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STRATEGIES TO PROVIDE INCREASED RESISTANCE OF DENTAL HARD TISSUES TO ACIDIC CHALLENGE

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Our studies aimed to evaluate morphological, mechanical and chemical aspects of enamel, dentine and cement when using different remineralizing products before and after acidic challenge by SEM, EDX, AFM investigation or by hardness and profilometry determination. Products like toothpastes or gels containing sodium fluoride 0.2%, 0.24% or 0.4%, stannous or aluminium fluoride provided an increased gain of calcium and phosphate ions when they have been applied on dental hard tissues in acidic conditions. Association of fluoride with other active ingredients increased the protective effect of the products. Ingredients like hydroxyapatite in conjunction with calcium lactate or fluoride demonstrated a high remineralization potential of the products when compared to only fluoride containing products. CPP-ACP strategy led to increased enamel, dentine and cementum protection against acidic attacks and demonstrated an increased remineralization potential on primary and permanent teeth. The effect was demonstrated to be higher in dentine when compared to enamel and cementum. The consumption of milk, cheese and broccoli before the ingestion of acidic drinks significantly reduced the aggressive potential of these beverages. A good protective effect of dental hard tissues was provided also by saliva, in direct relation to an optimal supply of mineral ions.

DENTAL BIOMATERIALS-TISSUE INTERACTION: NEW TRENDS & CHARACTERIZATION TECHNIQUES

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Dental biomaterials offer the clinicians a powerful set of clinical tools for patient treatment and are found in virtually every instrument, device, implant, or piece of equipment. A significant number of materials including metals, ceramic, polymers, composites and some nanomaterials exist and are used in dental medicine for current and potential applications. This paper focuses on some newly developed dental biomaterials as well as the novel technologies used for dental biomaterials processing and characterization. New trends in metallic dental alloys, surface modification, and characterization techniques will be reviewed and discussed with particular reference to their relevance in dental biomaterials-tissue interactions phenomena. Because the advanced microscopically techniques such as scanning electron microscopy and atomic force microscopy are used now to determine the interfacial structure/property/biofunctionality relationships of synthetic dental biomaterials with human tissues, different practical examination of some relevant dental biomaterials will be presented in order to show the advantage given by these techniques. In conclusion, future research and studies on some promising dental biomaterials are essential in terms of biocompatibility, structure and properties in order to make them clinically viable. Interdisciplinary research between engineers and clinicians appears to be mandatory in order to be sure that new proposed dental biomaterials and technologies will be applied in practice.

Keywords: dental biomaterials, metallic alloys, composites, SEM, AFM

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INDICATION DETERMINES THE MATERIAL

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Starting from the variety of classified materials that do not necessarily suggest the clinical indications, we will choose a few with distinct properties and indications, so-called „extended-indications-materials”, which can only be processed through the CAD / CAM technique, but retain their individual properties after milling.

ASSESSMENT OF LASER WELDING IN RPD TECHNOLOGY

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Introduction. Modern techniques, like laser welding, are used for repair the metallic frameworks of dental prostheses.

Aim. The aim of study was to determine the quality of welding procedures and to make a correlation of the welding parameters with the structure and properties of cobalt dental based alloys.

Materials and methods. CoCrMo dental alloys samples were used for welding in butt joint or addition system. “C” alloy (Vaskut Kohászati Kft-Hungary) and WIRONIT (Bego-Bremen, Germany) were welded with laser devices MiniSaldatrice XXS, Orotig, Italy. Welded joints qualities were investigated by: radiography, metallography, micro-hardness analyzes stereo-microscopy and applied finite elements method for thermal and static analysis of stress state in welding area.

Results. Combining parameters in laser welding is a very complex operation, which depends on alloys composition, welding procedure, thickness and profiles of cast samples. Some of the microscopically faultless welding in reality contained hidden pores or cracks, which compromise the rib in 72% of the cases. Micro hardness analysis (100 g charges) shows the increasing of hardness in heat affected zone and in rib. On joints chemical composition it can be observed only a small decrease of mainly chemical components. The heat flux distribution on a period of 1-6s was evaluated on longitudinal section of welded plates for the stress areas according to the welding type: on two faces or one face.

Conclusions. Metallic prosthetic pieces welding is a real re-optimization possibility of removable partial dentures. It may become constant in dental laboratory, if prefabricated parts could be used.

Keywords: welding, CoCrMo alloys, removable partial denture technology

THE DIAGNOSTIC VALUE OF COMPUTERIZED AXIOGRAPHY IN DETECTING THE TMJ INTERNAL DERANGEMENTS

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Aims. The aim of this study was to demonstrate if computerized axiography could be a reliable tool in assessing the internal derangements of TMJ (disc displacements with or without reduction).

Material and methods. A number of 33 patients (66 TMJs), 27 females and 5 males, with signs and symptoms of TMJ disorders, according to the Research Diagnostic Criteria for Temporomandibular Disorders, were included in this study. All patients received computerized axiography and magnetic resonance imaging (MRI) of both TMJs, 1 to 5 days after the clinical examination. MRI examinations were performed using 1.5 T MRI equipment (Siemens Avanto, Siemens, Erlangen), while computerized axiography was performed with Cadiax Compact 2 system (GAMMA Medizinisch-wissenschaftliche Fortbildungs-GmbH).

