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Acta Stomatologica Marisiensis is an international journal dedicated to publishing high-quality peer-reviewed articles about all fields of dental medicine. The important topics covered by the journal refer to the complete, complex and interdisciplinary treatment of the patient with dental problems. This involves addressing all branches of dental medicine and does not exclude research in the field of nanomaterials, biotechnology or medical engineering.
By focusing on the publication of new documents and evidence of high quality research, Acta Stomatologica Marisiensis aims to improve research and clinical practice of dental medicine at an international level.
The journal focuses on the publication of quality medical research articles that bring new insights into dental medicine from the perspective of diagnosis and treatment methods as well as the materials used. No less important are presentations of interesting clinical cases that can bring new light into diagnosis and treatment methods or interdisciplinary therapeutic approaches or collaborations with various fields of engineering for the development of innovative new technologies.
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EDITORIAL

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Utilizing technology to enhance compliance and oral health.

Anahat Khehra, Liran Levin

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Treatment of caries, periodontal disease and dental trauma is only successful if the patient is compliant with home care and regular dental visits [1-3]. Relapse, recurrence and further progression of disease can occur if oral health compliance is neglected. The consequences of disease progression might include tooth loss, reduced chewing ability, unfavorable esthetics and reduced quality of life [4]. Thus, compliance plays an utmost important role in dental treatment and oral health. The issue of compliance can also be seen in other healthcare fields. Brown et al reported that patient nonadherence to medications occurs 50% of the time [5]. The lack of compliance is associated with increased hospitalizations, health care burden, post-operative pain, and mortality [6]. There is a need to explore additional methods to increase patient participation in the treatment of their acute or chronic conditions. In the field of physical therapy, for instance, long-term exercise plays a significant role in improvement and recovery of function [7]. The lack of compliance to home-based exercise programs will have a negative effect on the patient's health and fitness. As health care professionals, it is our responsibility to educate and provide our patients with resources to help achieve the desired treatment outcomes. The use of technology has been proven to be an advantageous resource in medication adherence [8-10]. The reported success can be used as an example for oral health care compliance enhancement.

Enhancing oral health for better overall health

Oral diseases can influence a patient's overall health and poor oral health was found to be related to many systemic diseases and conditions (Figure 1). For example, it is well documented that periodontal disease has an association with diabetes [11, 12]. Prevention and treatment of periodontitis can improve glycemic control in type II diabetic patients [12]. On the other hand, lack of periodontal care leads to poor glycemic control and can contribute to diabetic complications. Another association made to periodontitis is cardiovascular disease [13]. The bacteria involved in periodontitis can enter the blood stream and increase risks for future cardiovascular events [14].

From the accumulation of data regarding the oral-systemic connections it is now clear that patients' compliance to home care measures not only affects their own oral health, but also profoundly influences their general overall health and wellbeing. This can also affect pediatric patients' risk of early childhood caries [15]. Another aspect of the perio-systemic relationship is pregnancy outcomes. Pregnancy brings about major physiologic changes to the body. The oral cavity should not be ignored and pregnant patients should continue to present for recall appointments [16, 17]. Timing is critical and compliance with regular dental visits plays a significant role. From these examples, and many more, it is clear that the importance of oral health education and compliance is vital, not only for dental integrity, but also for patients' overall wellbeing.

Technological advancements can serve as valuable tools to enhance compliance and awareness of patients in order to improve treatment outcomes and oral health. Few examples of the utilization of technology for

education and improved compliance are presented here.

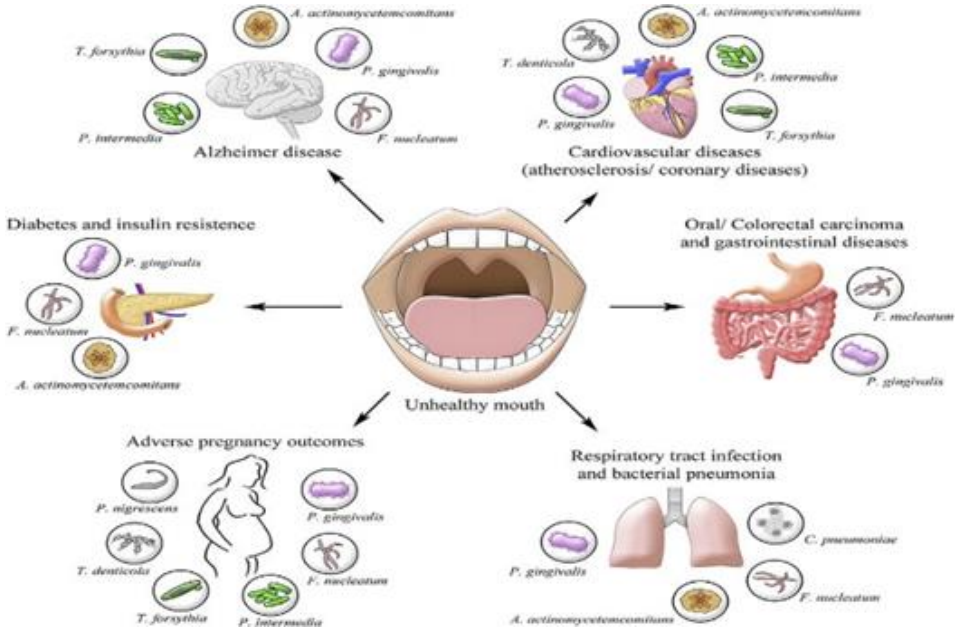

Figure 1. The various studied relationships between oral and systemic diseases. Reproduced with permission from Bui FQ, Almeida-da-Silva CLC, Huynh B, Trinh A, Liu J, Woodward J, Asadi H, Ojcius DM. Association between periodontal pathogens and systemic disease. Biomed J. 2019 Feb;42(1):27-35. doi: 10.1016/j.bj.2018.12.001.

Dental trauma emergency management interactive guide

In recent years, phone applications relating to dental care have been released for use by the public. One example is the ToothSOS app that was created by the International Association of Dental Traumatology as a free service to provide information on emergency management and prevention of dental injuries [18]. Parents and patients can find easy to read instructions and pictures to guide them through a dental injury before visiting their dentist (Figure 2). In addition, patients have access to information about injury prevention and the types of mouthguards.

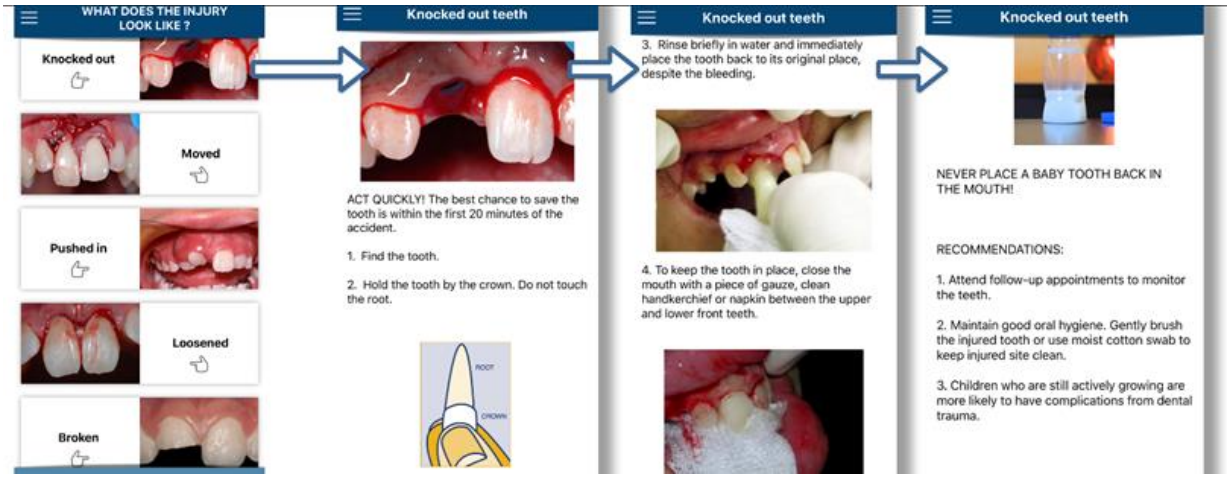

Figure 2. Tooth injury types and recommendations provided in the patient section of the free ToothSOS app developed by the International Association of Dental Traumatology (IADT).

The incidence of dental trauma occurs at higher rates amongst children and adolescents [19]. The importance of prevention and treatment of dental injuries cannot be underestimated as it has an influence on patients' future oral health [20]. The ToothSOS app has the potential to spread knowledge and improve treatment outcomes of traumatic dental injuries. Patient engagement with the app may improve compliance with dental visits and as a result, improve their overall oral health.

Better toothbrushing guided by an app

Another important example is a dental application that was released as an effort to increase patient brushing time and efficacy. With Bluetooth connectivity to an Oscillating-Rotating Electric Toothbrush, the free application can track brushing habits and provide feedback based on recommendations by dental professionals (Figure 3). The app also includes a personalized coaching feature that allows the user to track their weekly and monthly progress. The feedback generated is individualized and targeted to improve each patient's oral hygiene status. In addition, the user has the opportunity to assess their gum health with the Gum Guard feature. It indicates where the patient is brushing harshly on the gums and tracks gum bleeding.

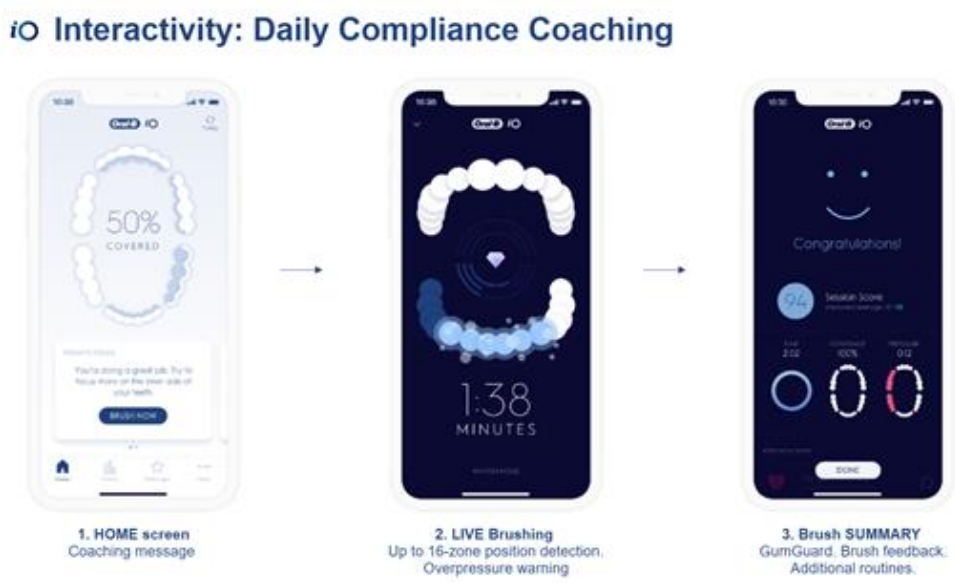

Figure 3. Coaching and feedback features of the Oral-B app connected via Bluetooth technology to the Oscillating-Rotating electric toothbrush.

Phone applications can improve patient compliance because it is convenient and most of the time, comes at no cost. The app can also provide a report to the dental professional about the recent performance of the patient with relation to home care. This can be used to facilitate conversation, enhance home care habits and overall oral health. With technology, the patient has easy access to many oral health care resources.

Social media as an educational tool

Another accessible way to share oral health information is through social media sites, such as Facebook, Instagram or TikTok (Figure 4). It allows for wide distribution of educational resources at a low cost. Patient engagement may improve if they see their dental practitioner active on social media. The benefits of social media may include: increased patient education, increased patient compliance, improvements in overall health and better treatment outcomes [21].

On the other hand, social media does not filter false information and thus allows for the spread of "fake medical news" [22, 23]. For example, many influencers share recipes for homemade teeth whitening pastes without any evidence of their effectiveness [24]. Healthcare

professionals should act to counter disinformation by sharing evidence-based facts through social media platforms [25].

If more reliable content exists on social media, then patients are less likely to come across false information.

Figure 4. Oral health education video posted on social media in order to improve communication with patients, enhance compliance and better performance of home care measures.

Teledentistry

Dental care compliance may be influenced by a number of factors, including patient motivation, financial constraints or location barriers. Teledentistry is a new development aimed to improve accessibility to dental care [26, 27]. It allows for the delivery of care to individuals who are unable to seek dental advice in-person. Virtual consultations and remote monitoring of patients are two ways in which teledentistry can be used. A dental practitioner can promote and encourage oral hygiene compliance by conducting one-on-one online sessions with their patients. This approach allows for continued care and communication with patients that have limited access to a dental clinic. Teledentistry has many advantages and will continue to grow as more and more patients turn to technology to find readily available information.

As identified by Talla et al, there are some obstacles with teledentistry [26]. Dental professionals require training prior to offering online services to their patients. In addition, privacy and security measures must be implemented. Lastly, online services have yet to be recognized by regulatory bodies and insurance companies. The mentioned obstacles might be mitigated with a combined effort from the dental community. Using technology to advance oral health care is the way to go and teledentistry is an approach that may help get us there.

Conclusions

The advances in technology give dental practitioners the opportunity to directly reach out to a larger audience. The goal is to bring awareness to the importance of oral hygiene and improve compliance. If compliance is enhanced, the patient will likely see improvements in their oral health. In addition, better oral health will positively contribute to a patient's overall wellbeing. The use of technology in dentistry is an important tool to share reliable and well researched information with the general public.

Conflict of interest: Ms. Anahat Khehra reports no conflict of interest; Prof. Levin provides occasional lectures and consulting services to oral health companies such as Colgate, Procter & Gamble and Sunstar as well as to several implant companies. He is also currently the president-elect of the International Association of Dental Traumatology (IADT).

References

1. Hsu U, Hui BK, Pourat N. Recall compliance and incidence of dental caries among underserved children. J Calif Dent Assoc. 2015; 43(2):77-81
2. Bakdash B. Oral hygiene and compliance as risk factors in periodontitis. J Periodontal. 1994; 65(5):539-44.
3. Lee JY, Divaris K. Hidden consequences of dental trauma: the social and psychological effects. Pediatr Dent. 2009; 31(2):96-101.
4. Perio and General Health (Manifesto). European Federation of Periodontology. https://www.efp.org/fileadmin/uploads/efp/Documents/Manifesto/EFP_manifesto_full_version_2018.pdf. Accessed February 2021.
5. Brown MT, Bussell J, Dutta S, Davis K, Strong S, Mathew S. Medication Adherence: Truth and Consequences. American Journal of the Medical Sciences. 2016; 351(4):387-99.
6. Ho PM, Magid DJ, Shetterly SM, Olson KL, Maddox TM, Peterson PN, et al. Medication nonadherence is associated with a broad range of adverse outcomes in patients with coronary artery disease. Am Heart J. 2008; 155(4):772-9.
7. Saner J, Bergman EM, de Bie RA, Sieben JM. Low back pain patients' perspectives on long-term adherence to home-based exercise programmes in physiotherapy. Musculoskeletal Science and Practice. 2018; 38:77-82.
8. Thakkar J, Kurup R, Laba TL. Mobile Telephone Text Messaging for Medication Adherence in Chronic Disease. JAMA Intern Med. 2016; 176(3):340-9.
9. Park JYE, Li J, Howren A, Tsao NW, Vera MD. Mobile Phone Apps Targeting Medication Adherence: Quality Assessment and Content Analysis of User Reviews. JMIR Mhealth Uhealth. 2019; 7(1):e11919.
10. Kini V, Ho PM. Interventions to Improve Medication Adherence: A Review. JAMA. 2018; 320(23):2461-73.
11. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012; 55(1):21-31.
12. Chee B, Park B, Bartold M. Periodontitis and type II diabetes: a two-way relationship. Int J Evid Based Healthc. 2013; 11(4):317-29.
13. Sanz M, Castillo AMD, Jepsen S, Gonzalez-Juanatey JR, D'Aiuto F, Bouchard P, et al. Periodontitis and cardiovascular diseases: Consensus report. J Clin Periodontol. 2020; 47(3):268-288.
14. Naderi S, Merchant AT. The Association Between Periodontitis and Cardiovascular Disease: an Update. Curr Atheroscler Rep. 2020; 22:52.
15. Xiao J, Alkhers N, Kopychka-Kedzierawski DT, Billings RJ, Wu TT, Castillo DA, et al. Prenatal Oral Health Care and Early Childhood Caries Prevention: A Systematic Review and Meta-Analysis. Caries Res. 2019; 53(4):411-21.
16. Hartnett E, Haber J, Krainovich-Miller B, Bella A, Vasilyeva A, Kessler JL. Oral Health in Pregnancy. J Obstet Gynecol Neonatal Nurs. 2016; 45(4):565-73.
17. Silk H, Douglass AB, Douglass JM, Silk L. Oral health during pregnancy. Am Fam Physician. 2008; 77(8):1139-44.
18. Khehra A, Cohenca N, Cehreli ZC, Levin L. The International Association of Dental Traumatology ToothSOS mobile app: A 2-year report. Dent Traumatology. 2020; 37(1):145-50.
19. Levin L, Day PF, Hicks L, O'Connell A, Fouad AF, Bourguignon C, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. Dent Traumatol. 2020; 36(4):309-13.
20. Levin L, Zadik Y. Education on and prevention of dental trauma: it's time to act! Dent Traumatol. 2012; 28(1):49-54.
21. Bhavnani, SP, Narula J, Sengupta PP. Mobile technology and the digitization of healthcare. Eur Heart J. 2016; 37(18):1428-38.
22. Kanekar AS, Thombre A. Fake medical news: avoiding pitfalls and perils. Fam Med Community Health. 2019; 7:000142.
23. Merchant RM, Asch DA. Protecting the value of medical science in the age of social media and "fake news". JAMA. 2018; 320: 2415– 6.
24. Dias da Silva MA, Walmsley AD. Fake news and dental education. Br Dent J. 2019; 226(6):397-9.
25. Levin L. Editorial: Fake medical news – how can we fight it? Oral Health Prev Dent. 2019; 17: 97.
26. Talla PK, Levin L, Glogauer M, Cable C, Allison PJ. Delivering dental care as we emerge from the

initial phase of the COVID-19 pandemic: teledentistry and face-to-face consultations in a new clinical world. Quintessence Int. 2020; 51(8):672-7.

27. Daniel SJ, Kumar S. Teledentistry: a key component in access to care. J Evid Based Dent Pract. 2014; 14:201-8.

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STATE-OF-THE-ART ARTICLE

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Compendium of current ceramic materials used for the CAD/CAM dentistry.

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Abstract

Nowadays, patients require the highest quality of treatment, but generally prefer to spend as little time as possible in the dental chair. Therefore, there is significant benefit for using new technologies such as CAD/CAM (computer aided design/computer aided manufacturing), which provides both quality and speed. There is an increase in ceramic materials and ceramic blocks/discs available, with varying properties. This has resulted in some confusion and difficulty in making an informed decision about which material is best for a specific clinical situation. The objective of this review is to provide an overview and comparison of basic mechanical properties of currently used CAD/CAM ceramic materials based on a review of the currently available literature.

