and periodontal processes, the use of therapeutic drugs is essential to kill any bacteria and to stimulate tissue repair. [17-22].

In this case, the patient requested treatment for esthetic reasons. The esthetic appearance of the treated tooth was improved via the zirconia-ceramic crown. Two years post-treatment both the esthetics and the periodontal health were improved. The present case report suggests that successful periodontal and esthetic results can be achieved and maintained for at least 2 years after regenerative treatment of a tooth with extremely severe periodontal conditions [23, 24].

Conclusions

This case report illustrates how a severely compromised tooth can be successfully treated, with proper diagnosis followed by applying the correct treatment sequence.

Proper and early diagnosis of EPL is critically important and will dictate the appropriate course of treatment, so decision on patient management and treatment should be made by the clinician to provide what is in the patient's best interest, and not the COVID-19 forced healthcare policies.

The presented treatment method would offer an optimal solution for normal and stable occlusion, an adequate width of attached gingiva and good esthetic results of a severely affected tooth. Although first experimental data are encouraging, long-term clinical data are necessary for this treatment solution to be recommended for daily practice.

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CASE REPORT

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The power of ICON infiltration in an adolescent patient. Case report.

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Abstract

Introduction. White spot lesions are early signs of demineralization, which may or may not lead to the development of caries. An inactive white spot lesion might act as an arrested dental caries and affect the esthetic appearance by displaying a milky white color. These lesions need a non-invasive or a minimally invasive treatment. One of the materials taken into consideration in treating these lesions is ICON, a biomimetic material that infiltrates the white spots and can reestablish the esthetic function. The aim of the current study was to evaluate the esthetic efficacy of a minimally invasive technique and a relatively new product on the dental market, ICON, in the treatment of different non-cavitated carious lesions. Case presentation. A 14-year-old patient presented to the dental clinic with asymptomatic, non-cavitating lesions on the cervical aspect of all permanent teeth. The lesions were diagnosed as incipient caries on the buccal, occlusal, and palatal surfaces of the teeth, and the proposed treatment to arrest their progression and improve the esthetic appearance was the use of the ICON infiltration technique. Conclusion. The ICON resin infiltration treatment increased esthetics, visibly diminishing the appearance of non-cavitating carious lesions.

Keywords: ICON, low viscosity resin, white spots, biomimetic restorative dentistry.

Introduction

White spots are defined as the demineralization of the enamel surface and enamel substrate with no cavitation. They are the first clinical observation of the occurrence of dental caries that can be arrested in their evolution. A white opaque appearance characterizes these lesions. Sometimes these lesions are observed in patients who have undergone orthodontic treatment with a fixed appliance hindering oral hygiene and increasing the risk of enamel demineralization [1].

These defects affect dental esthetics, lowering self-esteem [2]. These situations should be treated in a minimally invasive way, leading to better esthetics. Infiltration with low-viscosity resin has proven to be the right treatment, fulfilling both conditions. The material is effective in treating incipient caries, mild and moderate fluorosis, but also in cases of Molar Incisor Hypomineralization (MIH) and other types of opacities [3, 4].

The infiltration of demineralized enamel with a low viscosity light-curing resin resulted in a process of enamel hybridization similar to that occurring in etched dentin. However, unlike etched dentin, the resin forms extensions in the hollow spaces within the demineralized enamel [5].

ICON is a low viscosity resin produced by DMG America. DMG describes its product as a breakthrough product designed for the minimally invasive treatment of incipient and superficial carious lesions [1].

The aim of this study was to verify the esthetic effectiveness of treating incipient caries using a new product emerging from the minimally invasive category of biomimetic dentistry: ICON.

The natural appearance of the tooth is determined by how the incident light beam is absorbed by the tooth tissue and follows a linear path in healthy enamel [6]. The white spot appearance occurs when porosities develop in the enamel, as the tissue structure is altered. In this situation, photons are scattered unevenly, and light will reflect and refract in different directions. The white spot is more visible if the lesion is dehydrated since the crystals in the healthy enamel structure are replaced by organic fluids or air in the case of demineralization. Due to different refractive

indexes, light beam trajectory changes occur. Resin infiltration of the lesion makes the photon passage more homogeneous and results in the loss of the opaque white appearance [7-9].

To mask white spots, it is necessary to replace the enamel porosity with a material having a refractive index as close as possible to that of healthy enamel. By limiting the changes in the path of incident rays, light transmission is achieved similarly to healthy enamel. ICON ensures that part of the light beam is transmitted to the dentin tissue and the other part is reflected to the observer's eye [10]. Given that the refractive indexes of enamel and ICON resin are similar, the difference between them is considered negligible (enamel refractive index = 1.65, ICON refractive index = 1.46-1.52); the light beam will be only slightly or not at all deflected, and the lesion will look like healthy enamel [11].

Case presentation

This study presents the case of a 14-year-old patient who came to the dental clinic for esthetic reasons, with multiple white spot lesions, size 1 and 2 by the Ekstrand index, asymptomatic, chalky in appearance, on different dental surfaces. The lesions were diagnosed as incipient, non-cavitated caries on the buccal, occlusal, and palatal surfaces. The proposed treatment to stop their progression and improve the esthetic appearance was the use of the minimally invasive ICON infiltration technique.