Results. MRI detected 19 (28.79%) normal TMJs, 30 (45.45%) with disc displacement with reduction and 17 (25.76%) with disc displacements without reduction. Axiography depicted 23 (34.85%) normal TMJs, 22 (33.33%) with disc displacements with reduction and 21 (31.82%) with disc displacements without reduction. Compared to MRI, computerized axiography showed a sensitivity of 85.11%, specificity of 84.21%, diagnostic accuracy of 84.85 %, a positive predictive value of 93.02% and a negative predictive value of 69.57%.

Conclusions. Based on our results, computerized axiography represents a useful tool in detecting the presence of a displaced TMJ disc, except the cases of minor disc displacements. The graphics obtained with this method should always be correlated with the clinical examination.

PHOTODYNAMIC THERAPY (PDT) APPLICATIONS FOR THE CONTROL OF ORAL BIOFILM

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Background. Photodynamic therapy (PDT) has generally been developed as an alternative approach for cancer treatment. PDT can be highly selective to the microorganisms.

Increasing antibiotic resistance of gram-positive and gram-negative bacteria, triggers the research towards new strategy, alternative antimicrobial therapies such as antimicrobial PDT (aPDT). It is designed to achieve a long term aim, inactivating biofilm-state pathogens with minimal invasive consequences for the surrounding tissues. PDT is based on the

principle that visible light activates a photosensitizer (PS), leading to the formation of reactive oxygen species, singlet oxygen, which induce phototoxicity immediately during illumination.

Methods. The aim of the present review is to outline the PDT applications towards decreasing microorganisms and inactivation of biofilm-state pathogens. As a search strategy, the databases PubMed/Medline were used, and articles were retrieved from 2013 until March 2018 using the following key-words: PDT, photochemotherapy, photosensitizing agents, oral biofilm.

Results. Results from the available articles reported that aPDT was effective in reducing bacteria causing tooth decay (*S.mutans*, *Lactobacillus* spp). Also PDT showed a significant reduction of gingival tissue inflammation, low local toxicity, acceleration of dental treatment and a low cost effect.

Conclusions. PDT may be an important adjunct therapy to conventional technique for the treatment of several diseases concerning oral status. From a clinical perspective further randomized trials are needed to assess the efficacy of a PDT towards oral bacterial reduction.

SIGNIFICANCE OF POLYMETHYLMETHACRYLATE (PMMA) MODIFICATION BY ZINC OXIDE NANOPARTICLES FOR FUNGAL BIOFILM FORMATION

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Aim of the study. Denture stomatitis is still a clinical problem in patients particularly vulnerable to this disease. The objective of this study was to obtain a material composite with antifungal properties for dentures to be used as an alternative protocol in denture stomatitis treatment and prevention.

Materials and methods. Composites of PMMA and doped ZnONPs (weight concentrations, 2.5%, 5%, 7.5%) and PMMA with sprayed solvothermal and hydrothermal ZnONPs were tested. The following investigations of newly formed biomaterials were undertaken: influence on *Candida albicans* solution, biofilm staining, XTT analysis and total amount of adhered *Candida* cells.

Results. These studies evidenced the antifungal activity of both nanocomposites PMMA– ZnONPs and the efficacy of sputtering of zinc oxide nanoparticles on the PMMA. The study of the biofilm deposition on the surface showed that antifungal properties increase with increasing concentration of ZnONPs. The XTT assay in conjunction with testing the turbidity of solutions may indicate the mechanism by which ZnONPs exert their effect on the increased induction of antioxidative stress in microorganism cells.

Conclusion. The denture base made of the aforesaid materials may play a preventive role in patients susceptible to fungal infections. Based on the results obtained a modified treatment of denture stomatitis type II (Newton's classification) complicated by fungal infection was proposed.

DEVELOPMENT OF A NEW FIBERGLASS REINFORCED COMPOSITE FOR CAD/CAM APPLICATIONS

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Despite the important developments of dental materials for CAD/CAM technology in dentistry, a quality material indicated for all clinical situations, with high reproductibility, industrially processed, operator friendly at a low cost remains a continuous challenge.

Objective. The development of an innovative material, a glass fiber reinforced composite (FRC) for CAD/CAM applications in dentistry.

Materials and methods. The experimental FRC will be obtained using the combinations of silanated E-glass woven rovings and veils. The resins used for the impregnation of the glass-fibres will contain a mixture of Bis-GMA, superior oligomers with high molecular weight, UDMA and TEGDMA. Radiopaque glass fillers are to be placed between the woven rovings and/or veils. Initiator systems for the chemical, free radical polymerization are used. The fibers glass will be displaced in uni-, bidirectional and whiskers directions.