Keywords: Dental ceramics, CAD/CAM, mechanical properties

Introduction

Today's patients often prefer whiter teeth and a smile with a straight alignment in a minimum amount of time [1,2]. As a result, the dental practitioner has to determine the right ceramic material with the appropriate optical properties in order to provide a result that the patient finds aesthetically pleasing while simultaneously meeting the requirement of strength and longevity. Knowledge of the different ceramic materials and their varying optical and mechanical properties are thus essential for a dental practitioner, in order that they can determine the best material for the varying clinical situations.

Ceramics are mostly composed of two phases: crystals and glass matrix. The crystals and glass ratio determines the mechanical and optical properties of the ceramics [3].

This paper provides an overview of some of the commonly used CAD/CAM ceramic blocks used for dental restorations based on a review of the currently available literature. The focus will be on the material composition and mechanical properties. The range of the mechanical properties such as flexural strength, elastic modulus and fracture toughness are presented as well.

Basic description of mechanical properties

Mechanical properties describe physical properties of materials exhibits under an applied load.

Flexural strength: Flexural strength is the maximum stress when the material is exposed to flexural loading. To measure flexural strength, common method is to use the three point bending test (uniaxial measurement) or ball on ring configuration (biaxial measurement) [4,5]. Its clinical importance is that it relates to how well the material can withstand chewing force. This is an ideal stage which is not including fatigue of the material. This value can help dentist to decide which material is better for anterior or posterior region, since the chewing forces in the posterior area are generally higher [4].

Elastic modulus: The Elastic or Young's modulus describes the elasticity of the material. It is calculated as the stress strain ratio based on the linear part of stress strain curve. Clinical relevance for dentist is that it describes stiffness of the material [4].

Fracture toughness: Fracture toughness is the energy need for failure of the material. Brittle material such as ceramics have low fracture toughness [4]. To measure the fracture toughness of brittle material, one usually uses single-edge-V-notched beam test (bending method) or indentation strength/fracture method [6]. Clinical importance is that it describes how well the material can withstand the critical propagation of flaws under the applied load [5].

Every material of a dental restoration should mimic the mechanical properties of the replaced tissue. Thus, the mechanical properties of ceramics should be ideally close to enamel and dentin. Enamel grinds food, thus its abrasion resistance is important. The hardness value should be prioritized for enamel. Dentin absorbs bite forces, thus strength and elastic modulus should be prioritized there [7].

CAD/CAM ceramics

CAD/CAM ceramics are available in blocks or discs of different sizes, colors, optical features and sintered stage. These blocks or discs are grinded/milled with diamonds burs or metal cutters to the desired shape of the restoration - this is called subtractive machining process. Based on sintered stage of block, the manufacturing can be divided into soft or hard machining. Presently CAD/CAM machining materials can be categorized as:

- Glass ceramics: Feldspar ceramics mainly containing silica
- Glass ceramics reinforced with crystals: Leucite reinforced ceramics, Lithium disilicate ceramics, Zirconia reinforced lithium disilicate ceramics
- Polycrystalline ceramics: Zirconia ceramics which consist only in a crystalline matrix [8]
- PICN- Polymer infiltrated ceramics network

Feldspar ceramics

The feldspar ceramics for CAD/CAM use are made from a similar material as traditional feldspar ceramics but by different process, called extrusion molding, to achieve the desired blocks or discs shape [9]. For example, Vita Mark II (Vita Zahnfabrik) consists of 30% fine grinded ground feldspar particles. The average size of the particles is 4 micrometers [10–12]. In the feldspar ceramics the leucite crystals arise due to firing process when the feldspar is melting. Leucite crystals have a very similar diffraction index as glass matrix. For this reason, restorations made from this ceramic can have a good esthetic result due to their translucent properties [13].

Figure 1 depicts the range of flexural strength measured by the three point bending test [10,12,14–22], figure 2 shows the range of elastic modulus [15,20,23–26] and figure 3 demonstrates the range fracture toughness [9,15,20,22,27] of feldspar ceramics (Vita Mark II).

The indications for this type of ceramic are: inlay, onlay, veneer, partial crown, anterior crown, and veneering material for oxide ceramic substrate [22,25,28,29]. The main advantages are esthetics, translucency, wide range of block shades, while the disadvantages include fragility and translucency [23].

The ceramics are grinded in a fully sintered stage (hard machining). Cooling water is used to protect overheating of the grinding material [9,30]. The restoration can be finally treated by polish, glaze, stains or personalized with cut back technique [23]. Due to the high content of ceramics and poor mechanical properties, this ceramic material is recommended to be fixed by adhesive fixation to increase the restoration resistance to fracture [31].

Examples of representative CAD/CAM ceramics that can be found on the market are Vita Mark II (Vita Zahnfabrik), Cerec blocs (Sirona Dental Systems), Vita TriLuxe forte (Vita Zahnfabrik), Vita RealLife (Vita Zahnfabrik).

Leucite reinforced glass ceramics

The leucite glass ceramics consists of leucite crystals and glass matrix. For example, IPS Empress CAD (Ivoclar -Vivadent) is 30-45% represented by leucite crystals ($KAlSi_2O_6$) which are approximately 1-10 micrometers in diameter [3,9,32]. Leucite crystals influence the thermal expansion of material and eliminate the propagation of cracks if the fracture energy is absorbed by crystals. The difference between the thermal expansion of the crystals and the glass matrix causes an increase in resistance and flexural strength [29].

Figure 1 depicts the range of flexural strength values which were measured by three point bending test [9,12,15,18,22,29,33], figure 2 shows range of elastic modulus [15,23,25,34–36] and figure 3 demonstrates the fracture toughness [15,22,34,36] of leucite reinforced glass ceramics (IPS Empress CAD).

Indications for leucite glass ceramics are: inlay, onlay, partial crown, veneer, and anterior crowns [22,28,29]. Their advantages include

good aesthetics, translucency, wide range of block shades, while the disadvantages are mainly fragility and translucency [23].

The ceramics blocks are also present and grinded in fully sintered stage (hard machining) and cooled by water during the grinding process to protect overheating [4,9,30]. The final surface treatment is the same as for feldspar ceramics [23]. This ceramic has higher content of glass and the adhesive fixation is also recommended to increase the strength of final restoration [31].

Examples of representative CAD/CAM ceramics on the market are IPS Empress CAD (Ivoclar -Vivadent); Initial LRF Block Universal (GC); Initial LRF Block CEREC/InLab Blocks (GC).

Lithium disilicate glass ceramics

Lithium disilicate glass ceramics appear on the market under the name IPS e.max CAD (Ivoclar-Vivadent). These ceramic provides good mechanical and esthetics properties. Lithium disilicate glass ceramics consists of 70 % lithium disilicate crystals (Li2SiO5) and retains relatively high translucency properties [9]. Translucency is achieved due to the low refractive index of lithium disilicate crystals [3]. Crystals dimensions are 1.5-5 micrometers [9,13]. The large amount of crystals help to increase the strength [29]. IPS e.max CAD is produced in partially crystallized stage and is called blue stage because of the color of partially crystallized block of ceramic. Blue stage consists of 40% of the meta-silicates crystals (Li2SiO3), around 0.2-1 micrometers in diameter. This composition enables easier milling and less deterioration of grinding tools. The restoration after milling is still in the partially crystalline state and has to undergo a crystallization process. During this process, the meta-silicate crystals are dissolved and the lithium disilicate crystals are crystalized. After the crystallization process, the ceramics obtain the shade, translucency, and the mechanical features described above [9,10,37,38].

Figure 1 depicts the range of flexural strength measured by the three point bending test [9–13,17,18,22,25,33,39–43], figure 2 demonstrates range of elastic modulus [23,25,26,34,35,39,42–46] and figure 3 shows the fracture toughness [22,25,27,34,40–47] of lithium disilicate glass ceramics in fully crystallized stage (IPS e.max CAD).

These ceramics are sold in a fully sintered, partially crystalized stage [4]. After the hard milling by water cooling, the restoration needs to undergo the crystallization process to achieve final crystallinity, strength and optical features. The final surface treatment for monolithic restoration includes polishing, staining, glazing or cut back technique, and the restoration can also be veneered with conventional ceramic [23]. Both cementation types (conventional/adhesive) are reported, but to maximize strength, adhesive cementation is usually preferred to reinforce the present ceramics [11,30,48,49].

Suitable indications for Lithium disilicate glass ceramics are: inlay, onlay, veneer, partial crown, anterior and posterior crown [29], endocrowns [23], three-unit bridges up to premolar, anterior and posterior implant abutments and implant crowns, and veneering material [22,28]. The main advantages include good aesthetics, mechanical strength, wide range of block shades and good optical properties. The disadvantage of lithium disilicate ceramics is usually low translucency [23].

Example representatives are IPS e.max CAD (Ivoclar-Vivadent); Amber Mill (Hass); Obsidian (Glidewell Laboratories); Suprême.cad (Suprême); Rosetta SM (Hass); MAZIC Claro CAD (Vericom).

Lithium di-silicate ceramics reinforced with zirconia

New lithium disilicate ceramics reinforced with zirconia are appearing on the market. Lithium di-silicate ceramics reinforced with zirconia consist of a fine-grain crystalline phase of lithium metasilicate and lithium disilicate with an average size of crystals being about 0.5-0.7 micrometers. These lithium disilicate ceramics are reinforced with 8-10 wt% of zirconia which is dissolved in glass matrix [37,39,49–51]. This results in higher flexural strength. An example of the lithium disilicate zirconia ceramics on the market is the Vita Suprinity (Vita Zahnfabrik). This material is sold in the partially crystallized form, so it is easier to mill the restoration [37].

Figure 1 shows range of flexural strength values measured by the three point bending test [12,14,25,33,42–44], figure 2 refers to the range of elastic modulus [25,42–46] and figure 3 depicts range of fracture toughness [25,42–46,52] of zirconia reinforced lithium disilicate glass ceramic in fully crystallized stage (Vita Suprinity).

Lithium disilicate zirconia reinforced ceramics is sold in fully sintered partially/fully crystalized state. After water-cooled hard machining, the restoration in partially crystalized state has to undergo thermal heating process called crystallization. During this thermal process, the ceramic will reach final crystallization and increase in strength. Final surface treatment is identical to the lithium disilicate ceramics [23]. The adhesive fixation is recommended [49,50].

The types of restorations which can be indicated for Lithium disilicate zirconia reinforced ceramics are veneers, inlays, onlays, anterior and posterior crowns [29], endocrowns, bridges of small extent in anterior region [23]. The advantages of this ceramics are good esthetics, mechanical strength, wide range of blocks shades and their optical properties. The disadvantage is typically less translucency [23]. Available products on the market are Vita Suprinity (Vita Zahnfabrik); Celtra Duo (Sirona Densply). Celtra Duo is sold in fully crystallized form.

Zirconia ceramics

Zirconia is a polycrystalline ceramic. It is a highly crystalline ceramic without an intervening matrix. Chemically it is zirconium dioxide [13]. Zirconia is available in three crystalline forms: monoclinic, tetragonal and cubic. The monoclinic form is stable from room temperature to 1170°C and the density is 5.6 g/cm². Tetragonal phase is stable from 1170°C to 2370°C. This form has good mechanical properties with density of 6.1 g/cm^2. The cubic phase is stable at over 2370°C and its density is 6.27 g/cm^2. Due to the low mechanical properties of the monoclinic phase, it is good to eliminate this phase in the composition of the ceramics [9,53]. Tetragonal/cubic zirconia can be partially stabilized in room temperature by adding an oxide such as yttria (Y2O3), ceria (CeO2) or magnesia (MgO) [4,9].

Zirconia ceramics have a unique feature called transformation toughening. Transformation toughening occurs when the propagation of the crack induces the stress which results in a phase change from tetragonal phase to monoclinic phase. Due to this phase transformation, there is a volume increase of 3-5 % which results in compressive stress around the walls of the crack. This closes the crack in transformation zone, decreases crack propagation and increases the toughness of material [4,13].

The manufacture of zirconia restorations can be divided to soft machining process, hard machining manufacture [4]. The zirconia blocks or discs for CAD/CAM technique are sold in three states: chalk or green state (non-sintered), pre-sintered or fully sintered state [5].

The not fully sintered states are softer and easier for milling. This causes less wear of milling burs. Milling of non-sintered and pre-sintered blocks is called soft machining process and has to be followed by sintering process. The green stage is very porous and could absorb a lot of water, thus, dry milling is required to avoid drying time before sintering. The restorations from non-sintered and pre-sintered zirconia ceramics are milled in a larger sizes to allow for a shrinkage during the sintering process (about 20-25%) [23,30,53]. The fully crystalized blocks are manufactured by grinding with diamonds burs with water cooling. The disadvantages of hard machining process of fully crystalized blocks are higher wear of grinding burs and longer grinding time. The advantage is the non-shrinkage of the material [30].

The fixation of zirconia ceramic is mostly done with conventional cementation, but adhesive fixation of zirconia ceramic is also possible. The zirconia is not etchable by hydrofluoric acid due to the absence of glass nor contain silica to achieve chemical bond with silane coupling agent. To achieve micro retention, air abrasion with alumina particle or tribochemical silica coating is used to increase surface roughness. Then the surface is treated with adhesive with MDP monomer (methacryloyloxydecyl dihydrogen phosphate monomer) to achieve chemical bond between

dental surface and resin cement. If the surface is air abraded with silica coated alumina particles, the surface can be treated with the silane coupling agents for glass ceramics [31,54].

3Y-TZP zirconia

The 3Y-TZP (yttria tetragonal zirconia polycrystals) frameworks are very opaque due to the high content of alumina. The monolithic form requires veneering with glass ceramics to achieve an improved esthetic result [55]. The manufactures later introduced a dedicated monolithic zirconia, having lower content of alumina which increases translucency, but is still quite opaque compared to glass ceramic. 3Y-TZP is commonly stabilized with 3 mol% of yttria [3Y-TZP] and the tetragonal phase is stabilized at room temperature. Both forms exhibit transformation toughening.

The mechanical properties of these forms are similar [23,46,53,53]. Zirconia causes wear of the antagonist enamel that can be improved with a surface finishing and polishing technique [55]. Figure 1 depicts the range of flexural strength measured by three point bending test [12,18,43,46,53,56], the range of elastic modulus is shown in figure 2 [15,43,56] and figure 3 shows the fracture toughness [15,34,43,46,57] of 3Y-TZP ceramics. Since the mechanical properties for 3Y-TZP zirconia are predominantly reported for a whole group rather than for individual brands of this material, the mechanical properties for the whole group are shown here.

Suitable indication for restorations from 3Y-TZP ceramics are crowns, bridges, implants abutments, implants, orthodontic brackets, endodontics posts [9]. The advantages of 3Y-TZP ceramic are its mechanical properties, while the disadvantages include worse aesthetics, less translucency and implementation [23] and antagonist wear [55].

Examples of representative CAD/CAM ceramics on market are: Framework zirconia – Vita YZ T (Vita Zahnfabrick); In-Ceram Classic Zirconia (VITA North America); In-Ceram YZ (VITA North America); inCoris ZI (Dentsply Sirona); IPS E.max ZirCad LT MO (Ivoclar Vivadent). Monolytic zirconia – IPS E.max ZirCad LT (Ivoclar Vivadent); Lava Plus (3M ESPE); Katana HT, ML (Kuraray Noritake); Cercon HT (Dentsply Sirona); Vita YZ HT (Vita Zahnfabrick); inCoris TZI, TZI C (Dentsply Sirona); BruxZir Full-Strength (Glidewell Laboratories); Pretau Zirconia (Zirkonzahn).

Cubic zirconia

Currently, a more translucent zirconia form is available on the market, namely cubic zirconia or 4Y-TZP/5Y-TZP (yttria stabilized zirconia) zirconia. It is zirconia stabilized with 4 or 5% yttria and contains a higher percent of cubic phase. 4Y-TZP contains more than 25% of cubic phase and 5 Y-TZP zirconia up to 50 % of cubic phase. This increases the translucency of the material [23,43,58]. The translucency is also achieved by reduction of light scattering due to larger size of grains and less grains boundaries. The size of the grains is around 1.5 μm while 3Y-TZP has size of grains around (0.5-1μm) [23,43]. The main disadvantages of these materials are that they have smaller amount of tetragonal phase and the cubic phase does not undergo transformation toughening [58]. Thus, the mechanical features such as strength and toughness decrease in comparison with conventional zirconia. The flexural strength is denoted around 500 to 700 MPa [43]. Suitable indications for this ceramic material are veneer, inlay, onlay [43], single crown and anterior three-unit bridge [58]. The advantages can include esthetics, higher translucency in comparison with conventional zirconia and the disadvantages are low mechanical properties.

There are very few experimental measurements of the mechanical properties of the new zirconia, thus they were not included in the graphs. Examples of representative CAD/CAM ceramics on market can be 4Y-TZP- IPS e.max ZirCAD MT (Ivoclar Vivadent); Katana ST/STML; Zpex 4 (Tosoh). 5Y-TZP: Lava esthetics (3M ESPE); Katana UT/UTML (Kuraray Noritake); BruxZir Anterior (Glidewell Laboratories); Pretau Anterior (Zirkonzahn); Zpex Smile (Tosoh).

Polymer Infiltrated ceramic network (PICN)

PICN is ceramic network which is infiltrated by polymer. It contains ceramic (75 % v/v, 86% w/w) and polymer (25% of v/v, 14% w/w) [10,22,37,59]. This ceramic mostly

contains 23% alumina and polymer and is composed mainly of TEGDMA (triethylene glycol dimethacrylate) and UDMA (urethane dimethacrylate). Due to the added polymer in the ceramics, the hybrid ceramics are less hard than traditional ceramics and therefore cause less antagonist wear. Therefore the material lost over time is higher in comparison with traditional ceramic [60]. The flexural strength, elasticity and abrasion are very similar to dentin [61].

Figure 1 depicts the range of flexural strength values measured by the three point bending test [10,14,19,21,22,25,37,39,40], the range of elastic modulus is shown on figure 2 [23–25,39,40,62,63] and figure 3 demonstrate range of fracture toughness [22,27,40,62,63] of PICN (Vita Enamic – Vita Zahnfabrik).

The final surface is polished to high gloss and the restoration can be also individualized by staining. Manufacturers denote adhesive fixation, including hydrofluoric acid etching of inner- surface and application of silane coupling agent.

Inlay, onlay, veneer, anterior and posterior crown can be made from these type of ceramics [22,28,29]. The advantages of PICN are the mechanical properties, rapid milling, implementation and low antagonists' wear. Disadvantages can be less aesthetics and sustainability [23].