The differential diagnosis of incipient carious lesions was made with non-carious white spots, classified as fluorosis, progressive enamel hypomineralization, Molar Incisor Hypomineralization syndrome, hypomineralization resulting from trauma, and enamel hypoplasia, which may be caused by genetic, environmental factors or rare disease [11-14]. Given the location of the carious lesions at the cervical level, their presence on each tooth, and the fact that palpation with a probe did not reveal any loss of substance, the positive diagnosis was that of incipient carious lesions.

Prior to implementing the ICON treatment, the patient was instructed about oral hygiene and diet and was recommended to use a toothpaste with 1450 particles per million of Fluoride and a Casein phosphopeptide - amorphous calcium fluoride phosphate (CPP-ACFP) paste - the latter for about 6 months, to remineralize the affected teeth. Even with improved hygiene and constant remineralization treatment, the white spots were not fading. Thus, treatment with low viscosity resin was required on all of the patient's teeth.

Various therapeutic procedures complementary to the infiltration technique may be necessary before starting the ICON treatment, depending on the lesion type: bleaching, microabrasion with sandblasting, macroabrasion, and diamond burr polishing [15]. However, complementary treatments were not necessary in the present study.

For the correct and efficient use of the material and to avoid accidents or possible allergic reactions to the constituents of the material, the teeth were isolated using a rubber dam system and dental floss.

Prior to each treatment session, the teeth were cleaned with airflow to remove any exogenous discoloration and infiltrate the substance onto a clean tooth surface.

Six treatment sessions were required to treat all affected areas following the same protocol.

After dam isolation and teeth cleaning, the following protocol was used:

1. ICON-Etch application on the dental surfaces for 2 minutes
2. Washing ICON-Etch for 30 seconds
3. Air drying
4. ICON-Dry application for 30 seconds on each treated surface to visually inspect the demineralization result
5. Air drying
6. These steps were repeated twice more, applying ICON-Etch and ICON-Dry three times on each tooth

7. Following the treatment with the first two components of the ICON system, ICON Infiltrant was applied for 3 minutes
8. Dental floss was used to remove the excess resin present interdentally
9. Light curing the material for 40 seconds
10. ICON Infiltrant was repeated for 1 minute
11. Dental floss was used to remove the excess resin present interdentally
12. Light curing the material for 40 seconds

At the end of the treatment, the treated teeth were refined with polishing discs and prophylaxis brushes.

Because the premolar lesions did not disappear after the first treatment session, it was decided to repeat the protocol in the following treatment sessions. In this case, ICON proved ineffective in the second session as well.

From an aesthetic point of view, the ICON resin infiltration treatment was effective as seen in figure 1 – 6, although not all the spots disappeared completely.

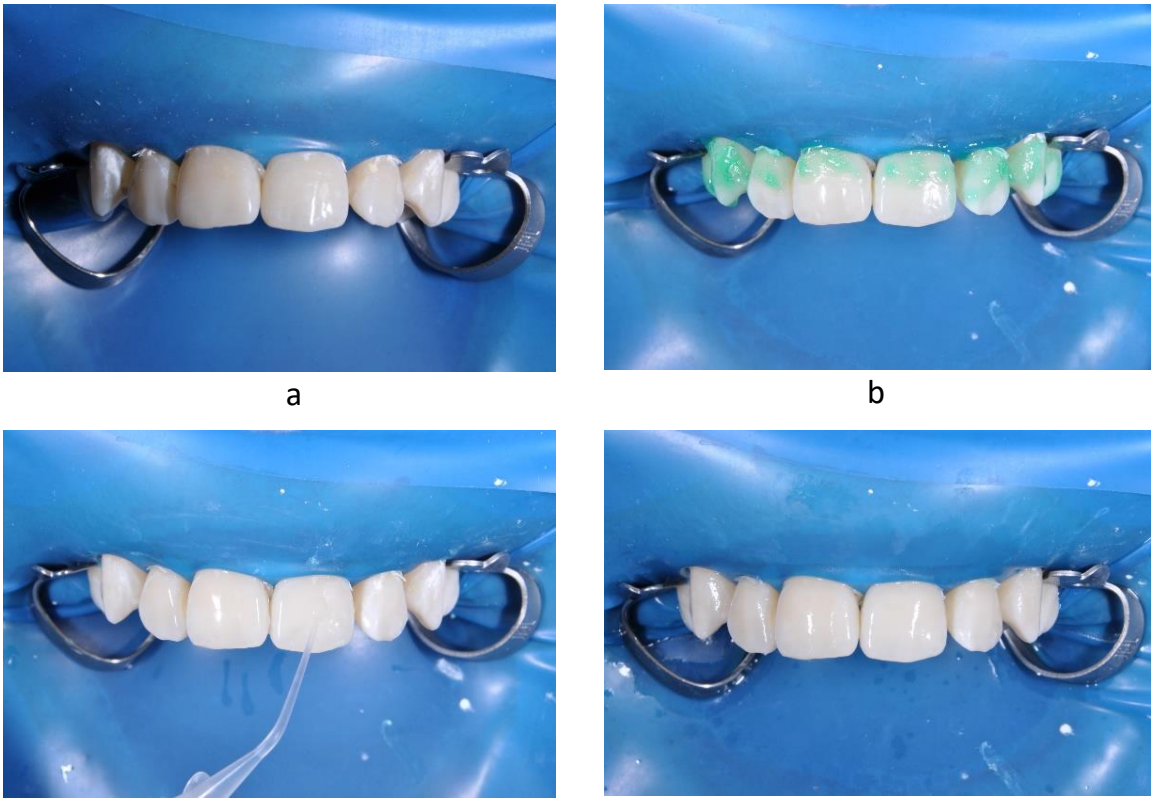
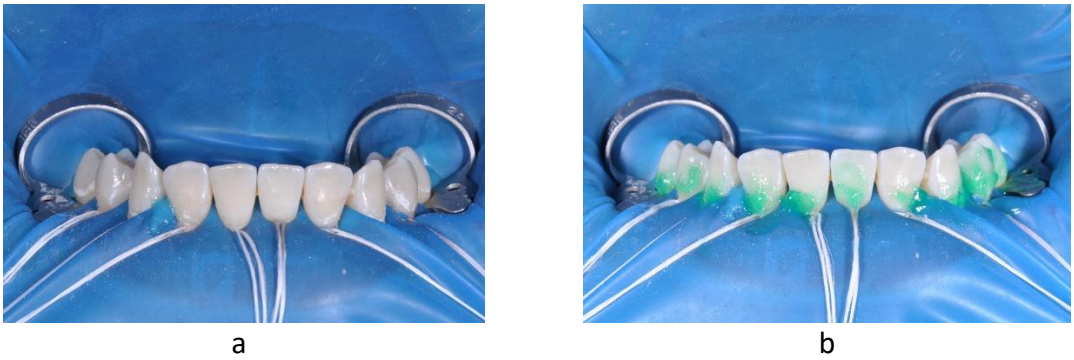
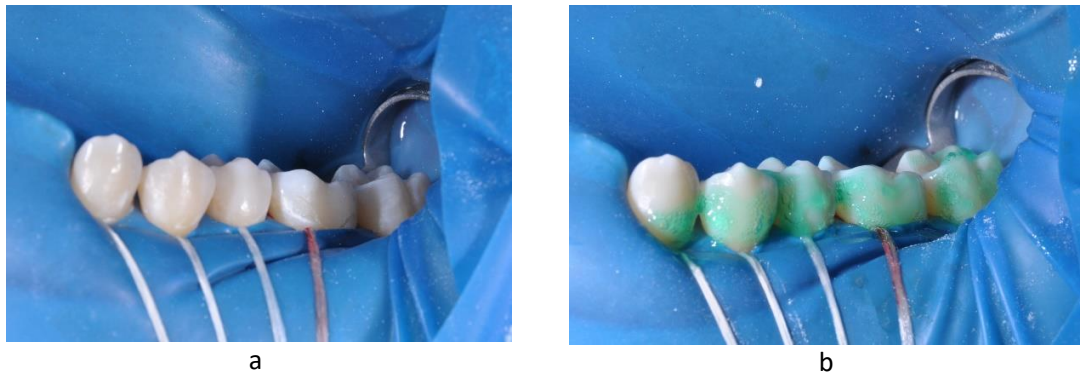


Figure 1. Treatment protocol using ICON in the maxillary frontal area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dry, d-Situation after treatment.



a b c d

Figure 2. Treatment protocol using ICON in the mandibular frontal area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dry; d-Situation after treatment.



a b c d

Figure 3. Treatment protocol using ICON in the left lateral mandibular area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dry; d-Situation after treatment.

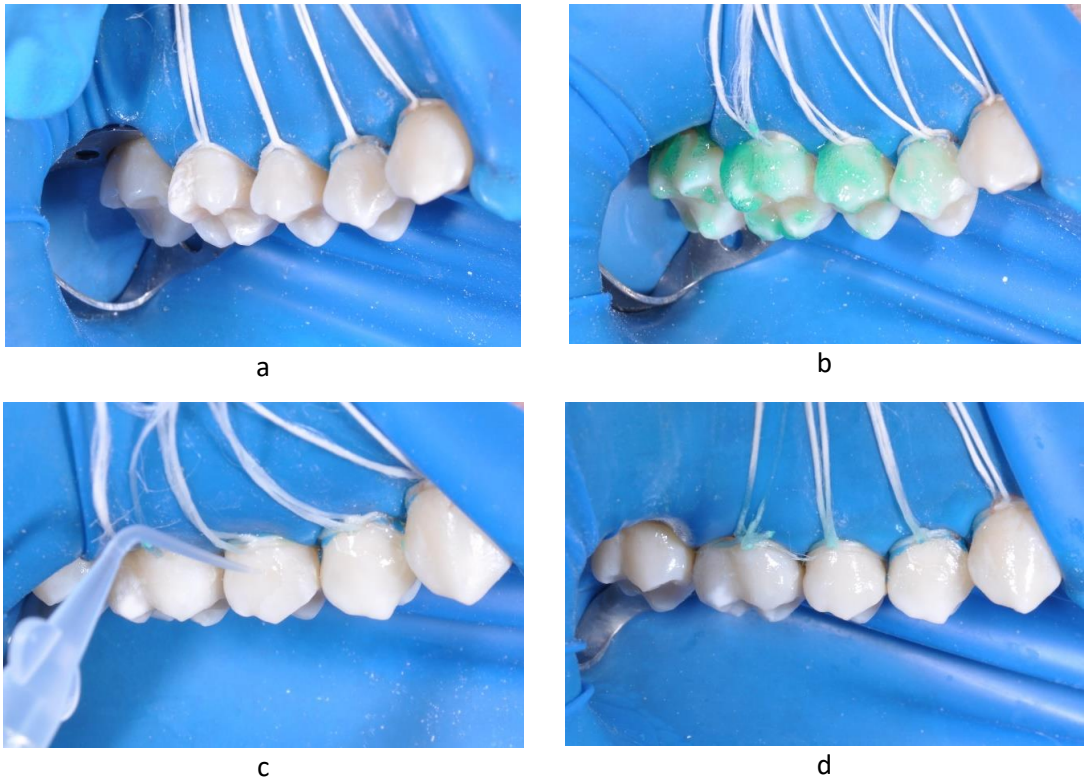


Figure 4. Treatment protocol using ICON in the right maxillary lateral area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dry; d-Situation after treatment