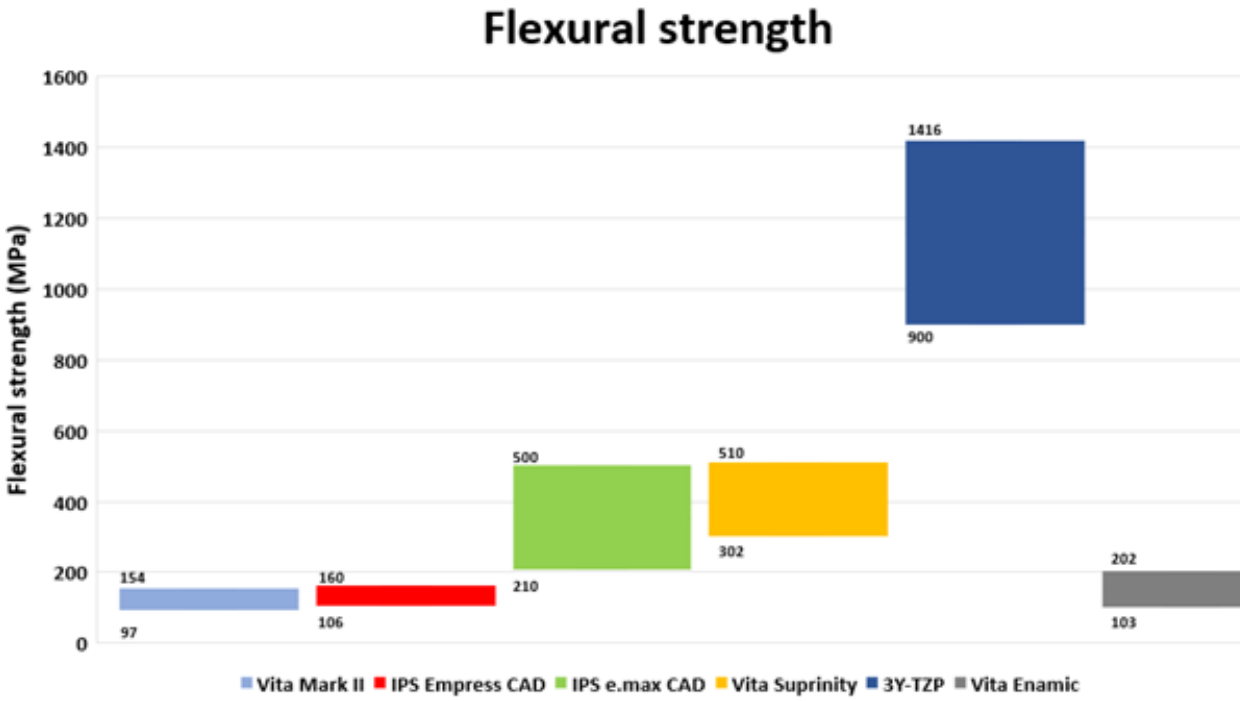

Figure 1. Flexural Strength. Boxing graph shows the range of flexural strength in MPa for each ceramic group.

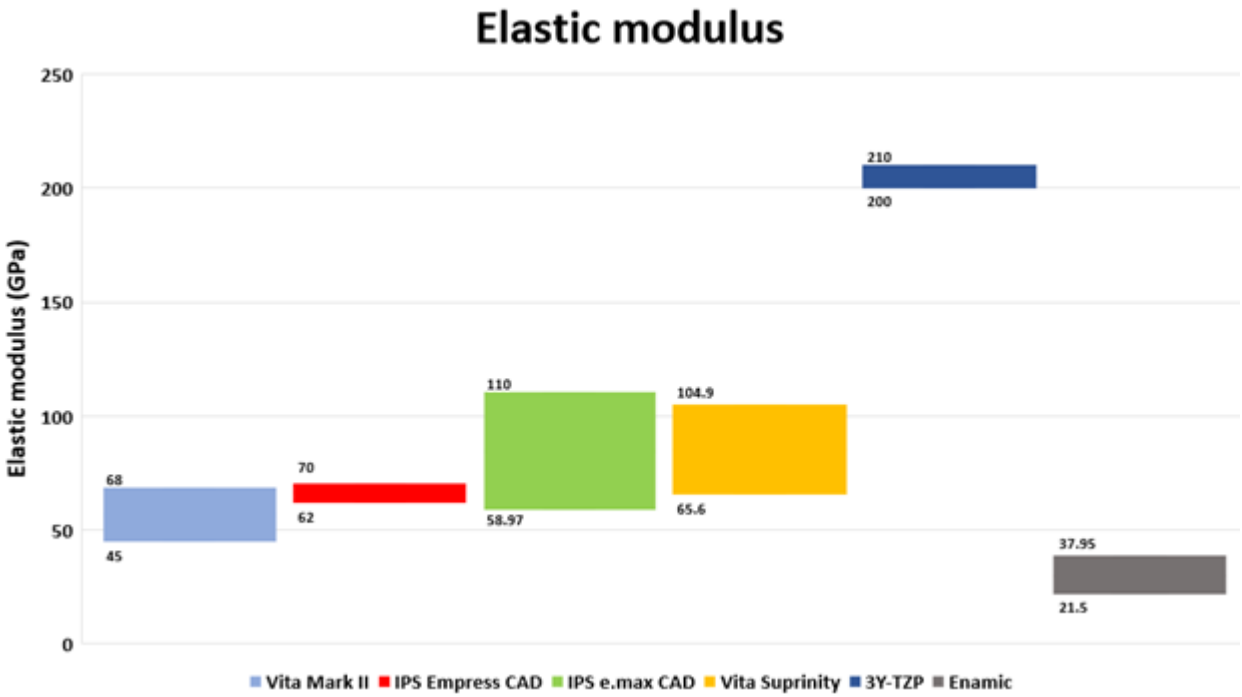

Figure 2. Elastic Modulus. The boxing graph shows the range of elastics modulus in GPa for each ceramic group.

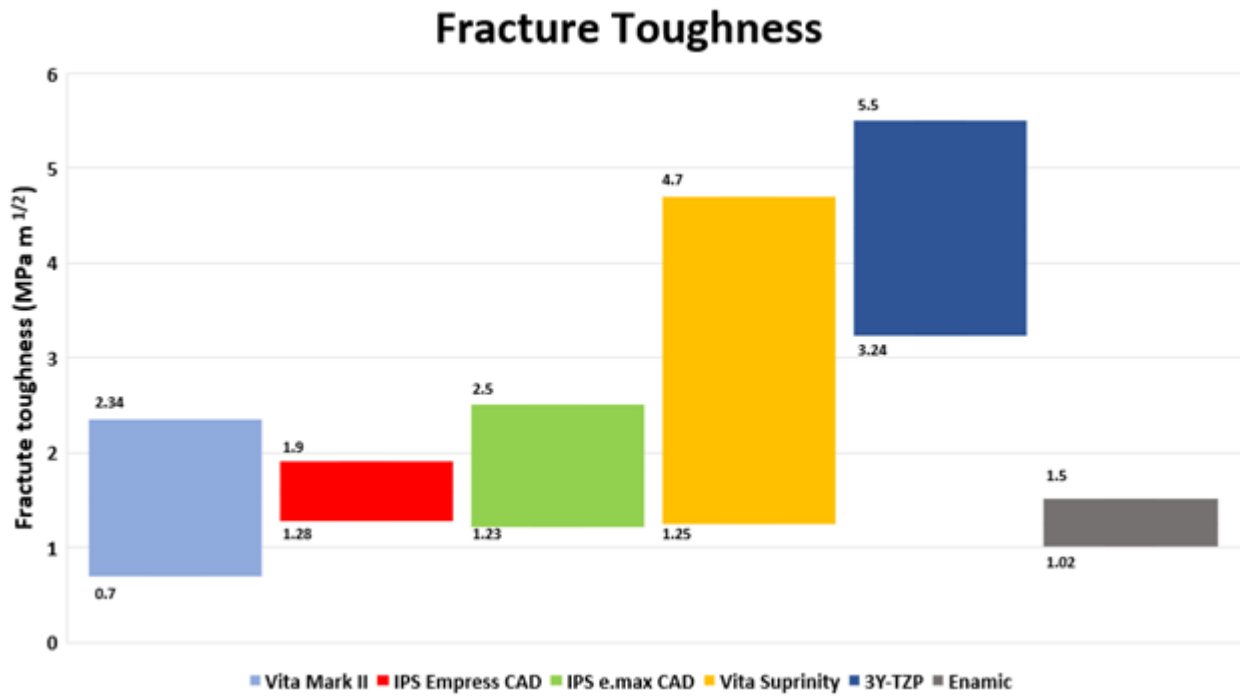

Figure 3. Fracture Toughness. The boxing graph shows the range of fracture toughness in $MPam^{1/2}$ for each ceramic group.

Discussion

As could be seen in Figures 1-3, zirconia ceramic 3Y-TZP has the highest values of all the mentioned mechanical properties: flexural strength (900-1416 MPa); elastic modulus (200-210 GPa) and fracture toughness (3.24-5.5 $MPam^{1/2}$).

The lowest values of flexural strength (97-154 MPa) and fracture toughness (0.7-2.34 $MPam^{1/2}$) are shown with Vita Mark II. This is likely due to the highest amount of glass in its composition. The lowest value of elastic modulus is reported for Vita Enamic (21.5-37.95 GPa). This is in line with the statement from Ceren at al. that elastic modulus of Vita

Enamic exhibits the similar properties as dental tissues.

Vita Enamic has likely the closest elastic modulus to dentin which is likely due to the added polymer. It is still controversial topic amongst dentists whether PICN and nanoceramics should be classified as ceramics. In PICN the matrix reinforced by polymer is ceramics, but in resin nanoceramic the matrix reinforced by ceramic is polymer, therefore PICN should be considered a ceramic, but the resin nanoceramics should not. PICN is also sometimes classified as hybrid ceramic. Some authors and manufactures include resin nanoceramic in the hybrid ceramics. Since this brings even more confusion, we referred to PICN hybrid as a ceramic.

For feldspar ceramic and leucite reinforced ceramic the use for crowns in posterior region is not indicated due to deficient mechanical characteristics to resist the loading from posterior chewing forces.

The ratio of crystals and glass composition influence the mechanical and optical properties of ceramic material. Based on the presented information, one can conclude that if the ceramics predominantly consists of glass matrix, the resulting restoration will be more translucent with good aesthetic but weaker. If the ceramics consists predominantly of crystals, the resulting restoration will have very good mechanical properties but will be opaquer. It follows that crystals increase the mechanical resistance and glass matrix adds aesthetics and a potentially a more natural look for a ceramic restoration. Nevertheless, it was shown that transmission of light through the material can also be influenced by the size of crystals, quantity of crystals, crystalline phase, pigments and wavelength and thus influence the translucency of the ceramic material [64].

The clinician has to also keep in mind the fatigue of the material. The strength values from three-point bending test denote the maximum stress when the material is exposed to a single load. The ceramic restorations are subjected in the mouth to the cyclic loads - several times a day during the chewing process. If the ceramic material is loaded several times under the yield point (the point where plastic deformation of material occurs), it can cause the fatigue of ceramic material. This means that the material strength reduces, and this can lead to a failure of the material. The fatigue of material can be also influenced by other condition in patient mouth such as pH changes, humidity and thermal changes [4].

Conclusion

There are various CAD/CAM ceramic groups which have different mechanic and aesthetic properties. The clinician should identify the differences between these ceramics in order to be able to choose properly the suitable material for each individual case.

Conflict of interest: None declared

References

1. Tin-Oo MM, Saddki N, Hassan N. Factors influencing patient satisfaction with dental appearance and treatments they desire to improve aesthetics. BMC Oral Health. 2011;11(1):1–8.
2. Samorodnitzky-Naveh GR, Geiger SB, Levin L. Patients' satisfaction with dental esthetics. The Journal of the American Dental Association. 2007;138(6):805–8.
3. McLaren EA, Giordano R. Ceramics overview: classification by microstructure and processing methods. International Dentistry – African Edition. 2014;4(3):18–30.
4. Sakaguchi, Powers. Craig's Restorative dental materials. Edition thirteen. Elsevier Mosby; 2012. P.33–49; 85; 91; 253–258.
5. Anusavice K, Shen C, Rawls R. Philip's Science od Dental Materials. Edition twelve. Elsevier; 2013.P. 48–64.
6. Domingues NB, Galvão BR, Ribeiro S, Almeida Junior AA de, Longhini D, Adabo GL. Comparison of the indentation strength and single-edge-v-notched beam methods for dental ceramic fracture toughness testing. Braz J Oral Sci. 2017;15(2):109-112.
7. Chun KJ, Lee JY. Comparative study of mechanical properties of dental restorative materials and dental hard tissues in compressive loads. Journal of Dental Biomechanics. 2014;5:1–6.
8. Shenoy A, Shenoy N. Dental ceramics: An update. J Conserv Dent. 2010;13(4):195–203.
9. Li RWK, Chow TW, Matinlinna JP. Ceramic dental biomaterials and CAD/CAM technology: State of the art. Journal of Prosthodontic Research. 2014;58(4):208–16.
10. Leung BTW, Tsoi JKH, Matinlinna JP, Pow EHN. Comparison of mechanical properties of three machinable ceramics with an experimental

fluorophlogopite glass ceramic. The Journal of Prosthetic Dentistry. 2015;114(3):440–6.
11. Fasbinder DJ. Materials for Chairside CAD/CAM Restorations. Compendium of continuing education in dentistry. 2010;31(9):702–9.
12. Atay DDS, PhD A, Sağirkaya DDS, PhD E. Effects of Different Storage Conditions on Mechanical Properties of CAD/CAM Restorative Materials. Odovtos - Int J Dent Sc. 2019;161–74.
13. Helvey GA. Classification of Dental Ceramics. Inside dentistry. 2013;April 2013:62–76.
14. Sen N, Us YO. Mechanical and optical properties of monolithic CAD-CAM restorative materials. The Journal of Prosthetic Dentistry. 2018;119(4):593–9.
15. Low IM. Advances in Ceramic Matrix Composites. Edition secound. Woodhead publishing; 2018. P.711–721.
16. Vichi A, Sedda M, Del Siena F, Louca C, Ferrari M. Flexural resistance of Cerec CAD/CAM system ceramic blocks. Part 1: Chairside materials. American Journal of Dentistry. 2013;26(5):255–9.
17. D'Arcangelo C, Vanini L, Rondoni GD, De Angelis F. Wear properties of dental ceramics and porcelains compared with human enamel. The Journal of Prosthetic Dentistry. 2016;115(3):350–5.
18. Denry I, Holloway J. Ceramics for Dental Applications: A Review. Materials. 2010;3(1):351–68.
19. Blackburn C, Rask H, Awada A. Mechanical properties of resin-ceramic CAD-CAM materials after accelerated aging. The Journal of Prosthetic Dentistry. 2018;119(6):954–8.
20. Lu T, Peng L, Xiong F, et al. A 3-year clinical evaluation of endodontically treated posterior teeth restored with two different materials using the CEREC AC chair-side system. The Journal of Prosthetic Dentistry. 2018;119(3):363–8.
21. Lauvahutanon S, Takahashi H, Shiozawa M, et al. Mechanical properties of composite resin blocks for CAD/CAM. Dent Mater J. 2014;33(5):705–10.
22. Sonmez N, Gultekin P, Turp V, Akgungor G, Sen D, Mijiritsky E. Evaluation of five CAD/CAM materials by microstructural characterization and mechanical tests: a comparative in vitro study. BMC Oral Health. 2018;18(5):1–13.
23. Lambert H, Durand J-C, Jacquot B, Fages M. Dental biomaterials for chairside CAD/CAM: State of the art. J Adv Prosthodont. 2017;9:486–95.
24. Alamoush RA, Silikas N, Salim NA, Al-Nasrawi S, Satterthwaite JD. Effect of the Composition of CAD/CAM Composite Blocks on Mechanical Properties. BioMed Research International. 2018;2018:1–8.
25. Sulaiman TA. Materials in digital dentistry—A review. J Esthet Restor Dent. 2020;32(2):171–81.
26. de Kok P, de Jager N, Veerman IAM, Hafeez N, Kleverlaan CJ, Roeters JFM. Effect of a retention groove on the shear bond strength of dentin-bonded restorations. The Journal of Prosthetic Dentistry. 2016;116(3):382–8.
27. Badawy R, El-Mowafy O, Tam L. Fracture toughness of chairside CAD/CAM materials – Alternative loading approach for compact tension test. Dental Materials. 2016;32:847–52.
28. Bajraktarova-Valjakova E, Korunoska-Stevkovska V, Kapusevska B, Gigovski N, Bajraktarova-Misevska C, Grozdanov A. Contemporary Dental Ceramic Materials, A Review: Chemical Composition, Physical and Mechanical Properties, Indications for Use. Open Access Maced J Med Sci. 2018;6(9):1742–55.
29. Sannino G, Germano F, Arcuri L, Bigelli E, Arcuri C, Barlattani A. Cerec CAD/CAM chairside system. Oral & Implantology. 2014;7(3):57–70.
30. Beuer F, Schweiger J, Edelhoff D. Digital dentistry: an overview of recent developments for CAD/CAM generated restorations. Br Dent J. 2008;204(9):505–11.
31. Vargas MA, Bergeron C, Diaz-Arnold A. Cementing all-ceramic restorations. The Journal of the American Dental Association. 2011;142:20S-24S.
32. Brenes DC, Duqum I, Mendonza G. Materials and systems for all c-eramic CAD/CAM restorations. Dental tribute. 2016;3:10–5.
33. Pitiaumnuaysap L, Phokhinchatchanan P, Suputtamongkol K, Kanchanavasita W. Fracture resistance of four dental computer-aided design and computer-aided manufacturing glass-ceramics. Mahidol Dental Journal. 2017;37(2):201–8.
34. Ritzberger C, Apel E, Höland W, Peschke A, Rheinberger V. Properties and Clinical Application of Three Types of Dental Glass-Ceramics and Ceramics for CAD-CAM Technologies. Materials. 2010;3(6):3700–13.
35. Zhu J, Rong Q, Wang X, Gao X. Influence of remaining tooth structure and restorative material type on stress distribution in endodontically treated maxillary premolars: A finite element analysis. The Journal of Prosthetic Dentistry. 2017;117(5):646–55.
36. Byeon S-M, Song J-J. Mechanical Properties and Microstructure of the Leucite-Reinforced Glass-Ceramics for Dental CAD/CAM. J Dent Hyg Sci. 2018;18(1):42–9.
37. Furtado de Mendonca A, Shahmoradi M, Gouvêa CVD de, De Souza GM, Ellakwa A. Microstructural and Mechanical Characterization of CAD/CAM Materials for Monolithic Dental Restorations: Characterization of CAD/CAM Materials. Journal of Prosthodontics. 2019;28(2):587–94.