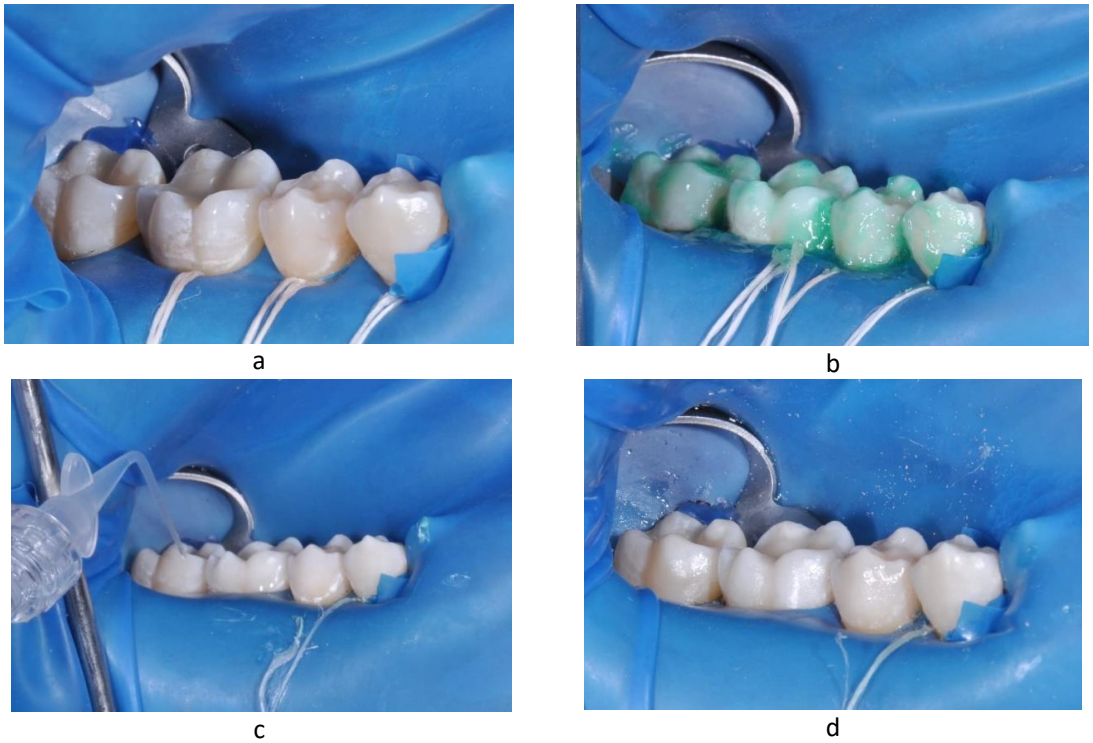


Figure 5. Treatment protocol using ICON in the right lateral mandibular area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dry; d-Situation after treatment.