38. Culp L, McLaren EA. Lithium Disilicate: The Restorative Material of Multiple Options. Compendium of continuing education in dentistry. 2010;31(9):716–25.
39. Lawson NC, Bansal R, Burgess JO. Wear, strength, modulus and hardness of CAD/CAM restorative materials. Dental Materials. 2016;32(11):275–83.
40. Goujat A, Abouelleil H, Colon P, Jeannin C, Pradelle N, Seux D, et al. Mechanical properties and internal fit of 4 CAD-CAM block materials. The Journal of Prosthetic Dentistry. 2018;119(3):384–9.
41. Zarone F, Ferrari M, Mangano FG, Leone R, Sorrentino R. "Digitally Oriented Materials": Focus on Lithium Disilicate Ceramics. International Journal of Dentistry. 2016;2016:1–10.
42. Elsaka SE, Elnaghy AM. Mechanical properties of zirconia reinforced lithium silicate glass-ceramic. Dental Materials. 2016;32(7):908–14.
43. Zhang Y, Lawn BR. Novel Zirconia Materials in Dentistry. Journal of Dental Research. 2018;97(2):140-147.
44. Chen X-P, Xiang Z-X, Song X-F, Yin L. Machinability: Zirconia-reinforced lithium silicate glass ceramic versus lithium disilicate glass ceramic. Journal of the Mechanical Behavior of Biomedical Materials. 2020;101:1–10.
45. Ramos N de C, Campos TMB. Microstructure characterization and SCG of newly engineered dental ceramics. Dental Materials. 2016;32(7):870–8.
46. Sacher E, Franca R. Dental Biomaterials. Vol. secound. New Jersey: World Scientific; 2018. P.148–203.
47. Willard A, Gabriel Chu T-M. The science and application of IPS e.Max dental ceramic. The Kaohsiung Journal of Medical Sciences. 2018;34(4):238–42.
48. Eakle WS, Bastin KG. Dental Materials Clinical Applications for Dental Assistants and Dental Hygienists. fourth. Elsevier Health Sciences; 2019.
49. McLaren EA, Figueira J. Updating Classifications of Ceramic Dental Materials: A Guide to Material Selection. Compendium of continuing education in dentistry. 2015;36(6):739–44.
50. Rinke S, Rödiger M, Ziebolz D, Schmidt A-K. Fabrication of Zirconia-Reinforced Lithium Silicate Ceramic Restorations Using a Complete Digital Workflow. Case Reports in Dentistry. 2015;1–7.
51. Rinke S, Pabel A-K, Rödiger M, Ziebolz D. Chairside Fabrication of an All-Ceramic Partial Crown Using a Zirconia-Reinforced Lithium Silicate Ceramic. Case Reports in Dentistry. 2016;1–7.
52. Traini T, Sinjari B, Pascetta R, et al. The zirconia-reinforced lithium silicate ceramic: lights and shadows of a new material. Dental Materials Journal. 2016;35(5):748–55.
53. Helvey GA. Zirconia and Computer-aided Design/Computer-aided Manufacturing (CAD/CAM) Dentistry. Inside dentistry. 2008;4(4).
54. Della Bona A, Borba M, Benetti P, et al. Adhesion to Dental Ceramics. Curr Oral Health Rep. 2014;1(4):232–8.
55. Passos SP, Torrealba Y, Major P, Linke B, Flores-Mir C, Nychka JA. In Vitro Wear Behavior of Zirconia Opposing Enamel: A Systematic Review: Enamel Wear Caused by Zirconia Ceramics. Journal of Prosthodontics. 2014;23(8):593–601.
56. Alghazzawi TF, Lemons J, Liu P-R, Essig ME, Bartolucci AA, Janowski GM. Influence of Low-Temperature Environmental Exposure on the Mechanical Properties and Structural Stability of Dental Zirconia: Zirconia Exposed to Low-Temperature Degradation. Journal of Prosthodontics. 2012;21(5):363–9.
57. Burgess JO. Zirconia: The Material, Its Evolution, and Composition. Compendium of continuing education in dentistry. 2018;39(4):4–8.
58. Meirelles L. Ceramic CAD/CAM Materials: An Overview of Clinical Uses and Considerations. ADA professional product rewiev. 2017;12(1):1–9.
59. Campos F, Almeida C, Rippe M, de Melo R, Valandro L, Bottino M. Resin Bonding to a Hybrid Ceramic: Effects of Surface Treatments and Aging. Operative Dentistry. 2015;40(6):1–8.
60. Ceren N, Turp V, Emir F, Akgungor G, Ayyildiz S, Şen D. Nanoceramics and hybrid
61. materials used in CAD/CAM systems. Aydın Dental Journal. 2016;55–61.
62. Dirxen C, Blunck U, Preissner S. Clinical Performance of a New Biomimetic Double Network Material. The Open Dentistry Journal. 2013;7:118–22.
63. Wang H, Cui B, Li J, et al. Mechanical properties and biocompatibility of polymer infiltrated sodium aluminum silicate restorative composites. J Adv Ceram. 2017;6(1):73–9.
64. Della Bona A, Corazza PH, Zhang Y. Characterization of a polymer-infiltrated ceramic-network material. Dental Materials. 2014;30(5):564–9.
65. Bao YW, Gong J, Tian. Testing and Evaluation of Inorganic Materials I. Switzerland: Trans Tech Publications Ltd; 2011. P.300.

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REVIEW

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The assessment of two-way relationship between periodontal diseases and diabetes mellitus.

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Abstract

Periodontal disease and diabetes mellitus have been said to have a two-way relationship, with diabetes leading to oral disease and periodontitis exacerbating hyperglycemia. The universal biologic mechanisms and demographic and behavioral risk drivers, underlying these associations in both directions, are also described.

Both the diseases are chronic and they are affecting large population worldwide. Periodontitis is also recognized as the sixth major complication of diabetes, while diabetes mellitus is a metabolic disorder which has an impact on the global health and plays a crucial role in the pathogenesis of periodontitis.

The aim of this article is to illustrate a systematic and comprehensive analysis of the literature, on the mutual relationship between diabetes mellitus and periodontal diseases,

trying to identify if the prevalence of periodontitis is higher in diabetics or if the incidence of diabetes is greater in patients with periodontal disease. Moreover, our intention is to increase the level of awareness of diabetologists and dentists about the interaction between this two pathologies.

Oral and periodontal health should be promoted as integral components of diabetes management. Dental professionals can detect unrecognized potential dysglycemia and refer for medical examination. Furthermore, the control of periodontal disease may enhance glycemic control which contributes to a better control of periodontal disease.

Keywords: periodontal disease, diabetes mellitus, two-way relationship.

Introduction

The oral cavity hosts an environment rich in bacteria, generating the mouth microbiome, which in pathogenic conditions can lead to alterations in oral soft and hard tissues, changes that can reflect specific systemic disease. If so far, the traditional pattern was to focus only on the oral cavity, recently there has been a change. Until now, diseases in the oral cavity were diagnosed and treated as loco-regional conditions, but the current trend is to find correlations between the pathogenesis of the oral cavity with systemic diseases and microflora elsewhere in the body, a different approach called systemic connection [1].

Periodontal disease is a group of chronic, inflammatory and microbial-induced conditions, normally manifesting in two major types, gingivitis and chronic periodontitis. Both types of periodontal disease have a bacterial etiology with gram-negative anaerobes predominating as periodontal pathogens [2, 3].

Gingivitis is an inflammation of the gums induced by biofilm or bacterial plaque, which is reversible, but can progress to individuals susceptible to chronic periodontitis. Gingivitis is treated clinically after the interruption of the mechanical action of the biofilm, usually through efficient and regular oral hygiene [2, 3].

Chronic periodontitis occurs in vulnerable people with prolonged accumulation of supra and subgingival bacterial plaque. The chronic presence of plaque results from the enrichment and maturation of the biofilm, causing continuous, uninterrupted inflammation, and, therefore, a permanent damage. Chronic periodontitis is characterized by the irreversible loss of the supporting structures of the tooth, including the fibers of the connective tissue at the gingival level, the periodontal ligament and the alveolar bone. This local, irreversible destruction of the marginal periodontium tissues, in severe cases, can lead to tooth loss [2, 3].

From an etiological, pathological, clinical and therapeutic point of view, diabetes mellitus is a heterogeneous syndrome. Diabetes mellitus is characterized by chronic hyperglycemia caused by decreased insulin secretion or insulin resistance of various tissues, especially muscle, fat and liver. As a result of hyperglycemia, insulin deficiency and hyperinsulinemia, a secondary manifestation of insulin resistance, there are also changes in protein, lipid and hydroelectrolytic metabolism. These changes, ultimately, lead to a complex disorder of the body's energy metabolism. Hyperglycemia and other associated abnormalities produce severe acute and chronic complications, altering the quality and reducing the duration of the patient's life [4].

In the oral cavity, periodontal disease is the most important complication of diabetes. However, a number of other lesions and oral disorders have been detected in patients with diabetes [5].

Given the linkage between the periodontal disease and diabetes mellitus, two entities which interact continuously, we intended to review the existing literature, asking the subsequent question: Is there any association between diabetes mellitus and the prevalence of periodontal disease or is the incidence of diabetes mellitus greater in patients with periodontitis?

Such interdisciplinary, patient centered care, could contribute to improved health, wellbeing and quality of live in people worldwide.

Material and methods

We performed a bibliographic search on PubMed database, reviewing the interrelationship between diabetes and periodontal diseases.

The literature search was made using the following keywords: diabetes mellitus, glycated hemoglobin or metabolic control and periodontal disease, periodontitis or gingivitis.

Our attention was turned to the studies that follow the interaction between this diseases.

The inclusion criteria were articles or books, written in English and Romanian, containing the keywords mentioned. We included in our review researches performed on human subjects. We have excluded the papers that were published in other languages, than English or Romanian. The articles were selected and analyzed by a single reviewer.

We researched ninety seven documents from the examined topic.

The researched items were published from 1967 to 2016. Duplicates were eliminated, and the remaining articles, with potential abstracts and titles, were filtered, based on the inclusion and exclusion criteria. Of the total papers found, based on our search strategy, we chose thirty seven, which met the inclusion criteria. In our study were included thirty two articles and five books.

The articles have been divided as follows: thirteen were reviews of literature, two were comparative studies, one cross sectional study, a case control study and the other fifteen did not belong to a certain category.

Articles presenting various classifications for diabetes and periodontitis used over the years, varying clinical and radiographic criteria used to assess periodontal disease prevalence, extent and severity, evolving standards for the degree of glycemic control and changing methods for assessing complications associated with diabetes were included in our research.

Results

Repercussions of diabetes mellitus on the periodontium.

Several studies have thoroughly investigated the influence of diabetes on oral wellness. In this context, the levels of glycemia have been shown to be peculiar, and cannot be overlooked [6, 7].

It was found that individuals with diabetes present local irritation such as increased gingival bleeding, enlarged gingiva, increased probing depths, considerable loss of attachment, more tooth loss caused by

increased tooth mobility and tendency towards greater alveolar bone loss [8].

Prolonged exposure to hyperglycemic condition results in decreased fibroblast proliferation, decreased collagen synthesis, enhanced collagen glycosylation and cross linkage resulting in defective collagen metabolism. Normal collagen is, therefore, replaced by highly polymerized and cross linked collagen. Increased collagenase activity results in excess removal of gingival collagen fibers. Vascular basement membrane thickening and alteration, narrowing of the lumina of the capillaries and precapillary arterioles and vascular degeneration of the gingiva leading to reduced oxygen consumption and oxidation of glucose. These angiopathies contribute to hampered delivery of nutrients to the surrounding tissues and inadequacy elimination of waste products necessary for maintenance of gingival tissues.

All the above referred mechanisms, contribute to aggressive removal of connective tissue and severe periodontal destruction [9].

The impact of periodontal diseases on diabetes mellitus.

As diabetes can cause alterations of the periodontal structures, the conditions of the supporting tissues of the tooth can also be unfavorable in the control of the glycemic level in the patients with diabetes.

The first testimony that confirms this theory emerges from the exploration started on people who belonged to the indigenous population of the Gila River in New Mexico. At the beginning of the study, it was found that severe periodontitis is associated with poor blood sugar control, with glycosylated hemoglobin of over 9.0%, being an unfavorable circumstance, even suggesting that severe periodontitis is a factor that destroys diabetes management [10].

The major characteristic of periodontitis is chronic inflammation of the periodontal tissues, inflammation that can contribute to insulin resistance or irregular blood sugar levels [11]. Chronic inflammation is considered to link impaired oral health to poor blood sugar control [12].

Gram-negative microorganisms, which cause chronic periodontal infections, may increase insulin resistance. Some of these, such as Prevotella intermedia, Porphyromonas gingivalis or Tannerella forsythensis, increase levels of C-reactive protein (CRP), fibrinogen and interleukin 6 (IL-6) [13].

Additionally, systemic bacteremia can have an individual contribution in worsening the inflammation. It is well known that diabetes and insulin resistance, atherosclerosis and obesity are bounded by a prevalent agent, which is chronic inflammation. In this context, insulin sensitivity can be improved by blocking tumor necrosis factor (TNF-α). This factor is interrelated with the production of interleukin 6 (IL-6) and C-reactive protein (CRP) [14]. It has been suggested that tumor necrosis factor (TNF-α) may be responsible for the interconnection between diabetes and periodontal disease. Increasing the level of tumor necrosis factor (TNF-α), plays an important role in stimulating fibroblasts, synthesizing degrading enzymes of osteoclasts and cellular matrix, resulting in active bone resorption [15, 16].

Recent evidence suggests, that chronic infections like periodontitis, may induce a chronic state of insulin resistance, which would then lead to poor glycemic control and contribute to the cycle of hyperglycemia, non-enzymatic irreversible glycosylation, AGEs of protein binding with further accumulation [17].

Disscusion

From the total of articles researched in this review, eighteen were related to the impact of diabetes mellitus on the periodontium, while nineteen of them studied the implication of periodontal disease on diabetes mellitus.

The relationship between diabetes and periodontal diseases has been the subject of many articles. Underlying the two-way relation between these diseases and act accordingly, could improve their screening and

management, with important benefits for the patients.

Countless epidemiological studies bring diabetes to the fore, as the major risk factor for periodontitis, the risk of developing periodontal disease, being even greater the weaker the metabolic control. Patients with poor blood glucose control will therefore have an extremely high risk of suffering from gingival and periodontal disease, and complications can lead to massive bone resorption at the alveolar ridges. This category of patients are also exposed to micro and macrovascular complications [18, 19].

The study of the prevalence of diabetes and the multitude of clinical cases existing in oral pathology, led to the conclusion that diabetes has the greatest impact on the oral cavity, being the most important systemic condition identified in the personal pathological history of patients presenting to the dental office [5]. Research conducted by Ervasti and colleagues has shown that in patients with poor diabetes control, gingival bleeding is more pronounced, compared to subjects in the control group, which included patients without diabetes or diabetic patients with good blood sugar control [20]. In the non-insulin dependent patient, gingival hypertrophy was detected, an oral pathology that was not present in those without diabetes. Untreated gingivitis can advance to periodontitis, which also has been detected in patients with poor blood sugar control [21].

Indian researchers have identified in patients with HBA1c > 8, increased depth of pocket probing depths and loss of gingival attachment, accompanied by abundant bacterial plaque and increased gingival inflammation, compared to patients with HBA1c ≤ 7 or HBA1c =7-8 [22]. Following the two-year study, these researchers concluded that the risk of alveolar bone resorption is eleven times higher in patients with poor glycemic control, compared to subjects in the control group [23].

In young patients diagnosed with various forms of periodontitis, higher values of glycated hemoglobin have been reported [24, 25]. Poor glycemic control, over two to five years, substantially increases the depth of periodontal probing and loss of gingival attachment, in diabetic patients, compared to patients with good metabolic control [26].

At the same time, a case-control study, recently elaborated, showed that children with diabetes lose gingival attachment remarkably widely, compared to young patients without diabetes [27]. Furthermore, research on epidemiological problems, has reflected a higher prevalence and harshness in the loss of gingival attachment and bone degeneration in diabetic adults [28, 29]. To determine the risk of osteolysis, the researchers conducted a two-year study, concluding that this risk is four times higher in patients with non-insulin dependent diabetes, than in patients without diabetes [30].

A longitudinal study, conducted over two years, showed that deep marginal periodontitis encountered in diabetic patients, deteriorates up to six times, the control of blood sugar [23]. After analyzing 25 reviews, it was concluded that a timely established treatment, in a proper way, helps to reduce glycemic (HbA1c) levels, by up to 0.9% [31].

Other systematic investigations, conducted during 2010, by analyzing data from articles in Cochrane databases, supported the same idea that is maintaining blood sugar under control, after the treatment of diseases of the superficial or deep marginal periodontium [32]. However, in order to maintain good clinical results and steady glycemic values, in laboratory investigations, requires a sustained periodontal treatment, performed periodically, at intervals of at least six months [33].

It is rational to suppose that poor glycemic control forecast a shortfall in periodontal disease management, especially that the impact of poor glycemic control is well known in severe periodontitis. At the same time, periodontal disease, can be triggered, as a consequence or complication of diabetes [34].

A number of researchers have focused on investigating non-oral complications of

diabetes, showing that cardiovascular complications, retinopathy and diabetic neuropathy, or proteinuria, have been more severe, when combined with periodontal disease [35].

Because periodontal disease is not accompanied by pain, at least in its infancy, most people do not realize that they suffer from periodontal disease, until the disease affects the supporting structures of the tooth and the destruction is marked. In order to maintain oral health in diabetic patients, early treatment of infections located in the superficial or deep periodontium is mandatory.

The treatment of periodontal disease will have a positive effect in maintaining glycemic control and limiting diabetic complications [36]. Most diabetologists support the existence of a close link between oral and systemic health, considering that an interdisciplinary, dental treatment, would have a positive impact for these patients [37].

Conclusions

According to published reviews, it is obvious that there is an association between diabetes and periodontal disease. Patients with diabetes have a higher risk of developing periodontal lesions, specifically when there is no glycemic control. This category of patients will come to the dental office in dire need of periodontal treatment. All diabetic patients should benefit from routine consultations and preventive dental treatment, through professional hygiene of the oral cavity, in order to maintain oral health, in the general context of a healthy lifestyle.

The treatment of gingival and periodontal diseases, as well as their prevention, should be seen as an indispensable part in the management of diabetes mellitus. For this reason, the prevention of periodontitis in patients at risk of developing diabetes is required. Diabetic patients with poor metabolic control should be consulted more often, precisely if periodontal disease is already present. It is shown that the management of blood glucose levels and keeping them under control, has its benefits for periodontal tissues, while the treatment of periodontal pathology improves the metabolism of diabetic patients.

Therefore, the clinical correlations between these two conditions should be further investigated, through various clinical and laboratory studies. Now is the time to be aware of this two-way relationship, between diabetes and periodontal disease, to be conscious of it and to treat it with the utmost importance, as a local condition in the oral cavity can influence the general condition of the body, and vice versa.

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References

1. Ryden L, Buhlin K, Ekstrand E, et al. Periodontitis increases the risk of a first myocardial infarction: A report from the Parokrank study. 2016;133:576-83.
2. Genco RJ, Goldman HM, Cohen DW, et al. Contemporary Periodontics. St. Louis: Mosby. 1990, pp.63-81.
3. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet. 2005;366(9499):1809-20.
4. Viorel S. Tratat roman de boli metabolice. Editura Brumar. Timișoara. 2010, pp.69-86.
5. Ira BL: Non-periodontal oral complication of diabetes mellitus. In Diabetes Mellitus and Oral Health: An Interprofessional Approach, First Edition, Blackwell Publishing. 2014, pp.157-190.
6. Papapanou PN. Periodontal diseases: Epidemiology. Ann Periodontol. 1996;1:1-36.
7. Mealey BL, Moritz AJ. Hormonal influences: Effects of diabetes mellitus and endogenous female sex steroid hormones on the periodontium. Periodontol. 2000. 2003;32:5981.
8. Lund, Loe H. Relationship between periodontal state and diabetes duration. J Periodontol. 1968;39:243.

9. Krejci CB, Bissada NF. Periodontitis - The risks for its development. General Dentistry. 2000;48(4):430-436.
10. Taylor GW, Burt BA, Becker MP, et al. Severe Periodontitis and risk for poor glycemic control in patients with non-insulin-dependent diabetes mellitus. Journal of Periodontology. 1967;1085-1093.
11. Han K, Nam GE, Kim DH, et al. Association of periodontitis with urinary albumin excretion in korean adults with diabetes. The 2012 Korea national health and nutrition examination survey. Baltimore. 2015;94:e1839.
12. Deshpande K, Jain A, Sharma R, et al. Diabetes and periodontitis. J Indian Soc Periodontol. 2010;14:207-12.
13. Yang NY, Zhang Q, Li JL, et al. Progression of periodontal inflammation in adolescents is associated with increased number of Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythensis and Fusobacterium nucleatum. Int J Paediatr Dent. 2014;24:226-33.
14. Nishimura F, Iwamoto Y, Mineshiba J, et al. Periodontal disease and diabetes mellitus: The role of tumor necrosis factor-alpha in a 2-way relationship. J Periodontol. 2003;74:97-102.
15. Nagpal R, YamashiroY, IzumiY. The two way association of periodontal infection with systemic disorders: An overview. Mediators Inflamm. 2015;2015:793898.
16. Grover HS, Luthra S. Molecular mechanisms involved in the bidirectional relationship between diabetes mellitus and periodontal disease. J Indian Soc Periodontol. 2013;17:292-301.
17. Nishimura F, Murayama Y. Periodontol inflammation and insulin resistance-lessons from obesity. Journal of Dental Research. 2001;80(8):1690-1694.
18. Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. Lancet. 2005; 366:1809-1820.
19. Soskolne WA, Klinger A. The relationship between periodontal diseases and diabetes: an overview. Ann Periodontol. 2001;6:91-98.
20. Ervasti L, Knuuttila M, Pohjamo L, et. al. Relation between control of diabetes and gingival bleeding. J Periodontol. 1985;56(3):154-7.
21. Cutler CW, Machen RL, Jotwani R, et al. Heightened gingival inflammation and attachment loss in type 2 diabetics with hyperlipidemia. J Periodontol. 1999;70(11):1313-21.
22. Jindal A, Parihar AS, Sood M, et al. Relationship between severity of periodontal disease and control of diabetes (glycated hemoglobin) in patients with type 1 diabetes mellitus. J Int Oral Health. 2015;7:17-20.
23. Taylor GW, Burt BA, Becker MP, et al. Glycemic control and alveolar bone loss progression in type 2 diabetes. Ann Periodontol. 1998;3:30-9.
24. Gusberti FA, Syed SA, Bacon G, et al. Puberty gingivitis in insulin-dependent diabetic children: Cross-sectional observations. J Periodontol. 1983;54:714-20.
25. Deshpande K, Jain A, Sharma R, et al. Diabetes and periodontitis. J Indian Soc Periodontol. 2010;14:207-12.
26. Tervonen T, Oliver RC. Long-term control of diabetes mellitus and periodontitis. J Clin Periodontol. 1993;20:431-5.
27. Lalla E, Cheng B, Lal S, et al. Periodontal changes in children and adolescents with diabetes: a case-control study. Diabetes Care. 2006;29(2):295-9.
28. Shlossman M, Knowler WC, Pettitt DJ,et al. Type 2 diabetes mellitus and periodontal disease. Jada. 1990;121(4):532-6.
29. Emrich LJ, Shlossman M, Genco RJ. Periodontal disease in noninsulin dependent diabetes mellitus. J Periodontol. 1991;62(2):123-31.
30. Taylor GW, Burt BA, Becker MP, et al. Non-insulin dependent diabetes mellitus and alveolar bone loss progression over 2 years. J Periodontol. 1998;69(1):76-83.
31. Garcia R. Periodontal treatment could improve glycaemic control in diabetic patients. Evid Based Dent. 2009;10:20-1.
32. Simpson TC, Needleman I, Wild SH, et al. Treatment of periodontal disease for glycaemic control in people with diabetes. Cochrane Database Syst Rev. 2010. doi: 10.1002/14651858.CD004714.pub2.
33. Simpson TC, Weldon JC, Worthington HV, et al. Treatment of periodontal disease for glycaemic control in people with diabetes mellitus. Cochrane Database Syst Rev. 2015. doi: 10.1002/14651858.CD004714.pub3.
34. Marchand F, Raskin A, Dionnes HA, et al. Dental implants and diabetes: Conditions for success. Diabetes Metab. 2012;38:14-9.
35. Thorstensson H, Kuylenstierna J, Hugoson A. Medical status and complications in relation to periodontal disease experience in insulin-dependent diabetics. Journal of Clinical Periodontology. 1996;23:194-202.
36. Gavrav M, Gurvanit L, Manjit T. Association of periodontitis with Diabetes Mellitus: a review. Journal of Medical College Chandigarh. 2011.

37. Lopes MH, Southerland JH, Buse JB, et al. Diabetes educators knowledge, opinions and behaviors regarding periodontal disease and diabetes. J Dent Hyg. 2012;86:82-90.

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ORIGINAL RESEARCH

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Contribution to the study of improving the aesthetics of the smile by repairing and reshaping the incisors with composite materials.

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Abstract

Introduction. Dental aesthetics, although it seems something relative and difficult to evaluate, it is governed by a series of laws and rules that connect the dental disciplines, creating a unitary whole. It is structured by rules, perfected by artistic sense and by the inclination towards beauty of all specialists in dento-facial cosmetics.

The aim of the study is to highlight an overview of aesthetic factors to consider when restoring anterior teeth with direct composite materials.

Material and methods. A total of 25 patients were included in the study where the anterior teeth were restored using Gradia Direct Anterior (from GC) and Filtek Z550 (from3M-ESPE) composite kits, in perfect isolation using rubber damn, with a separate appointment after 24 hours for the polishing step, for which Rainbow Kit Technic and polishing Platina Hi-Gloss (from Prevest) paste were used. While the replacement of the tooth defect, we ensured that the composite increment, which we used should not be more than 2mm in thickness, and light cured for 20 seconds as the producer recommends. In none of all tooth shape modification (elongation in incisal zone) we did not modify the occlusion, by eliminating all premature contacts. All patients included in the study have signed the informed consent and agreed to participate in this research.

Results. From a total of 25 patients, we repaired 20 central incisors with the mesial (18 cases) or distal (2 cases) angles fractured, in different accidents, 5 cases with diastema by small shape of the crown or malposition of one of the central incisors.

Conclusions. Restoring the incisal angle or the incisal edge and refining a natural and improved smile of the patient is e very frequent dental intervention, especially nowadays when aesthetics plays an important role in the social society.

Keywords: smile, dental aesthetic, composite, incisal angle, tooth fracturese.

Introduction

With the attraction for elective dentistry, more than half of dental practitioners are concerned with branches that belong to dental aesthetics, whether it is prosthetics, orthodontics or surgery. At the same time, the number of patients requesting cosmetic dental procedures, in order to obtain a perfect smile, is increasing. So, for optimizing dental aesthetics, it is necessary to analyze all components of the face, and establish the improvements that can be made, in order to obtain a smile as close as possible to the ideal. This requires the intrinsic perception of the relationship between teeth, gums and lips and the needs or vision of the patients [1,2].

Due to the multiple variations related to age, culture, civilization, individuality, it becomes almost impossible to define the ideal smile. A perfect smile depends largely on the symmetry and balance between the characteristics of the face and those of the teeth. The colour, shape and position of the teeth, occupy the main place in the aesthetic determination [3].

There are different features and characteristics present in the teeth which depends on various factors, as for example the gender. The female teeth have a rounder shape, manifested both by the incisal edge and by the transition lines. The incisal embrasures are also more pronounced, the incisal edge is more translucent, fact that creates the aspect of elegance [4]. The male teeth are much more angled and irregular. With age, the saturation of the teeth, in the case of men, is higher, the colour of the body of the tooth extends to the incisal edge. The incisal embrasure is squarer and not so pronounced. The individualization is strong, incorporating grey or brown cracks [5].

Regarding the age of patients, the teeth of the elderly have the following characteristics: they lack texture, are dark in colour, have a higher colour saturation, are shorter, abraded

(in smiles can be seen less), have a larger clinical crown (even if they are abraded, a consequence of gingival retractions) and are more individualized. The lower incisors exhibit straight incisal edges with dentin islands. Young individuals are at the opposite pole. The young teeth are more textured, brighter, have a low saturation, the gingival edge corresponds to the enamel-cement junction, the incisal edge is rounded so that the lateral incisors appear shorter than the central and canine, the cervical embrasures are reduced, with low individualization, usually with hypoplasic lines and spots [6].

Perceptions of colour, size, tooth shape, age and gender of the patient are based on certain prejudices that are a part of the cultural environment of each individual. Perceptual preconceptions can be divided into two categories: cultural and artistic. The use and manipulation of these preconceptions allow cosmetic dentistry to fool the eye of the observer when we consider prosthetic restorations. Proponents of these theories claim that, illusion is the art of changing perception in order to create an affiliation other than reality [7,8]. Teeth can be made to look wide, narrow, small, large, short, long, aged, rejuvenated, belonging to any gender whether it is male or female. Understanding these basic principles of perception and manipulating them in the control of illusion allow the realization of aesthetic prosthetic reconstructions [9,10].

Aim of the study

The main aim of this study is to create minimally invasive, long lasting restorations, a functional and natural smile makeover by reshaping the incisal angles, the incisal line or the vestibular surface using only composite materials.

Material and methods

In the present clinical study were included a total of 25 patients whose anterior teeth were restored with composites following proper technique. We have explained the important steps to all patients and they have all accepted and signed the informed consent. As we have discussed the aesthetic, anatomical and optical properties of natural tooth, an adequate technique, appropriate materials and equipment were selected to get the best possible outcome. Here are the steps that we followed to obtain an aesthetic smile, which promoted morphology stability, health, function and biocompatibility with the surrounding tooth tissues.

- *Composite Selection*

The Gradia Direct Anterior (from GC) and Filtek Z550 (from 3M-ESPE) composite kits were used in all the patients to restore the anterior teeth. Gradia Direct Anterior and Filtek Z550 are light-cured resin composites consisting of micro-filled hybrid. All these materials offer significant advantages in aesthetics, improved and easy polish ability, better wear resistance and fracture toughness. Additionally, they also demonstrate tooth-like color reflection and absorption which made them our first choice.

- *Shade Selection*

In this step, we ensured that the anatomical layering technique was followed. We selected the shade of the dentin by observing the cervical third of the tooth while the shade of enamel was selected by choosing the translucency similar to the incisal third. Initial shade selection was done by matching a shade tab to the area of interest (dentin or enamel).

- *Tooth Preparation*

The tooth preparation for direct composite restorations involves only the walls of the defect. In cases where previous failed restorations were present, we removed them alongside the weakened enamel. A stable and supportive convenience form was obtained, which also included the bevel placement. As there are no minimum depth requirements for composite preparation, the tooth hard tissue cutting was done in such a way that the material easily bonded with the tooth, giving it enough space and strength.

- *Bonding and etching*

We have used Tokuyama Etching Gel HV for etching the enamel and dentin, which contains 39% phosphoric acid. For the bonding, in the present clinical study we used G-Premio BOND (from GC), a universal, 8th generation bonding agent which is compatible with different etching techniques namely, total-etch, self-etch and selective etch techniques

- *Composite placement and light-curing*

The composite material was applied using incremental technique. Layer by layer, the

missing tooth part was placed and light-cured. We used this technique as it allows proper and complete anatomical build up. While the placement of the material, we ensured that the composite increment would not be more than 2mm in thickness. We light cured the build-up for 20 seconds as the producer recommends.

- *Shaping*

Shaping is the most important step for final aesthetic appearance of a composite restoration. We used appropriate burs, discs and finishing strips to give the restoration a look of a natural teeth. When we shaped the central incisor, we evaluated the symmetry and appearance characteristics of the adjacent tooth, so that we can re-establish the ideal form. The transition lines were adequately positioned so that an aesthetically pleasing outline is obtained.

- *Finishing and polishing techniques*

We used Kit Technic Rainbow for polishing combined with Platina Hi-Gloss (from Prevest) polishing paste.

Results

From a total of 25 patients that agreed to participate to our study, we repaired 20 (80%) central incisors with the mesial (18 cases, 90%) or distal (2 cases, 10%) angles fractured in different accidents. 5 cases (20%) had diastema caused by small shape of the crown or malposition of the frontal teeth or anodontia. For 12 patients (48%) we repaired the fractured angle and reshaped both the central incisors. For 10 patients (40%) we repaired and reshaped all four superior frontal incisors and only for 3 patients (12%) we repaired only the defect.

The composite placement and technique used were adequately planned. After the treatment, all the patients were completely satisfied with their aesthetics and were glad that they got the treatment done.

From all the clinical cases included in the study we present:

Clinical case no.1 is a 13-year-old boy who presented in our office due to a dissatisfaction of his smile induced by the missing of all 4 incisors. Considering the need of improving his smile, a complex treatment was recommended including orthodontic procedures (Figures 1a, 1b). After positioning the canines in the incisor place, we used composite material to create an incisor-like shape.

Color A2 (enamel) from the Filtek Z550 Kit composite was used. The surfaces were smoothened and polished so that both teeth look similar (Figure 2). The final polishing was done using discs from Kit Technic Rainbow and final smooth surface was obtained by using diamond polishing paste.

Figure 1a. Placing the canines in the central incisors position with orthodontic procedure.

Figure 1b. Image after removing the orthodontic appliance.

Figure 2. The canine's new central incisor-like shape

Clinical case no.2 represents a 37-year-old woman who presented in our office due to the dislocation of the filling applied on the 2.1 incisor and an inaesthetic shape of the lateral incisor 2.2. Considering the aesthetics, a proper contour and vestibular shape were given restoring the lateral incisor. The mesial incisal angle of 2.1 was corrected by using layering technique. Color A2 from the Gradia Direct Anterior, composite kit was used. The surfaces of the teeth were smoothened and polished so that both teeth look similar (Figure 3). The final polishing was done by using same technique.

Figure 3. Initial and the final imagine after repairing the central incisor's 2.1 mesial angle and reshaping the lateral incisor 2.2.

Discussions

The way we proceed with the dental treatments has changed a lot in the past decades. With a change in people's perception, there has been a growth in cosmetic dentistry focusing on various ways by which patient's smile can be improved. The people are now more aware of their aesthetic requirements and know what is best suited for them [11]. Therefore, it has become our responsibility to fulfill their needs and choose an elective aesthetic treatment option. The material which can meet all these qualities is tooth colored restorative material. Out of many materials which are available on the market, the composites have gained a lot of popularity and attention in last few years [12,13]. The approach which will result in best treatment outcome, is where a comprehensive plan is designed to fit patient's desires. In this way patients are actively involved so that they can share what they need with respect for their smile, teeth, gingiva, and other related structures. The dentist can also discuss the requirements associated with the tooth color, shape, size, gingival contour and architecture [14].

Currently, composite resins have become the materials of choice for restoring the anterior teeth. These materials are easy to use as the entire procedure can be done in a single session. They are available in all kinds of shades which are specific for enamel, dentin and tints so that they give a natural appearance [15,16].

All the patients included in the study had relatively small to medium sized fracture or required adequate amount of smile corrections. It is also observed that the size of the defect which needs to be filled also impacts the outcome.

Usually, in class I composite restorations, due to more void formation and inadequate wall adaptation, the restoration has chances of leakage even when stiff composites are used as compared to ones which are applied by injection technique [17]. A study was conducted where a small sized and large class I cavity was filled with a real packable or a medium viscosity composite material by injection technique. All the restorations were filled by using two increments [18]. The results showed that all operators encountered more difficulty in handling the packable composite resin.

Also, it is observed that composite restorations show more porosities and polymerization shrinkage where the size of the defect is large, compared to the smaller ones. Here the drawbacks were reduced to a great extent by following the layering technique [19]. Therefore, the composite adapted well to all the walls and also between the increments by way of the spacing was very small, porosity was also reduced. These porosities and voids act as sites for microleakage or may weaken the restoration [20,21].

In another in vitro study, clinical handling characteristics were created by providing samples of a stiff composite (Herculite) or a low viscous composite (P50). The sample were designed in bulk or applied in two layers [22]. In comparison, it was seen that samples prepared with layering resulted in a significantly lower flexural strength as compared with the samples prepared by the bulk technique. However, the flexural strength reduction was significantly more for Herculite than for P50. The low viscous composite (P50) showed better adaptation to the tooth layers and in between the incremental layers, whereas the stiff composite showed cracks and voids between the increments [24,25]. Due to this, it is observed that the fracture resistance will be reduced by repeated loading against fatigue. As in our present study we used the composite in proper incremental technique so that minimal polymerization shrinkage occurred, therefore the strength, wear resistance, flexural strength and aesthetics were adequately maintained which is in contrast with the in-vitro study [26].

In the present study we took care of all the factors related to the technique, material selection, smile design, aesthetics based on shade selection so that all the needs are fulfilled and the patients are finally comfortable, satisfied and happy with the final restoration. The anatomic form of the tooth, as well as the adjacent tooth or all four incisors were modified where necessary. The finished restorations gave an appearance of natural teeth. As the buildup was performed by using layering technique, the layers were adequately light cured so the probability of marginal fracture was reduced to a great extent. Some in vitro studies have reported higher incidence of marginal defects when Durafill and direct Herculite were used, whereas other study reported an overall incidence of 11.2% suggesting that marginal fracture is a minor, but significant, mode of failure for these restorations [27]. Overall, after completion we checked that the margins are properly finished and there is no gingival encroachment in the proximal areas. Also, all the patients were comfortable with the new restoration and none of them reported any pain and tenderness. Hence, the patients were immensely happy that composite material was used in the anterior region, as it helped to restore the tooth aesthetics and improve their functional demands.

Conclusions

1. The most common fracture of the frontal teeth is the fracture of the mesial angle of the central incisors and most frequent to men. Repairing this defect offers the pacients self-confidence, especially nowadays when aesthetics play an important role in the society.
2. The excessive removal of non-affected dental hard tissue is not necessary if the adjacent structures are not fractured or affected, and if the isolation, etching and adhesion respect the correct techniques.
3. Restoring the incisal angle or the incisal edge and refining a natural and improved smile implies a lot of well known

techniques, materials, a very precise protocole of work and, in most cases, the reshaping of two or more frontal teeth.