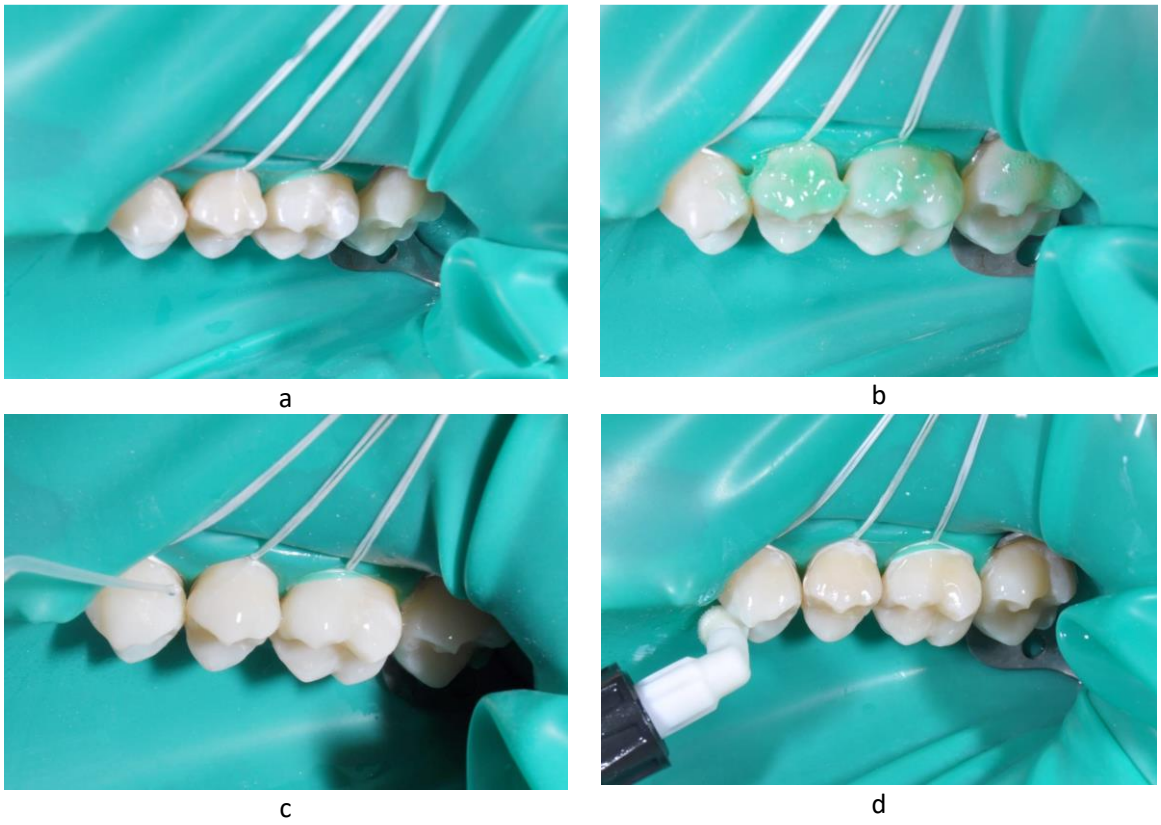


Figure 6. Treatment protocol using ICON in the left maxillary lateral area. a-Situation before treatment; b-Situation during ICON Etch; c-Situation during ICON Dr; d-Situation after treatment.

Of 28 incipient carious lesions, 15 showed Ekstrand 1 carious lesions, and 13 showed Ekstrand 2 carious lesions. After treatment with ICON, 11 Ekstrand 1, and 11 Ekstrand 2 carious lesions disappeared. Figure 7 shows that of 28 incipient carious lesions, 6 lesions were diminished, not completely removed, 4 of them being Ekstrand 1 carious lesions, and two Ekstrand 2.

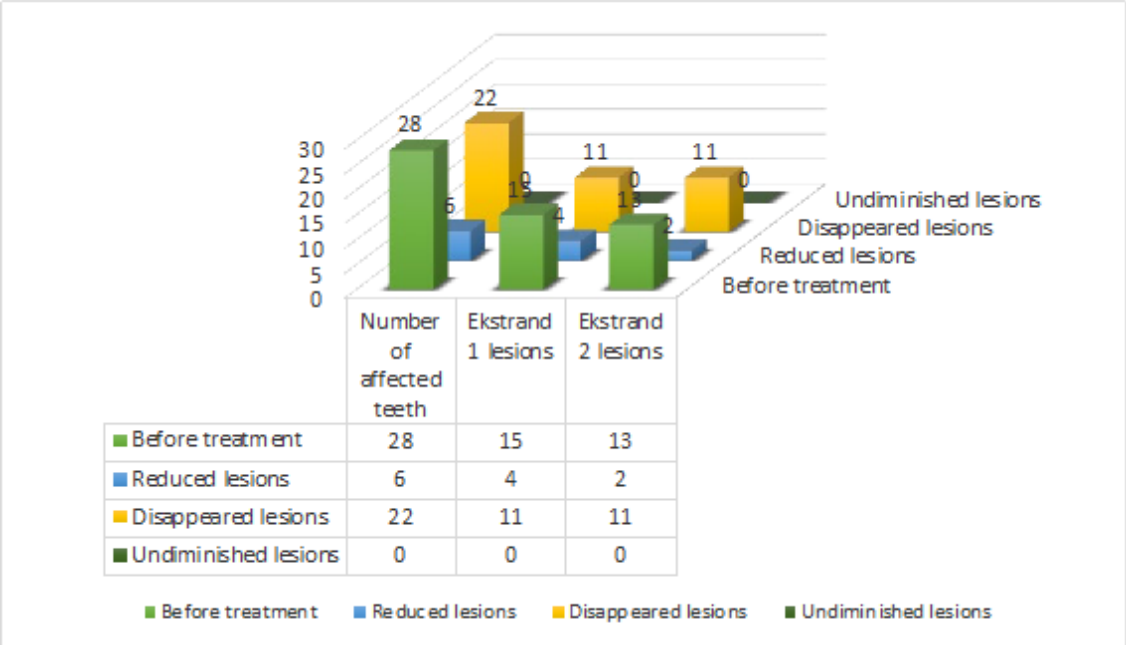


Figure 7. ICON effect on 28 incipient carious lesions.

Discussions

While several studies claim that the number of etching intervals should be adjusted to the surface hardness and depth of the carious lesions [16], product guidelines limit the number of etchings to three. Thus, we decided to use the product as the manufacturer recommends.

The results of the present study were similar to Krishna L Prasada et al. who demonstrated that ICON improves the esthetics of white spot lesions [17]. Other authors such as Seth V Senestraro et al. had similar results in a study conducted on 30 patients. They concluded that resin infiltration significantly improved the clinical appearance of white spot lesions and the results were stable eight weeks after treatment [18].

Baafif HA et al. compared the effectiveness of the ICON infiltration technique with that of using a casein phosphopeptide-amorphous calcium fluoride phosphate (CPP-ACFP) varnish in the treatment of carious lesions, and the result was positive for both treatment techniques. However, they proved that the CPP-ACFP was more effective than ICON [19]. In the present case, the use of Casein phosphopeptide-amorphous calcium fluoride phosphate (CPP-ACFP) paste stopped the patient's white spots from developing, but did not improve the esthetic appearance. Therefore, ICON proved to be more esthetically effective than CPP-ACFP treatment. In another study, Parastou Behrouzi et al. compared the hardness of dental tissue following treatment with two remineralizing pastes and ICON, and the results were unfavorable for resin since the ability of the pastes to remineralize dental tissue increased its hardness [20].