Conflict of interest: None declared.

References

1. Grover N, Kapoor DN, Verma S, Bharadwaj P. Smile analysis in different facial patterns and its correlation with underlying hard tissues. Prog Orthod. 2015;16(1):1-5
2. Krishnan V, Daniel ST, Lazar D, Asok A. Characterization of posed smile by using visual analog scale, smile arc, buccal cor-ridor measures, and modified smile index. Am J Orthod Dentofacial Orthop. 2008;133(4):515-523.
3. Ackerman MB, Ackerman JL. Smile analysis and design in the digital era. J Clin Orthod. 2002;36(4):221-236.
4. Manjula WS, Sukumar MR, Kishorekumar S, Gnanashanmugam K, Mahalakshmi K. Smile: A review. J Pharm Bioallied Sci. 2015;7(Suppl 1):271-275.
5. Dong JK, Jin TH, Cho HW, Oh SC. The esthetics of the smile: a review of some recent studies. Int J Prosthodont. 1999;12(1):15-17.
6. Liébart MF, Fouque-Deruelle C, Santini A, et al. Smile line and periodontium visibility. Perio. 2004;1(1):17-25.
7. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent. 1973;29(4):358-382.
8. McLaren EA, Culp L. Smile analysis. J Cosmet Dent. 2013;29(1):94-108.
9. Rufenacht CR. Principles of esthetic integration: Quintessence Publishing (IL); 2000:45-49.
10. Davis NC. Smile design. Dent Clin North Am. 2007;51(2):299-318.
11. Olsson M, Lindhe J, Marinello CP. On the relationship between crown form and clinical features of the gingiva in adolescents. J Clin Periodontol. 1993;20(8):570-577.
12. Lazarescu F. Incursiune în estetica dentară. Bucureşti; 2013:17-25.
13. Tarnow DP, Magner AW, Fletcher P. The effect of the distance from the contact point to the crest of bone on the pres-ence or absence of the interproximal dental papilla. J Periodontol. 1992;63(12):995-996.
14. Parekh SM, Fields HW, Beck M, Rosenstiel S. Attractiveness of variations in the smile arc and buccal corridor space as judged by orthodontists and laymen. Angle Orthod. 2006;76(4):557-563.
15. Frush JP, Fisher RD. The dynesthetic interpretation of the dentogenic concept. J Prosthet Dent. 1958;8(4):558-581.
16. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod. 1970;57(2):132-144.
17. Wheeler RC. A textbook of dental anatomy and physiology: WB Saunders Company; 1974:55-57.
18. Sharma PK, Sharma P. Dental Smile Esthetics: The Assessment and Creation of the Ideal Smile. Seminars in Orthodontics.18(3):193-201.
19. Bolton WA. Disharmony In Tooth Size And Its Relation To The Analysis And Treatment Of Malocclusion. Angle Orthod. 1958;28(3):113-130.
20. Ward DH. Proportional smile design using the recurring esthetic dental (red) proportion. Dent Clin North Am. 2001;45(1):143-154.
21. Azimi M, Dinparvar M, Teimourian H, Farhadian M. Evaluating Recurring Esthetic Dental Proportion (RED) and Golden Proportion in Natural Dentition. Avicenna J Dent Res.InPress(InPress): 17-20.
22. McLaren EA, Garber DA, Figueira J. The Photoshop Smile Design technique (part 1): digital dental photography. Compend Contin Educ Dent. 2013;34(10):772-774.
23. Chang CA, Fields HW, Beck FM, Springer NC, Firestone AR, Rosenstiel S, et al. Smile esthetics from patients' perspec-tives for faces of varying attractiveness. Am J Orthod Dentofacial Orthop. 2011;140(4):171-180.
24. Frush JP, Fisher RD. How dentogenic restorations interpret the sex factor. J Prosthet Dent. 1956;6(2):72-75.
25. Frush JP, Fisher RD. The age factor in dentogenics. J Prosthet Dent. 1957;7(1):5-13.
26. Aschheim KW. Esthetic dentistry: a clinical approach to techniques and materials: Elsevier Health Sciences; 2014:44-46.
27. Frush JP, Fisher RD. Introduction to dentogenic restorations. J Prosthet Dent.1955;5(5):586-595.

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ORIGINAL RESEARCH

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Efficiency of different instruments used for composite filling polishing.

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Abstract

Introduction: Improper finishing and polishing of fillings leads to surface roughness of the restoration which leads to excessive plaque accumulation, gingival irritation, increased surface staining and poor aesthetics of restored teeth. Therefore, it is essential to use polishing instruments and pastes as a final step of simple caries treatment in order to achieve optimal long-time results. The aim of this study is to evaluate the efficiency of 4 different finishing and polishing instruments used for surface smoothening of aesthetic restorative materials in vitro. Materials and methods: 40 composite (Reality X) samples were prepared in vitro. Their surface irregularities were measured along 3 diagonals before and after polishing. Sof-Lex discs (3M Espe), rubber cones (Kenda), Arkansas stone (Fino) and polishing paste and a professional toothbrush (Kerr) were used for polishing. Each sample was polished under 5N pressure for 30 seconds at 3000 rpm. The surface roughness was than measured using a profilometer. Statistic analysis was performed using ANOVA and unpaired T-tests, the significance level was set at a value of $p<0.05$. Results: Based on the mean values, the smallest roughness was found in the control group- 0.11, while the highest in the rubber polishers and Arkansas stone group- 0.47 and 0.48. The values for the Sof-Lex disc group and the polishing paste-toothbrush group were 0.40 and 0.39. Statistical analysis showed no significant differences between the four groups. Conclusion: It is mandatory to use polishing tools in order to obtain a smooth surface of the restoration and avoid the unwanted long-term complications. Polishing using brush and abrasive paste produced the smoothest surface of the composite.

Keywords: polishing, composite, Sof-Lex disc, rubber cone, Arkansas stone, polishing brush.

Introduction

One of the most desirable features of proper tooth restoration is a smooth surface. Adequate finishing and polishing of the rebuilt surface contribute greatly to the correct restoration of the teeth. Very important elements of the critical restoration process are the polishing instruments, which, used correctly, increase both the aesthetics and the longevity of the restored teeth [1-3].

Due to improper finishing and polishing of fillings, the surface of the restored teeth remains rough and can lead to excessive plaque accumulation, gingival irritation, surface staining and poor aesthetics. This can potentially cause demineralization of the enamel, possible appearence of secondary caries and even periodontal problems [4]. Therefore, it is essential to be aware of the properties of the appropriate polishing instruments and materials to achieve optimal results. The smoothness of the restoration is extremely important and crucial in the outcome of the simple caries treatment [5].

The clinical market offers a vaste range of instruments for doctors to choose from. Silicon carbide-coated or alumina-coated grinding discs, impregnated rubber or silicone discs, tungsten carbide finisher, drilling materials and hard-bonded ceramic/ diamond rotary tools are available to smooth the surface of the restorations.

The efficiency of finishing and polishing processes on restored surfaces is an important consideration in the simple caries treatment [6-7].

The aim of this study is to evaluate the efficiency of 4 different finishing and polishing tools used for in vitro surface roughness smoothening of aesthetic restorative materials.

Material and methods

The study was conducted at the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Targu Mures, Faculty of Dentistry, Discipline of Odontology and Oral Pathology in Romania.

As a first step, a template from Zeta Plus (Zhermack Dental) silicone was prepared. A dose of silicone was mixed with the associated activator. A little less activator was used to extend the setting time, which permitted to flatten the silicone onto one glass plate and then apply light pressure to it with another glass plate for a more even distribution. A 3 mm high silicone sheet was obtained, which was punched in a 9x9 ratio with a 5mm diameter metal cutting roller to complete the template.

As a restorative material, a microhybrid, 0,5-1,5 μm anorganic microparticles light curing composite was used (Reality X, P.L. SuperiorDentalMaterials GmbH, Hamburg, Germany). The composite samples were placed in the template between two plates of glass and then polymerized one by one through the glass plate. A total of 40 samples were prepared.

The samples were finally removed from the silicone model. To measure the surface area of the samples, it was necessary to fix them. For this purpose, Optosil Comfort Putty silicone and activator (Heraeus Kulzer, Germany) was used from which four rectangles were prepared. Then, one by one, the composite discs were placed evenly using a pair of tweezers.

A total of 40 composite discs were made, their surface irregularities were measured along 3 diagonals before and after polishing. Based on the obtained results, the samples for which the difference between the measured values was too large were eliminated.

Thus, a total of 35 samples remained, of which 7 were polished with Sof-Lex discs (3M Espe, USA), 7 with rubber cones (Kenda, Liechtenstein), 7 with Arkansas stone (Fino, Germany) and 7 with polishing paste (Clean Polish, Kerr, USA) and a professional brush (Kerr, USA) and 7 samples were kept unpolished as a control group.

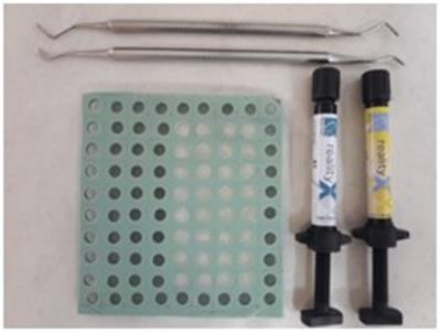

Figure 1. Composite samples placed in the silicone

Figure 2. Polishing instruments

Figure 3. Polishing brushes and paste

Each sample was polished under 5N pressure for 30 seconds at 3000 rpm. The 5 N pressure was controlled with a household scale.

The surface roughness was than measured using a Dektak profilometer with 8 needle. In order to obtain the most accurate results, three measurments were performed on each disk and a mean value was calculated for each sample. Using the contact profilometer along the surface of different samples, three-dimensional mapping with nanometer accuracy is possible. Based on the topography, the curvature and roughness of the surface, the height/ volume of some surface structures, the thickness of thin layers can be determined. The characteristics of the profilometer were Raλc = 0,8 x 3 0,05mm/s.

After eliminating the excessive values, statistic analysis was performed using ANOVA and unpaired T-tests, at a value of $p<0.05$.

Results

The results presented in the table below (Table 1) show the average of the 3 measurements per polishing group and the control group. Data marked in red show the mean value of the average values of the 3 measurments made on each disk. Based on the mean values, the least roughness was found in the control group- 0.11, while the highest

values were found in the rubber polishes and Arkansas stones group, 0.47 and 0.48. The values for the Sof-Lex disc group and the polishing paste-brush group were 0.40 and 0.39, respectively.

The obtained values after polishing are presented in the diagram below (Figure 4).

Table 1. The found values after polishing

Control group	Rubber cones	Arkansas stones	Sof-Lex disks	Polishing paste-brush
0,14	0,50	0,45	0,44	0,32
0,11	0,58	0,42	0,36	0,45
0,10	0,45	0,37	0,36	0,45
0,10	0,38	0,40	0,35	0,29
0,12	0,44	0,56	0,37	0,47
0,11	0,59	0,55	0,54	0,44
0,14	0,46	0,54	0,40	0,32
0,11	0,48	0,47	0,40	0,39

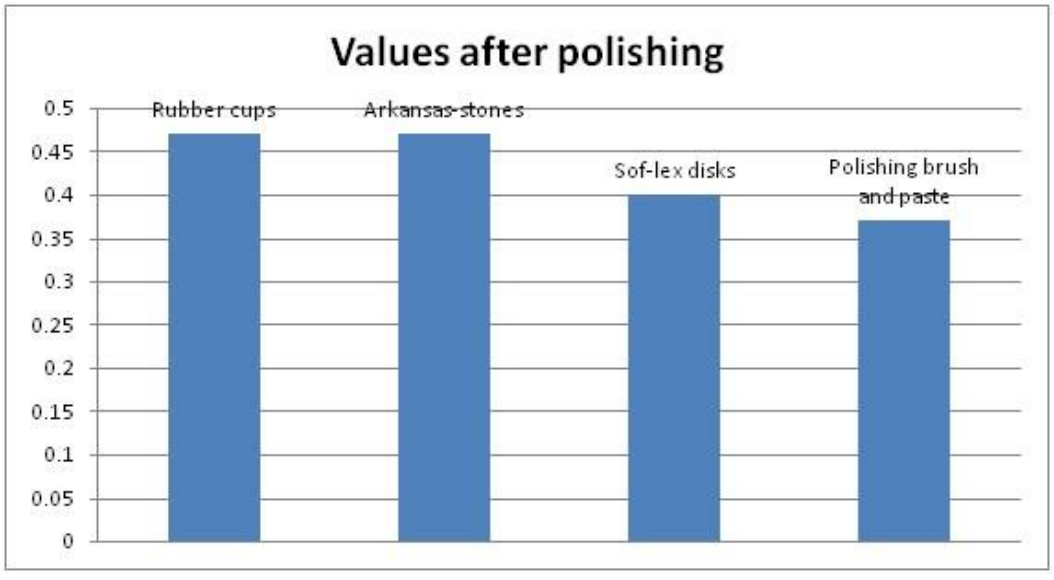

Figure 4. The obtained values after polishing

The surface of the control group shows the least roughness (Figure 5). This is followed by the surface of the composite discs polished using the polishing paste and brush, which at the same time shows a very minimal deviation from the surface polished by the Sof-Lex system (Figure 6).

Finally, the roughness of the surface polished using the rubber polishing and Arkansas stones remained higher compared to the control group.

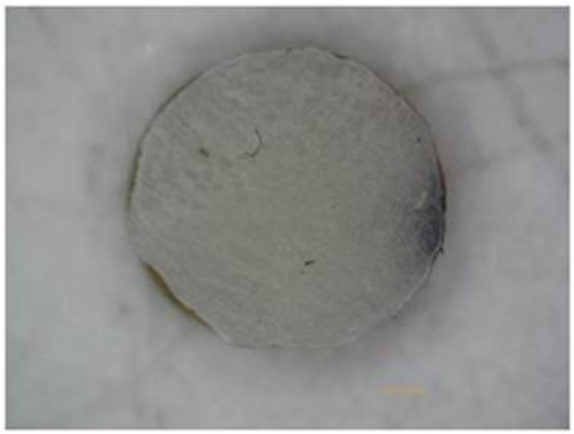

Figure 5. Unpolished control composite disk

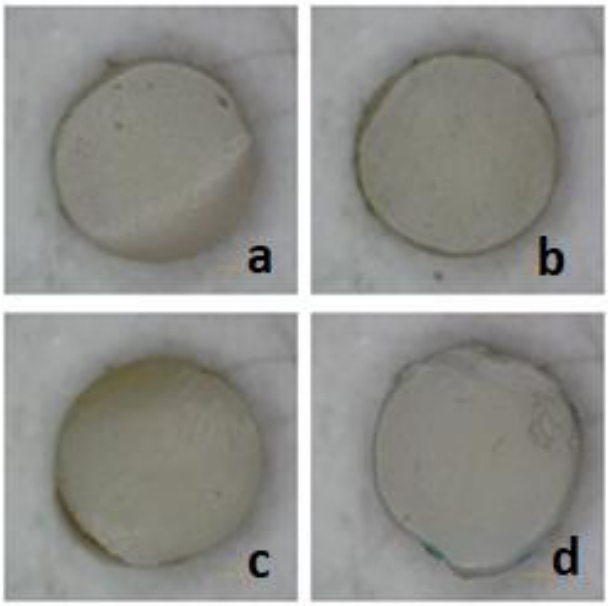

Figure 6. Composite disks surface after polishing with a. rubber cones, b. Arkansas stone, c. Sof-lex disks, d. polishing paste and brush

Using unpaired T-test the 4 group was compared to each other and the control group in order to find significant differences between the used polishing methods. Significance level was set to a value of $p< 0.05$.

Statistic analysis of the obtained results in the 4 groups compared to the control group showed:

1. **The first group** showed a significant difference compared to the control group. A statistically significant difference was found between the group of surfaces treated with polishing rubber cones and the roughness values of the control group ($p = 0.014$). Thus, the measured values were higher in the group where rubber cones were used.
2. **The second group** includes samples polished with Arkansas stone. There was a statistically significant difference between the control group and the group of surfaces treated with Arkansas stones ($p = 0.016$). The values obtained were higher in the Arkansas stone-polished group.
3. **The third group** includes composite samples with a surface treated with Sof-Lex discs. Statistical difference was found between the group of surfaces polished with the Sof-Lex disc and the roughness values detected in the control group ($p = 0.023$). Thus, the measured values were higher in the case of the group treated with Sof-Lex discs.
4. **The fourth group** is the group of professional polishing paste and rotary brush. A significant difference was found between the surfaces treated with brush and polishing paste and the control group, but not as much as in the previous three groups ($p = 0.026$).
5. Using ANOVA test ($p<0.05$) no significant differences were found between the four groups (Table 2).

Summary of Data

Table 2. Statistical analysis

	Treatments					
	1	2	3	4	5	Total
∑X	82	340	329	282	274	1307
Mean	5.8571	24.2857	23.5	20.1429	19.5714	18.6714
∑X²	978	16866	15835	11638	11084	56401
Std.Dev.	6.1875	25.7336	24.9669	21.4076	20.9788	21.5344

Result Details

Source	***SS***	***df***	***MS***	
Between-treatments	3108.2286	4	777.0571	*F* = 1.74836
Within-treatments	28889.2143	65	444.4495	
Total	31997.4429	69		

Discussions

The last but some of the most important steps of tooth restoration, finishing and polishing, are very decisive for the quality, aesthetics and longevity of the restoration.

In order to avoid possible enamel demineralization, secondary tooth decay, and periodontal disease, it is advisable to use a wide range of polishing and finishing tools [2-3]. They can be used to create less retentive restorations, thus preventing plaque deposition. The smoothness of the restoration is extremely important and crucial to the success of the restoration.

This study is axed on comparing the effectiveness of a total of four polishing tools. In this research the abrasive effects of rubber polishers, Arkansas stones, Soft-Lex discs and polishing paste brushes on the Reality X microhybrid composite were analised. Significant differences were found in the roughness of the control group and the surfaces polished with different polishers. However, comparing the efficiency of the polishing tools used, no significant differences were stated.

Several similar researchers, such as Tosco et al, Scheibe et al, Barbosa et al and Sibel et al studied the surface roughness of restorations [8-11].

Barbosa et al. studied the efficiency of four types of finishing / polishing systems, but for the surface roughness of different types of composites. According to their results, significant differences were found between the initial and postoperative surface roughnesses of the composites, but no significant difference was observed between the surfaces polished using different polishing systems. Our results are similar to this study. Although the finest surface in Barbosa's study was provided by the Sof-Lex discs, no statistically significant difference was found between the finishing and polishing systems ($p > 0.01$) [10]. According to our results, Sof-lex systems provided the second most valuable surface, which contradicts the results of the mentioned research. This can be explained by the fact that the number and type of discs used (degree of grain size) in our study were limited to a given type of grinding discs.