Further studies have evaluated the reduction of white spots following infiltration treatment using fluorescence, showing that all lesions reduced in size regardless of their depth, resulting in the affected tissue losing fluorescence at the end of the treatment [21].

Epigares J. et al attempted the use of ICON in sealing microfractures formed between fillings and enamel. As a result, they found that ICON can be used to improve the sealing of existing composite fillings. They concluded that infiltration with low viscosity resin is a viable option for direct restorations with poor marginal adaptation [22].

Chandrasekhar R. et al. concluded that resin infiltrated enamel did not show surface alteration compared to healthy enamel, and resin infiltration can be considered an effective treatment in restoring early enamel lesions due to its good penetration properties, providing a surface with better characteristics and masking lesions in the form of white spots in both temporary and permanent dentition [23].

S. Paris et. al tested whether infiltration of interdental caries with the ICON system can stop the progression of caries. Their study indicates that resin infiltration of radiologically limited proximal carious lesions around the amelo-dental junction is very effective after 7 years. Progression of infiltrated interproximal lesions was significantly reduced compared to non-infiltrated control lesions treated with other preventive methods [24].

Conclusions

The ICON infiltration technique is effective for most carious lesions with a white-opaque appearance. The treatment results of the 28 incipient carious lesions presented in this case report are favorable. There is no doubt that dental esthetics was improved, and incipient caries were arrested in their evolution. The patient will be called for follow-up every 3 months to keep changes in her dental status under observation and evaluate the effects of ICON treatment in the medium and long term. Within the limitations of our case report, we conclude that the ICON infiltration technique visibly improves the esthetics of the white spot lesions.

Conflict of interest: None to declare.

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STATEMENT OF ETHICS

All research studies involving human subjects must have received approval of the appropriate institutional ethics committee and informed consent must be obtained from all the patients participating in the studies, prior to manuscript submission.

In cases where the institutional ethics review committee ruled that approval from them was not required or that the need for informed consent was unnecessary, a statement from the committee to this end should be forwarded to the Editor with the manuscript.

Human and animal rights

Studies involving experimental research on animals or humans must conform to the guiding principles of the Declaration of Helsinki. In order to respect a patient`s right to privacy, identifying information such as patients` names, images, initials of hospital numbers should not be included in any published material (tables, figures, text), unless the information is essential for scientific content. In these cases written permission must be obtained from the patient, and should be submitted to the editorial office at the time of manuscript submission. In the case of animal experiments, both national and the institutional guidelines pertaining to the experimental use of laboratory animals should be rigidly followed.

Conflict of interest (Declaration of Interests)

The manuscript should contain a statement fully disclosing any conflict of interest related to the manuscript. If there are no conflicts of interest, this should be stated as “none declared”. Material and financial support should also be acknowledged.

Scientific misconduct

Scientific misconduct includes data fabrication, falsification, plagiarism, redundant publication, ghost authorship or other fraudulent research practices. In order to prevent plagiarism issues, all manuscripts sent to the journal will be screened using anti-plagiarism soft-ware. Where there is a suspicion of scientific misconduct, the Editor will act in conformity with the principles stated in the COPE guidelines and if the fraudulent practice is confirmed the manuscript will be rejected outright and without the Editor entering into any further correspondence.

Clinical trials

In case of manuscripts presenting clinical trials, the clinical trial should be registered in a public trials registry at or before the time of first patient enrollment, as a condition for consideration for publication. Trials should be preferably registered in ClinicalTrials.gov, but any registry that is a primary register of the WHO International Clinical Trials Registry Platform (ICTRP) is acceptable, in accordance with the guidelines of the International Committee of Medical Journal Editors.

INSTRUCTIONS FOR AUTHORS

Acta Stomatologica Marisiensis Journal is an international journal dedicated to publishing high quality peer-reviewed articles pertaining to dental medicine. The themes covered by the journal include all the fields of dentistry, within a broad spectrum of disciplines and therapeutic areas, including, but not restricted to oral health, prosthetic dentistry, endodontics, paedodontics, orthodontics, oro-maxillo-facial surgery, implantology, dental materials, digital dentistry, nanotechnology and materials or medical engineering.

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All manuscripts submitted to Acta Stomatologica Marisiensis must be original, high quality and conform to the “Uniform Requirements for Manuscript Submitted to Biomedical Journals” published in Annals of Internal Medicine (1997;126:36-47).

Authors should not submit the same manuscript simultaneously to more than one journal, in the same or different language.

Authorship

All individuals listed as authors should qualify for authorship and should have participated sufficiently in the work to take public responsibility for appropriate portions of the content.

Authors included in the manuscript should meet all of the following conditions as stated in the ICMJE (International Committee of Medical Journals Editors) guidelines:

- Substantial contributions to the conception and design of the work, acquisition, analysis or interpretation of data;
- Drafting the article or revising it critically, for important intellectual content;
- Final approval of the version to be published.

- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Any other contributors, who do not qualify for authorship, should be acknowledged in an acknowledgment section. For further information about authorship, please refer to the ICMJE guidelines.

Studies involving experimental research on animals or humans must conform to the guiding principles of the Declaration of Helsinki. In case of research involving human subjects, the manuscript must contain a statement within the "Material and Methods" section indicating that the study protocol has been approved by the author(s) institutional ethical committee and that all study participants have given informed consent to the participate, or that the ethical committee has waived the need for informed consent. In order to respect patient confidentiality and the right to privacy, identifying information such as patient's names, images, hospital or hospital record details, should not be included in any published material unless the information is essential for the scientific content. If so, written permission must be obtained from the patient, and this permission should be submitted to the editorial office prior to publication.

In case of manuscripts reporting clinical trials, these should be registered in a public trials registry at or before the time of first patient enrolment, as a condition for consideration for publication. Trials should preferably be registered in ClinicalTrials.gov, but in accordance with the guidelines of the International Committee of Medical Journal Editors any primary register of the WHO International Clinical Trails Registry Platform (ICTRP) is acceptable.

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All manuscripts should be submitted via email to the email address asmj@umfst.ro

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1. Cover letter
2. License to publish
3. Manuscript
4. Figures
5. Tables
6. Appendices

1. Cover letter

All manuscripts should be submitted together with a cover letter attached as a separate file, stating that:

- the manuscript is original
- no portion of the manuscript is under consideration for publication in any other journal or has been previously published, except as an abstract of fewer than 400 words.
- all authors have read and approved the manuscript and accept responsibility for the full content.
- Authors must state all possible conflicts of interest relating to the manuscript or, if there are none, this should be stated as "none declared".

The cover letter should be signed by all authors. The corresponding author submits the manuscript and annexes on their behalf.

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A license to publish statement should be signed by be signed by all authors. The standard format of this document is available at www.asmj.ro

3. Manuscript

The manuscripts, including all tables and references, must be prepared in Word format. The text should be typed double-spaced with no indent, using "Times New Roman" font size 12.

Please arrange the contents of your manuscript in the following order:

I. Essential title page information

- Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations and formulae where possible.
- Author names and affiliations. Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript number immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.
- Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. Ensure that phone numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address. Contact details must be kept up to date by the corresponding author.

II. Abstract – an abstract of no more than 300 words should accompany manuscripts relating to original research, case presentations and review articles. This should be structured using the following headings: Introduction, Aim of the study, Material and Methods, Results, Conclusions. Detailed instructions on abstract preparation according to each manuscript type are given below.

III. Key words – up to 10 keywords should be supplied by the author(s).

IV. Full text – should be formatted in Microsoft Word, double-spaced, single columned. Use headings and subheadings in all the sections. Original research articles should not exceed 5.000 words including references, tables, table legends and figure legends, and should be divided into the following sections:

a. Introduction

This must be presented in a structured format, covering the following subjects, although actual subheadings should not be included:

- succinct statements of the issue in question;
- the essence of existing knowledge and understanding pertinent to the issue (reference);
- the aims and objectives of the research being reported relating the research to dentistry, where not obvious.

b. Materials and methods

- describe the procedures and analytical techniques.
- only cite references to published methods.
- include at least general composition details and batch numbers for all materials.
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- specify statistical significance test methods.

c. Results

- refer to appropriate tables and figures.
- refrain from subjective comments.
- make no reference to previous literature.
- report statistical findings.

d. Discussion

- explain and interpret data.
- state implications of the results, relate to composition.
- indicate limitations of findings.
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- must NOT repeat Results or Discussion
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- All references, tables and figures should be cited in numerical order.
- Language editing will be available during the editorial process, however authors whose native language is not English are strongly advised to seek appropriate grammatical assistance when preparing the manuscript. Poorly written manuscript will be returned for improvement before commencing the editorial process.

V. Acknowledgments – collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Please indicate any source of funding including grants, contracts or any other form of financial support relating to the study.

VI. References – Number the references in the order in which they are first cited in the text. References should be indicated as full-size Arabic numerals in square brackets placed before punctuation marks.

VII. Reference style – List all authors if six or less; otherwise list first three and add “et al”. Please abbreviate titles of periodicals according to Index Medicus, or spelled out in full if not listed in Index Medicus. Use the following formats, paying close attention to the use of punctuation i.e.colon (:), semi-colon (;), coma (,) and full-stops (.).

For journal articles: Kim J, Fitzgerald JG, Sanders AK, Hofman HG. Long term survival following implantation of drug eluting stents. J Am Coll Cardiol. 2002;42:652-8.

For articles-in-press: Hendricks-Ferguson VL, Sawin KJ, et al. Novice Nurses’ Experiences with Palliative and End-of-Life Communication. J Pediatr Oncol Nurs. 2015. doi: 1043454214555196. [Epub ahead of print]

For a chapter in a book: La Rovere MT, Schwartz PJ: Baroreflex sensitivity. In Opie, L: Drugs for the Heart, Sixth Edition. Philadelphia: WB Saunders. 2006, pp.67-93.

For a Book: Eisen HN. Immunology: an introduction to molecular and cellular principles of the immune response. 5thed. New York: Harper&Row; 1974. P.406.

VIII. Units – follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

4. Figures

Figures should be prepared separately and sent as additional files, in TIF or JPG format, or compressed into one ZIP file. The figures should be prepared at the standard resolution of 300 dpi. All abbreviations used in a figure should be explained in the figure legend. Figure legends should be concise but explicit, enabling a clear understanding of the illustration. Figures and figure legends should be numbered in Arabic numerals in the order of appearance in the text and should not be imbedded within the text. Colour figures are preferred. Where a figure(s) is reproduced

or adapted from another source, the author must first seek permission from both the author and publisher of the original material. Written evidence of permission for reproduction in both print and electronic formats for worldwide distribution must be forwarded with the manuscript and state "Reproduced with permission from…" or "Adapted with permission from…".