A similar study was conducted by Sibel et al to compare the surface roughness of nanofill, nanohybrid and microhybrid composites after polishing and brushing with a brush, respectively. No significant difference was found between the surfaces of unpolished

materials. Surfaces treated with Sof-lex discs resulted in greater roughness than surfaces treated with rubber polishers, as in the results we achieved. After use of the brush, the surface of all materials showed greater roughness than unpolished surfaces or surfaces polished using Sof-Lex discs or rubber polishers [11]. In contrast, in our research, while using the brush the result is the same - after polishing with a brush, each sample had a rougher surface than the control group-, we observed the opposite with the Sof-lex system and rubber polisher - in both cases a rougher surface is created, as in case of polishing using the brush.

Recently, another study has been conducted by Negin Nasoohi et al to investigate the surface roughness and microhardness of four composites, two nanohybrids and two microhybrids under wet and dry polishing with a Sof-Lex polishing system of different roughness (coarse, medium, fine, extra fine). Among the composites, the surface of the samples from the control group, which did not receive polishing, showed significantly lower surface roughness than the dry and wet polished groups ($p < 0.001$), similarly to our own results. For each sample, the surface roughness values of the wet-plated group were significantly higher than those of the control group ($p < 0.001$) [12].

Similarly, Senawongse et al and Kritzinger et al studied the surface roughness of nanocomposite and microcomposite after the usage of different polishing systems. Two types of composites and six polishing systems have been studied, also in combination with polishing paste. The surface of the control group showed a significant difference compared to all surfaces treated with the polishing system [13-14]. Our results are similar to what the researchers found in their study.

Based on the results presented, we did not find a significant difference between the polishing systems. However, when compared with the control groups, results showed significant differences in surface roughness. Although not satistically significant, but according to the found values the brush-paste group produced the smoothest surface, followed by the Sof-lex discs, Arkansas stone and rubber polishers in ascending order of roughness.

Conclusions

1. It is mandatory to use polishing tools in order to obtain a smooth surface of the restoration and avoid the unwanted long-term complications.
2. Polishing using brush and abrasive paste produced the smoothest surface of the composite.

Conflict of interest: None declared.

References

1. Bansal K, Gupta S, Nikhil V, Jaiswal S, Jain A, Aggarwal N. Effect of different finishing and polishing systems on the surface roughness of resin composite and enamel: an in vitro profilometric and scanning electron microscopy study. Int J Appl Basic Med Res. 2019;9(3):154-158.
2. Lesage B, Milnar F, Wohlberg J. Achieving the epitome of composite art: creating natural too esthetics, texture and anatomy using appropriate preparation and layering techniques. Int. Dent S.A. 2009;11: 34–48.
3. Kameyama A, Nakazawa T, Haruyama A, Haruyama C, Hosaka M, Hirai Y. Influence of finishing/polishing procedures on the surface texture of two resin composites. J. Open Dent. 2008;2:56–60.
4. Yadav RD, Raisingani D, Jindal D, Mathur R. A comparative analysis of different finishing and polishing devices on nanofilled, microfilled, and hybrid composite: a scanning electron microscopy and profilometric study. Int J Clin Pediatr Dent. 2016;9(3):201-208.
5. Madhyastha PS, Hegde S, Srikant N, Kotian R, Iyer SS. Effect of finishing/polishing techniques and time on surface roughness of esthetic restorative materials. Dental Research Journal. 2017;14(5):326.
6. Babina K, Polyakova M, Sokhova I, Doroshina V, Arakelyan M, Novozhilova N. The effect of finishing and polishing sequences on the surface roughness of three different nanocomposites and composite/enamel and composite/cementum interfaces. Nanomaterials (Basel). 2020;10(7):1339.
7. Guler AU, Guler E, Yucel AC, Ertas E. Effect of polishing procedures on color stability of resin composites. J. Appl. Oral Sc. 2009;17(2):108–112.

8. Tosco V, Monterubbianesi R, Orilisi G et al. Effect of four different finishing and polishing systems on resin composites: roughness surface and gloss retention evaluations. Stomatol. 2020;69(4):207-214.
9. Scheibe KG, Almeida KG, Medeiros IS, Costa JF, Alves CM. Effect of different polishing systems on the surface roughness of microhybrid composites. J. Appl. Oral Sci. 2009;17:21–26.
10. Barbosa H, Zanata RL, Navarro MF, Nunes OB. Effect of different finishing and polishing techniques on the surface roughness of microfilled, hybrid and packable resin composites. Braz.Dent. J. 2005;16:39–44.
11. Sibel A, Yazici AR, Kilinc E, Antonson DE, Hardigan PC. Comparison of different finishing/polishing systems on surface roughness and gloss of resin composites. J Dent. 2011;39(1):e9-16.
12. Nasoohi N, Hoorziad M, Tabatabaei SF. Effects of wet and dry finishing and polishing on surface roughness and microhardness of composite resins . J Dent (Tehran). 2017;14(2):69-75.
13. Senawongse P, Pongprueksa P. Surface roughness of nanofill and nanohybrid resin composites after polishing and brushing. J Esthet Restor Dent.2007;19:265–275.
14. Kritzinger D, Brandt PD, De Wet FA. The effect of different polishing systems on the surface roughness of a nanocomposite and microhybrid composite. S Afr Dent J. 2017; 72(6):249-257.

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ORIGINAL RESEARCH

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Fear and dental anxiety in children: a study of the contributing factors.

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Abstract

Introduction: Dental fear and anxiety are an important issue affecting children's oral health and clinical management, and also an insufficiently studied subject in dentistry.

Aim of the study: The aim of this study was to better understand the child patient - dentist versus dentist - child patient relationship and study the dental fear and anxiety of children in order to improve the dental office practice.

Material and methods: In this study a personalized questionnaire was created and applied on a number of 333 children, in 4 schools from Mures county, Romania, on girls and boys between the ages of 8 and 13. The questionnaires used emoticons alongside words in order to better determine the state of anxiety created by the dental appointment and everything that it entails. All data and results obtained were analyzed using Excel and Graph Pad Prism 5.0 software.

Results: Out of 333 patients, 133 subjects (40%) were 8-10-year-old, 143 subjects (42.9%) 11 - 13 years and 57 subjects (17.1%) were over 14 years. 175 girls (52.6%) and 158 boys (47.4%) demonstrated their courage and desire in participating in our study. It was determined that fear of dental appointments was caused in children over 14 years of age. The state of relaxation is generally enjoyed by urban children (45%) and those aged 11-13 years (37.1%); the percentage of boys in this category is an interesting aspect (40.5%).

Conclusion: Dental anxiety is multifactorial and is far more complex than can be explained by a single contributing factor. The direct involvement of the child from the perspective of maintaining dental health, leads to the elimination of the state of fear and anxiety. Regular visits to the dental office, on the initiative of the child patient itself can reduce the anguish.

Keywords: child behavior, oral health, questionnaire, dental anxiety.

Introduction

The presence of the child patient in the dental office, has to become a custom. In order to achieve this, the dentist has the duty to prevent fear and anxiety, which are the main issues affecting children's oral health and clinical management [1]. In this context, when considering the communication and relationship of the dentist with the child patient in the dental office, the following are indicated:

- detecting/identifying the problem;
- empowering and making the child aware that there is a situation that must be resolved together;
- proceed into solving the problem situation as soon as possible;
- developing an appropriate positive attitude, conduct and behavior towards the medical act itself [2].

It is believed that at the basis of the doctor-child patient vs. child patient-doctor communication and relationship, there are elements of knowledge, acceptance, understanding and mutual help [3].

To this dual equation (dentist-child patient) a third element is added, the family. We will thus have a triad in which we will be able to identify the parties that will position themselves either in the "partnership" or "conflict" relationship. Thus, we could have the following situations:

- doctor versus child-parent, characterized by the support of the child-parent team in front of the doctor, who remains alone;
- child-doctor versus parent, where the child-doctor alliance determines a positive attitude towards the medical act itself, the team being beneficial, the parent

conforming to the new situation created in this context;

- child versus doctor-parent, where the child is alone and does not understand the doctor-parent alliance, his conduct is not always the most appropriate, so that the desired result of success is not the expected one, the state of fear being triggered and present;
- child-doctor-parent versus parent-child-doctor, versus doctor-child-parent, the ideal situation in which there is at least one meeting, so that the understanding, acceptance and involvement in solving the problem situation, is fully resolved, avoiding over time, the fear of going to the dentist [4].

In this context, we can answer to the following group of questions: How much? Where? How? Who? And Why?, regarding the attitude, conduct and behavior of the child patient in the dental office. This leads to a certain attitude of the child patient towards everything that happens / will happen in the dental office, which will manifest itself in the form of: recalcitrant behavior; slow negative conduct; docility with the tendency of "seduction" of the doctor; the appearance of the "run away" element as an escape from the hostile environment; regression [5].

Aim of the study

The aim of this study was to better understand the child patient - dentist versus dentist - child patient relationship and study the dental fear and anxiety of children in order to improve the dental office practice.

Material and methods

In the present study a number of 333 children, girls and boys between the ages of 8 and 13, were included from 4 schools in Mures county. The study was conducted by 6 specialist dentists, on a 1-year period, from January 2019 until December 2019. Ethics approval was sought and obtained from the local Ethical Committee before the commencement of the study. The parents and caretakers of all selected children patients understood and signed the written informed consent prior the initiation of this research.

Using our personalized questionnaires, we have identified some key features which, at the perception level of the child patient, can create a certain attitude towards the environment of the dental office and also towards the dentist himself. In view of this, by taking into account the age features of the child patient, the conversation and questionnaire were used as the psychological investigation methods, which will be the basic and working tool of our medical-psychological investigation.

The study group consisted of 333 subjects identified by:

- age: 5-7 years / 8-10 years / 11- 13 years / over 14 years
- sex: boys /girls
- the living environment: urban / rural.

The original conception and realization of the two questionnaires where emoticons were used alongside words represent not only a novelty in the approach, but also a thorough knowledge of the age characteristics of the child patient.

Basically, the use of emoticons at this age leads to a higher and complex level of understanding, encoding and decoding responses, being more enlightening.

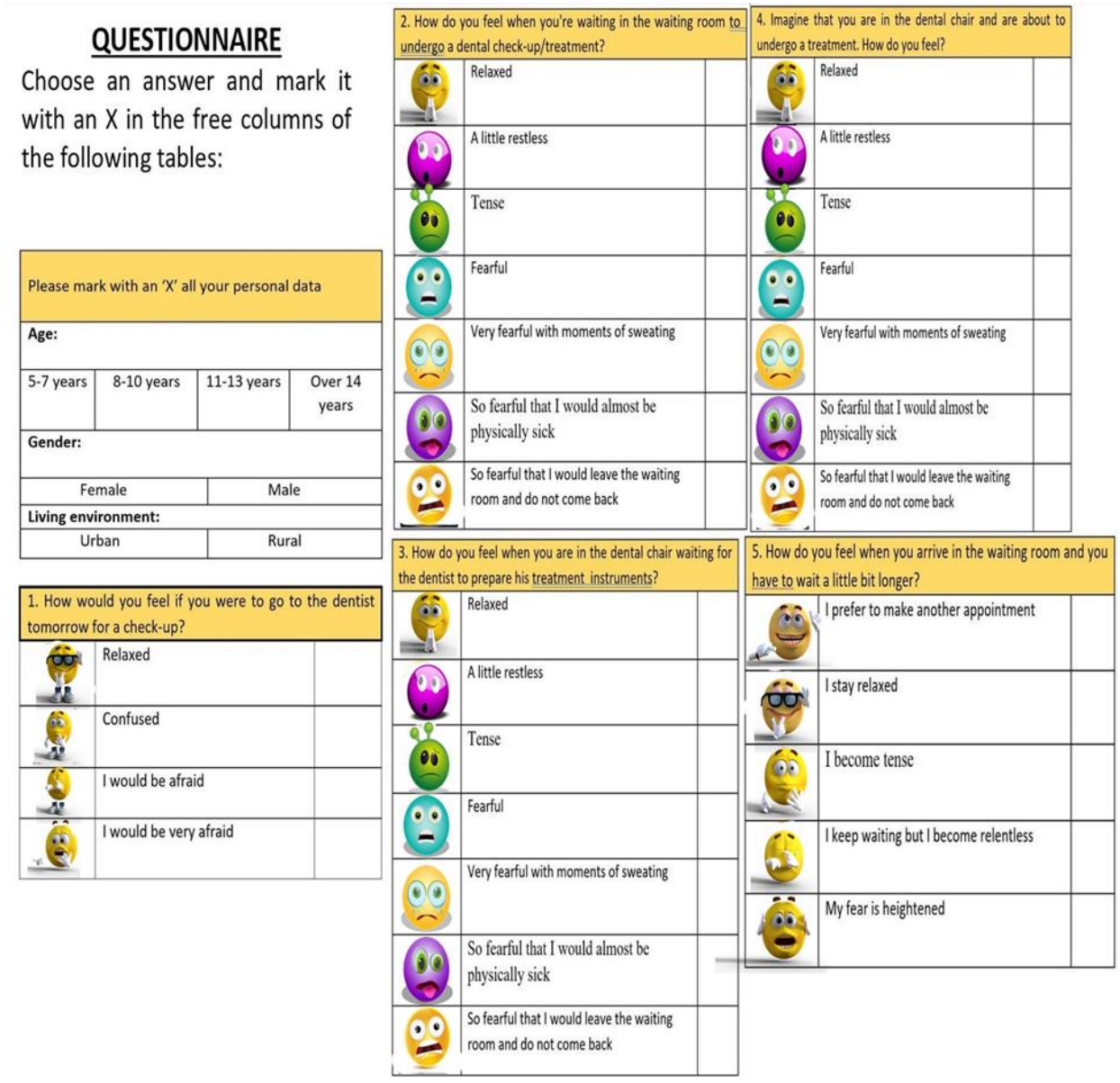
Made in the form of image(emoticon)-word correlation, the questionnaire was comprised of five questions that included the entire complex of manifestations as well as elements identifying the target group under study:

1. *How would you feel if you were to go to the dentist tomorrow for a check-up?* – the answer choices being (emoticon - word): relaxed, confused, I would be afraid, I would be very afraid;
2. *How do you feel when you're waiting in the waiting room to undergo a dental check-up/treatment?* - the answer choices being (emoticon - word): relaxed, a little restless, tense, fearful, very fearful with moments of sweating, so fearful that I would almost be physically sick, so fearful that I would leave the waiting room and do not come back;
3. *How do you feel when you are in the dental chair waiting for the dentist to prepare his treatment instruments?*- the answer choices being: relaxed, a little restless, tense, fearful, very fearful with moments of sweating, so

fearful that I would almost be physically sick, so fearful that I would leave the waiting room and do not come back;

4. *Imagine that you are in the dental chair and are about to undergo a treatment. How do you feel?*- the answer choices being: relaxed, a little restless, tense, fearful, very fearful with moments of sweating, so fearful that I would almost be physically sick, so fearful that I would leave the waiting room and never come back;
5. *How do you feel when you arrive in the waiting room and you have to wait a little bit longer?*- the answer choices being: I prefer to make another appointment, I stay relaxed, I become tense, I keep waiting but I become relentless, my fear is heightened.

It is noted that there is a similarity between the variants of items 2,3,4, they are gradually structured in the following form: item 2 = you are in the waiting room and waiting; item 3 = you are in the dental chair and wait for the dentist to prepare the instruments; item 4 = you are in the dental chair and you are waiting to undergo the treatment. We set out to assess the patient's state of fear in the situations outlined above, reaction, conduct and behavior starting from the verb "to wait" (Figure 1).



QUESTIONNAIRE

Choose an answer and mark it with an X in the free columns of the following tables:

Please mark with an 'X' all your personal data			
Age:			
5-7 years	8-10 years	11-13 years	Over 14 years
Gender:			
Female		Male	
Living environment:			
Urban		Rural	

1. How would you feel if you were to go to the dentist tomorrow for a check-up?	
Relaxed	
Confused	
I would be afraid	
I would be very afraid	

2. How do you feel when you're waiting in the waiting room to undergo a dental check-up/treatment?	
Relaxed	
A little restless	
Tense	
Fearful	
Very fearful with moments of sweating	
So fearful that I would almost be physically sick	
So fearful that I would leave the waiting room and do not come back	

3. How do you feel when you are in the dental chair waiting for the dentist to prepare his treatment instruments?	
Relaxed	
A little restless	
Tense	
Fearful	
Very fearful with moments of sweating	
So fearful that I would almost be physically sick	
So fearful that I would leave the waiting room and do not come back	

4. Imagine that you are in the dental chair and are about to undergo a treatment. How do you feel?	
Relaxed	
A little restless	
Tense	
Fearful	
Very fearful with moments of sweating	
So fearful that I would almost be physically sick	
So fearful that I would leave the waiting room and do not come back	

5. How do you feel when you arrive in the waiting room and you have to wait a little bit longer?	
I prefer to make another appointment	
I stay relaxed	
I become tense	
I keep waiting but I become relentless	
My fear is heightened	

Figure 1. Child specific questionnaire, pg.1
Source: www.pixabay.com [6]

An encoding of the factors that can trigger the state of fear of the child patient has been created using different degrees of appreciation (low, moderate, high, I do not know, I do not care), starting from:

1. Anesthetic injection;
2. Fear that I will not be sufficiently "numb";
3. The noise caused by the high/low speed hand piece;
4. Vibration of the bur;
5. Dental extraction;
6. Tired sensation of the jaws;
7. Fear of being hurt;
8. Not having the freedom to ask questions;
9. The smell of the ambient in the dental office;
10. Fear of the cost of the treatment;
11. Transport to the dental office;
12. Previous unpleasant experiences;
13. Doctor's expertise;
14. The doctor's reaction to my problem (Figure 2).

Nr.Crt.	Fear factors. Please evaluate your fear level towards the following dental procedures, by marking your preference with an X.	Level of fear				
		Low	Moderate	High	I don't know	Not interested
1.	Anesthetic injection					
2.	Fear that I will not be sufficiently "numb"					
3.	The noise caused by the high/low speed handpiece					
4.	Vibration of the bur					
5.	Dental extraction					
6.	Tired sensation of the jaws					
7.	Fear of being hurt					
8.	Not having the freedom to ask questions					
9.	The smell of the ambient in the dental office					
10.	Fear of the cost of the treatment					
11.	Transport to the dental office					
12.	Previous unpleasant experiences					
13.	Doctor's expertise					
14.	The doctor's reaction to my problem					

Thank you for the time and patience in completing this questionnaire.

Figure 2. Child specific questionnaire, encoding of trigger factors, pg.2
Source: www.pixabay.com [6]

Results

We have identified several series of variables, equations and connotations, evolutionary or not, related to the state of fear, manifested as the identity of the child patient in the dental office.

Regarding the first variable, namely the age, the most important percentage was among children between 11-13 years of age, followed by middle age children 8-10 years old, the desire to answer such an interesting questionnaire being an important aspect to our study.

- 8 - 10 years: 133 subjects (40%)
- 11 - 13 years: 143 subjects (42.9%)
- Over 14 years: 57 subjects (17.1%).

In regard to the second variable, the gender, the girls were more interested in completing the questionnaire (175 girls, 52.6%) than boys (158 boys, 47.4% percentage) demonstrating their courage and desire in participating in our study of the knowledge of fear in the dental office.

Related to the living environment, the interest shown by rural children is 55.3% (184 subjects), compared to those in urban areas (149 subjects), and the positive attitude of rural children towards maintaining their oral health is also appreciated.

To the first question: *How would you feel if you were to go to the dentist tomorrow for a check-up?* the decoding is shown in the table below:

Table 1.

State	Age – nr - %	Gender – nr - %	Environment – nr - %
Relaxed	8-10 years – 105 - 73,4% 11-13 years – 103 – 77,4% Over 14 years – 31 – 55,4%	F- 121 - 68,1% M – 118 -74,7%	R – 129 – 70,1% U – 110 – 73,8%
Confused	8-10 years – 11 – 8,3% 11-13 years – 14 – 9,8% Over 14 years – 11 – 19,3%	F – 17 – 9,7% M – 19 – 12%	R – 19 – 10,3% U – 17- 11,4%
I would be afraid	8-10 years – 13 – 9,8% 11-13 years – 17 – 11,9% Over 14 years -15 – 26,3%	F – 31 – 17, 7% M – 14 -8,9 %	R – 30 – 16,3% U – 15 – 10,1%
I would be very afraid	8-10 years – 6 – 4,5% 11-13 years- 7- 4% Over 14 years - 0 - %	F- 6 – 3,4% M – 7 – 4,4%	R – 6 – 3,3% U – 7 – 4,7 %

F: female, M: male, U: urban, R: rural

The following aspects are noted:

- there is a general state of tranquility which may be the consequence of the guarantee of just a check-up being carried out instead of an intervention: age, gender and the living environment highlight this fact;
- anxiety arises after the age of 14, because children are aware that they might undergo a treatment, and that there is a problem, which will correlate with a state of confusion (19.5% - in boys, 12% in urban areas), uncertainty being the cause of these feelings;
- confusion can occur, the percentages being quite close, a state of fear is caused in children over 14 years of age; 26.3% annihilates however, I would be very afraid, making the difference between them (11 -13 years: 17.9% - Idem 4%).

On the second question: *How do you feel when you're waiting in the waiting room to undergo a dental check-up/treatment?* the decoding is presented as follows:

Table 2.

State	Age – nr - %	Gender – nr - %	Environment – nr -%
Relaxed	8-10 years – 6246,8% 11-13 years – 55- 38,5% Over 14 years – 2- 45 %	F – 62 – 35,4 % M – 81 - 51,3%	R – 68 – 37,0% U – 75 – 50,35
A little restless	8-10 years – 56 - 42,1% 11-13 years – 71- 49,7% Over 14 years -1 - 31%	F – 81 – 46,3% M – 64 – 40,5%	R – 90 – 48,9% U – 55 – 36,9%
Tense	8-10 years – 6 - 4,5% 11-13 years – 8 – 5,6% Over 14 years -7 - 12%	F – 17 – 9,7% M – 4 – 2,5%	R – 13 – 7,1% U – 8 – 5,4%

Fearful	8-10 years – 4 - 36,4% 11-13 years –1 – 9,1% Over 14 years - 6 - 10%	F – 10 – 5,7% M – 1 – 0,6%	R – 4 –2,2% U – 7 –4,7%
Very fearful with moments of sweating	8-10 years – 2 - 1,5% 11-13 years – 6 – 4,2% Over 14 years – 0 - 0%	F –4 – 2,3% M -4 - 2,5%	R – 6 –3,3% U – 2 –1,3%
So fearful that I would almost be physically sick	8-10 years –2 - 1,4% 11-13 years –2 – 1,5% Over 14 years -0 - 0%	F –1 – 0,6% M -3 – 1,9%	R – 3 –1,6% U – 1 –0,7%
So fearful that I would leave the waiting room and do not come back	8-10 years –1 - 0,8% 11-13 years – 0 - 0% Over 14 years -0 - 0%	F –0 – 0% M -1 – 0,6%	R – 0 –0% U – 1 –0,7%

F: female, M: male, U: urban, R: rural

The following aspects are noted:

- the state of relaxation is present at all ages regardless of gender and the living environment, the state of normality being the main feeling, the procedure being just a check-up;
- slight anxiety occurs (49.7% in children aged 11-13 years and 42.1% in children 8-10 years old) because they will undergo a dental treatment, girls being more "courageous" (46.3%);
- confidence is minimal (10% of children over 14 years are fearful), due to the feeling of unknown in what can happen especially in case of girls (5.7%), while eliminating the other states (bad general state and leaving the room without returning);
- the bad general state is not perceived; only the middle aged (1.4% children aged 8-10 years) perceive this state, not posing a danger, not being aware.

On the third question: *How do you feel when you are in the dental chair waiting for the dentist to prepare his treatment instruments?* the decoding is presented in the following table:

Table 3.

State	Age – nr -%	Gender – nr - %	Environment – nr - %
Relaxed	8-10 years – 52 – 39,1% 11-13 years – 52 - 37,1% Over 14 years - 17 - 29,8%	F –58 - 33,1% M - 64 – 40,5%	R – 55 - 29,9% U –67-45,0%
A little restless	8-10 years – 47 – 41,6% 11-13 years – 47 – 41,6% Over 14 years - 19 - 16,8%	F –63 – 36,0% M -50 – 31,6%	R – 67- 36,4% U -40- 30,9%
Tense	8-10 years – 13 – 11,35 11-13 years – 15 – 9,1% Over 14 years - 9 – 15,8%	F –19- 10,9% M - 18 – 11,4%	R – 23- 12,5% U -14- 9,4%
Fearful	8-10 years – 6 - 4,5% 11-13 years – 17 – 11,9% Over 14 years - 12 - 21,1%	F –26 – 33,1% M - 64 – 40,5%	R – 21- 11,4% U -14- 9,4%
Very fearful with moments of sweating	8-10 years – 8 – 5,6% 11-13 years – 8 - 6,9% Over 14 years - 0 - 0%	F –7- 4% M – 9 - 5,7%	R – 10- 5,4% U - 6- 4,0%
So fearful that I would almost be physically sick	8-10 years – 1 - 0,8% 11-13 years – 3 – 2,1% Over 14 years - 0 - 0%	F – 0- 0% M – 4- 2,5%	R – 3- 1,6% U - 1- 0,7%
So fearful that I would leave the waiting room and do not come back	8-10 years – 2 – 1,4% 11-13 years – 4 - 3% Over 14 years - 0 - 0%	F –2- 1,1% M – 4 - 2,5%	R – 5- 2,7% U - 1- 0,7%

F: female, M: male, U: urban, R: rural

It is noted that:

- the state of relaxation is generally enjoyed by urban children (45%) and those aged 11-13 years (37.1%); the percentage of boys in this category is an interesting aspect (40.5%);
- anxiety occurs equally in children between 8-10 and 10-13 years (41.6%); 12.5% of children from rural areas become tense;
- pre-adolescents and adolescents (11.9% and 21.1%), boys (40.5%) become fearful, especially those in rural areas; when children patients know the procedure and the evolution of the treatment or if they are at the beginning of the treatment this causes a new attitude of the patient;
- as a psychosomatic state, sweating occurs in children aged 8-13 years, excluding a bad general state and the intention to leave the waiting room; such manifestations occur when there is a stressful situation for the child patient in the dental chair;

On the fourth question: *Imagine that you are in the dental chair and are about to undergo a treatment. How do you feel?* the decoding is presented as follows:

Table 4.

State	Age – nr -%	Gender – nr - %	Environment – nr - %
Relaxed	8 -10 years – 66 – 49,6% 11 – 13 years – 50 - 35,0% Over14 years – 1 – 21%	F – 56 – 32% B – 72 – 45,6%	R – 69 – 37,5% U – 59- 39,6%
A little restless	8 -10 years – 51 – 26,3% 11 – 13 years – 35 – 35,7% Over14 years -2 – 45%	F – 64 – 36,6% M -48 – 30,4%	R – 55 – 29,9% U – 57 – 38,3 %
Tense	8 -10 years – 18 – 13,5% 11 – 13 years – 17 – 11,9% Over 14 years -5 – 20%	F – 25 – 14,3 % M - 19 – 12%	R – 28 -15,2 % U -16 – 10,7%
Fearful	8 -10 years – 11 – 7,7% 11 – 13 years – 8- 6,6% Over14 years – 6 – 10 %	F – 18 – 10,3% M -17 – 4,4%	R – 16 – 8,7% U – 9 – 6%
Very fearful with moments of sweating	8 -10 years – 3 – 2,3 % 11 – 13 years – 10 – 7,0% Over 14 years – 4 – 7 %	F – 9 – 5,1% M – 8 – 5,1%	R – 11 – 6% U – 6 – 4%
So fearful that I would almost be physically sick	8 -10 years – 0 -0% 11 – 13 years – 0 -% Peste 14 years – 0 -%	F – 0 – 0% M – 0 – 0%	R – 0 - 0% U – 0 – 0%
So fearful that I would leave the waiting room and do not come back	8 -10 years – 3 – 2,3 % 11 – 13 years – 4 - 2,8% Over 14 years -0 – 0 %	F – 3 – 1,7 % M – 4 – 2,5 %	R – 5 – 2,7% U – 2 – 1,3%

F: female, M: male, U: urban, R: rural

It should be noted that:

- the level of relaxation is maintained in the idea that treatment might require a follow-up in children 8-10 years (49.6%), boys (45.6%) which proves a certain confidence, everything being an imaginary and future situation if it does not refer to the present;
- children over 14 years of age do not panic, are slightly fearful (10%) because the imaginary can become reality, but not in a near future;
- bad general state not planed (0%);
- psychosomatic states (sweat) are common in ages 11-13 years (7%) and girls (5.1%), but also in rural children (6%);
- the borderline attitude of leaving the dental office without returning is irrelevant.

On the fifth question: *How do you feel when you arrive in the waiting room and you have to wait a little bit longer?* The decoding is presented as follows:

Table 5.

State	Age – nr - %	Gender– nr - %	Environment – nr - %
I prefer to make another appointment	8-10 years – 13 – 9,1% 11-13 years – 13 – 9,8% Over 14 years - 21 – 12%	F – 20 – 11,4% M – 13 – 8,2 %	R – 18 – 9,8% U –15 - 10,1%
I stay relaxed	8-10 years – 67 – 50,4% 11-13 years – 83 – 58% Over 14 years - 1 – 31%	F – 77 – 44% M-91 – 57,6%	R – 86 – 46,7% U – 82 – 55 %
I become tense	8-10 years – 15 – 11,3% 11-13 years – 8 – 5,6% Over 14 years -5 – 8%	F – 11 – 9,7 % M – 11 – 7%	R – 16 – 8,7 % U – 12 – 8,1%
I keep waiting but I become relentless	8-10 years – 31 – 27,1 % 11-13 years – 36 – 21,7% Over 14 years - 2 – 47%	F – 54 – 30,9 % M – 40 – 25,3 %	R – 59 – 32,1 % U – 35 – 23,5 %
My fear is heightened	8-10 years – 2 – 1,5% 11-13 years – 8 – 5,6 % Over 14 years -0 - 0 %	F – 7 – 4% B – 3 – 1,9%	R – 5 – 2,7% U – 5 – 3,4 %

F: female, M: male, U: urban, R: rural

- children between the ages of 8-13 remain relaxed, a sign that the time spent waiting is filled with something else, they have other concerns (television, magazines, telephone, internet) or perceive the unit waiting time differently;
- few children want a new appointment in the idea that they consider the visit to the dentist without purpose;
- waiting associated with restlessness occurs frequently;
- fear subsides, even disappears in subjects over 14 years of age;

Discussions

Numerous studies using the questionnaire as their working tool, have been carried out to assess the impact and influence of many specific factors on dental anxiety among children.

Our study shows that the injection causes a state of fear, but if the intervention is optimally moderate, it can lead to an element of carelessness, a feeling of "comes and passes" (8.7% in subjects over 14 years). The fear of not being numb enough creates some discrepancy in the idea that I do not know, do not care and low response, with a percentage of 55.5%, compared with the moderate and high response (44.4%, the least affected being the group of 8-10 years, especially boys, generally rural).

The sound caused by the high/low-speed hand piece can become for some children a real threat, namely a sound of discomfort, a psychological abuse. The 8-10 years age category is the most affected (high - moderate), 36.9% of less disturbed subjects being over 14 years of age.

The vibration of the bur also encodes a certain state of fear, within optimal limits (low - moderate - I am not interested): 74.7% children between 8-13 years, regardless of gender and background.

The extraction of primary teeth is no longer a problem in inducing the feeling of fear because most children had education when the first group of teeth was replaced.

The tiredness of the jaws due to induced fear was highlighted in children between 8-10 years (11.1%), the girls being more sensitive. The percentage of those with low response – moderate – I do not know, I do not care was 50.1%.

According to the results obtained in our study, the smell in the dental office is not a trigger of the feeling of fear (89% of subjects, regardless of age, background, gender have no olfactory discomfort).

Fear of previous unpleasant experiences is generally manifested at the age of over 14 (43.7% rural girls). The switch between I don't know and I don't care (27.5%) comes close to the area where the above did not leave any change (low score 35.7%).

Regarding the medical expertise of the dentist, our study reveals that few children are interested in this aspect (80.4%). 19.3% are

interested in the performance and competences of the dentist, through the prism of their parents.

A major impact on dental anxiety in children, is the age of the child patient. Similar to the results obtained in our study, other studies have revealed that younger children tend to be more anxious in the dental office compared to older children. This is most likely due to the feeling of the unknown and the feeling of abandonment among younger children. A higher ability to adapt and understand occurs when the child's age increases resulting in a greater cognitive ability. Thus, dental anxiety is indirect proportional to the age of the child patient. On the other hand, some studies have found that there is no difference in the severity of dental anxiety when comparing the age groups of the patients [7].

However, there have also been reports that have concluded that anxiety is directly proportional to age, due to a clearer awareness of the child patient of the situation and associated factors and the existence of possible previous painful experiences. According to these reports dental anxiety increases with age [8].

In terms of patient gender corelated with the different levels of anxiety, the studies were mostly inconsistent [9]. Compared to the results reported in our study, most studies showed higher levels of anxiety in girls than in boys, while some reported that there were no differences in anxiety between the two genders [10].

Dental anxiety has been shown to be related to dental procedures and associated with dental treatments. Thus, depending on the type of dental treatment that will be carried out during the dental appointment, dental anxiety can increase or decrease. Procedures such as dental extractions, dental anesthesis, use of rotative hand pieces, can increase the level of dental anxiety, compared to oral prophylaxis procedures that revealed lower levels of anxiety [11].

Dental anxiety levels have decreased in children who have already experienced dental treatments, especially when dental visits have been rare and the interval between visits was long. Other studies, however, have reported higher levels of dental anxiety in children who have experienced dental procedures in the past than in those who have not. This can be explained by the fact that those children are familiar with unpleasant dental procedures. But there have also been many studies that have supported the contrary. Unpleasant experience with painful or invasive dental procedures will increase the level of dental anxiety [12,13].

The correlation between the dental environment and the level of dental anxiety was also investigated. Similar to the results obtained in our study, the literature showed that higher dental anxiety is associated with the sound made by rotative hand pieces, associated with the moment of waiting in the waiting room. Also, the noise of other children who undergo dental procedures in the dental office can lead to anxiety in children waiting for their turn. A higher level of dental anxiety has been shown to be caused by the shape of the dental instruments and the smell of the dental office environment, all these factors associated with the dentist's attire and gender [14].

Conclusions

Children attractions like television, magazines, telephone, internet can be used to create a state of relaxation and to improve the dental management in all cases.

The idea that the treatment might require a follow-up in the case of half of the children, proves a certain confidence, everything being an imaginary and future situation as long as it does not refer to the present moment of dental appointment.

The responsibility and direct involvement of the child from all categories of gender, age and location, from the perspective of maintaining the dental health, leads to the elimination of the state of fear and can determine regular visits to the dental office.

Conflict of interest: None declared.

References

1. Merdad L, El-Housseiny AA. Do children's previous dental experience and fear affect their perceived

oral health-related quality of life (OHRQoL)?. BMC Oral Health. 2017;17:47.
2. Busato P, Garbín RR, Santos CN, Paranhos LR, Rigo L. Influence of maternal anxiety on child anxiety during dental care: cross-sectional study. Sao Paulo Med J. 2017;135:116-22.
3. Kakkar M, Wahi A, Thakkar R, Vohra I, Shukla AK. Prevalence of dental anxiety in 10-14 years old children and its implications. J Dent Anesth Pain Med. 2016;16:199-202.
4. Yildirim TT, Dundar S, Bozoglan A, et al. Is there a relation between dental anxiety, fear and general psychological status? Peer J. 2017;5:e2978.
5. Rajwar AS, Goswami M. Prevalence of dental fear and its causes using three measurement scales among children in New Delhi. J. Indian Soc Pedod Prev Dent. 2017;35:128-33.
6. www.pixabay.com
7. Soares FC, Lima RA, Barros MVG, Dahllöf G, Colares V. Development of dental anxiety in schoolchildren: A 2-year prospective study. Community Dent. Oral Epidemiol. 2017;45:281-88.
8. Yildirim TT. Evaluating the relationship of dental fear with dental health status and awareness. J Clin Diagn Res. 2016;10:ZC105-09.
9. Haworth S, Dudding T, Waylen A, Thomas SJ, Timpson NJ. Ten years on: Is dental general anaesthesia in childhood a risk factor for caries and anxiety? BDJ. 2017;222:299-304.
10. D'Alessandro G, Alkhamis N, Mattarozzi K, Mazzetti M, Piana G. Fear of dental pain in Italian children: child personality traits and parental dental fear. J Public Health Dent. 2016;76:179-83.
11. Patel H, Reid C, Wilson K, Girdler NM. Inter-rater agreement between children's self-reported and parents' proxy-reported dental anxiety. Br Dent J. 2015;218:E6.
12. Gao X, Hamzah SH, Yiu CK, McGrath C, King NM. Dental fear and anxiety in children and adolescents: qualitative study using YouTube. J Med Internet Res. 2013;15:e29.
13. Majstorovic M, Morse DE, Do D, Lim L, Herman NG, Moursi AM. Indicators of dental anxiety in children just prior to treatment. J Clin Pediatr Dent. 2014;39:12–7.
14. Asokan A, Kambalimath H, Patil R, Maran S, Bharath K. A survey of the dentist attire and gender preferences in dentally anxious children. J Indian Soc Pedod Prev Dent. 2016;34:30.

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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.

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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.

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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.

The journal does not have article processing charges, neither article submission charges.

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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.

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

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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

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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.

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- 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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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.
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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.

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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

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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.

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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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