5. Tables

These must be self-explanatory and should not duplicate the text. Tables should be numbered in Arabic numerals in the order of mention in the text and should not be imbedded within the text. Instead, each table should be typed on a separate page at the end of the manuscript. All the abbreviations used in the table should be typed as footnotes immediately below the table. Tables should be created with Word's Insert Table function in order to be editable. Do not submit tables as image files.

6. Appendices

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Acta Stomatologica Marisiensis Journal also publishes the following types of papers:

Reviews

The journal publishes comprehensive review papers on actual topics of interest related to dental medicine. Review articles should include a brief non-structured abstract of no more than 300 words and the text should be limited to 5.000 words including tables and figures, excluding references. In extraordinary situations or relevant and extensive topics, the Editor-in-Chief may decide to accept papers with a higher number of words, a maximum of 400 words for the abstract and 6.500 for the text, including tables and figures, excluding the references. Review articles can be submitted by invitation or unsolicited. In both cases, full consideration will be given to articles providing a substantial contribution to a better understanding of a pathophysiological or clinical aspect in a field related to dental medicine.

Case reports and case series

Case reports should be limited to presentation of a single particular and uncommon case, or uncommon presentation of a disease. Case series include description of a series of a maximum of 10 cases with common particularities. The abstract should be limited to 300 words, being divided into introduction, case presentation / presentation of case series and conclusions. The full manuscript should not exceed 3.000 words including references, figures and tables, being divided into sections headed Introduction, Case presentation / presentation of case series, Discussions, Conclusions. In manuscripts pertaining to case presentation or case series, the number of authors should be limited to four, the number of references to thirty and the number of figures to 8.

Original papers

Definitive reports on a full study, describing original preclinical or clinical study (which is not a case presentation or a case series report) represent research of high scientific level and timeliness. A concise abstract of no more than 300 words is required. The abstract should briefly state the purpose of the research, the main results and major conclusions. An abstract is often presented separate from the article, so it must be able to stand alone. The manuscript should be written clearly and concisely. The authors are responsible for providing the correct nomenclature, which must be consistent and unambiguous. The text should be arranged in the following order: Introduction, Materials and Methods, Results, Discussion and Conclusions.

The length of the manuscript should be limited to 5000 words (including references, tables and figures).

Brief reports

Brief reports refer to articles presenting a short communication related to an original preclinical or clinical study which is not a case presentation or a case series report. While the structure of the abstract and of the full text should be detailed similar to that for full original articles, the length of the manuscript should be shorter, the abstract limited to 200 words and the full text (including references, tables and figures) to 2.000 words.

Letter to editor

A letter to the editor may refer to an article recently published by the journal, commenting on the article in a constructive professional manner the content of which, in the opinion of the author(s) would add the current status of knowledge in the field. If accepted, the letter will be sent to the authors of the original article who will have the opportunity to respond and to have their response published in the same journal issue as the letter to the editor. The letters should be limited to 500 words, 5 references and 3 authors. No abstract is required.

Editorial

Editorials should be limited to 3000 words (including references) and should be related to an article published in the current number or to a specific topic that is current and of high interest to the readers.

State-of-the-art papers

The journal publishes state-of-the-art articles that aim to provide an update on the current status of areas of high interest to dental medical specialists. The main aim of such articles is to offer the specialist and other practitioners a source of continuous

education and forum for discussion. A state-of-the-art article should have a full text limited to 5.000 words, in addition to a 300 word unstructured abstract. Sections of the article should be divided using headings relevant to each particular case.

Peer review process

Submitted manuscripts are first checked to ensure that they comply with instructions to authors and are in accordance with the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals", Annals of Internal Medicine, 1997,126, 36-47, and that all references, figures and tables meet the journal's requirements.

All manuscripts sent to the journal are routinely screened using specialized anti-plagiarism soft-wares. In all cases where any possible irregularity exists, the editorial office will follow the principles stated in COPE (Committee on publication ethics) guidelines.

Only manuscripts complying with the above requirements and free of possible irregularities, will be entered into the review process. The author(s) will be informed that the manuscript has been accepted for review.

Authors may suggest the names of potential reviewers and the Editor may choose, without obligation or explanation, to use one or more of these. Authors may also specify the names of a person(s) which they do not wish to review their manuscript, in which case a brief explanation should be given.

All articles will be reviewed by at least two peers with expertise in the manuscript's subject matter. The identities of the reviewers, chosen by the editor, will not be disclosed to the authors.

The average time from submission to a decision following the first review is approximately 4-6 weeks. Based on the reviewers' opinion, the Editor will choose one of the following alternatives:

- Accepted;
- Minor revisions required;
- Major revisions required;

In cases where revision is required, the author(s) will be invited to amend their manuscript, which should be resubmitted as soon as possible, but not later than 6 weeks. The revised manuscript will be reappraised by the initial reviewers and notification of a final decision will be sent to the author in approximately three weeks.

After acceptance and prior to publication, authors will receive a pdf file with the edited version of their manuscript for final proofreading and will be asked to carefully check the completeness and accuracy of the text, tables and figures.

Complaints

In cases where the authors wish to file a complaint, please contact the editorial office:

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