A selection of 2 different types of resins R1 and R2 with 2 different types of hybrid filler F1 and F2 3 different types of E type fiber glass geometries in 4, 6, 8 and 10 layers were used in this in vitro study. Inside of a silicon cube of 1 cm side, layers of resin and fiber glass were placed one above another. After each layer a light curing process of 10 seconds was done in 5 different points. 2 mm thick samples were cut with a precision saw (Isomet 1000, Buehler, USA) and investigated with SEM and Raman spectroscopy.

Results. Raman analysis, showed a powerful interaction between the polymer and the fiber glass. SEM data revealed that the different fiber glass geometries were well incorporated inside the resin, resulting an acceptable homogeneity.

Conclusions. Preliminary conclusions are: it seems that it is possible to achieve a fiber glass reinforced composite for the use of CAD CAM technology. Further investigation must be done in order to test all the properties of the new material.

Acknowledgment. This work was supported by the Romanian National Authority for Scientific Research and Innovation, UEFISCDI, project PN-III-P2-2.1-PED-2016-1936.

TOOTH WEAR: FROM PREVENTION TO MANAGEMENT

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The incidence of caries has significantly decreased since the end of the Second World War thanks to numerous intensive prophylaxis programs. However, pathological tooth wear of chemical (erosion) or mechanical (attrition, abrasion, abfraction) origin has replaced this pathology. Its ever-increasing prevalence is even becoming a concern, especially among young individuals. The improvement of its care is therefore a main objective of public health, which is incumbent on all

practitioners to assimilate certain specific concepts.

The main objective of this lecture is therefore to familiarize each participant with this problem. For this, the different etiologies of tooth wear will be revealed, their differential diagnosis, as well as the management of lesions and their prevention. Special attention will be paid to erosive and parafunctional lesions.

QUESTIONNAIRE-BASED STUDIES ON THE PERCEPTION OF FACIAL AND DENTAL AESTHETICS

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Perception in aesthetics is largely subjective, influenced by factors such as: ethnicity, geographic and historic considerations, gender, individual preferences for fashion trends; this theory can also be applied to perception and interpretation of beauty in aesthetic dentistry.

The personal self-perception of the aesthetic outcome of the dental arches, as well as the opportunity and variants of treatment aimed at changing it, have to be taken into account whenever the aesthetic intervention in dentistry is envisioned.

There are more sequences of the communication between patients and dentist, aiming to improve the understanding of the patients' characteristics in self-perception and desires, among which the questionnaires play an important role.

The presentation is an overview of the experience of our research group in the domain of the aesthetic questionnaires. Several examples will be discussed: questionnaires aiming to emphasize: the role of the aesthetic parameters (such as dental colour) upon the motivation of patients to ask for dental treatment; differences in the preferences for certain dental colour or dental shape; preferences for certain facial typologies. Most of the questionnaires have images attached and their interpretation is based on the assessment and selection, by the patients, of the image that resemble the most his/her situation or preferences.

The answers to the questionnaires are further interpreted according to the patients' gender, age, ethnicity. In terms of communication with the patients, the questionnaires are continued with previsualisation of the possibilities of treatment, such as digital configuration of a new dental arrangement (DSD), wax-up, mock-up, provisional restorations.

SUCCESS ELEMENTS IN APPLYING BONE REGENERATION MATERIALS IN ORAL IMPLANTOLOGY

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Biocompatible are those materials where the vital environment reactions which they are introduced to are so insignificant that they do not adversely affect each other. The implant must not induce bone biosynthesis by its corrosion, biodegradation on the surface, secondary changes in the body, metallosis or biological instability. The most common materials used as a bone substitute are ceramic materials, together with treated bovine bone, synthetic ceramic of calcium phosphate (hydroxyapatite, tricalcium phosphate TCP) and calcium carbonate (coralline).

The lecture individualizes the choice of metallic versus non-metallic biomaterials in accordance with the various morpho-functional features of clinical cases for implant-prosthetic rehabilitation. A statistical evaluation was made, viewing the existing data, on a number of 325 cases between 2013-2017. The action mechanism of the various types of ceramics involved in oral implantology is based on osteo-conduction. These materials are used to reconstruct bone defects and augment resorbed alveolar ridges. They have good compressive strength and low torsional resistance, similar to the natural bone. Although biological responses differ, all biochemicals are indicated for augmentation. In cases of minor bone resorption, obtaining a suitable bone bed is achieved mainly with non-membrane allogeneic materials. From the analyzed cases, it is conclusive that bone regeneration biomaterials provide very good results in maintaining a bone size that can withstand demands, also providing a high percentage of vitality, safety and lack of complications.

Keywords: implantology, biomaterials, biocompatibility, osteo-conduction, biodegradation

PINK ESTHETICS: RECENT ADVANCES IN RESEARCH ON THE COLOR OF GINGIVA AND GINGIVAL SHADE GUIDE MODELING

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Color of human gingiva is frequently described as “coral pink” and is dependent upon the thickness of epithelium, the degree of keratinization, the magnitude of pigmentation, and the underlying vascularization.

Recent advances in compiling a reliable database, color range and color distribution of healthy human gingiva have been reported. It was found that ethnicity and age had statistically significant influence on color of human gingiva.

In a recent study, which involved computer-simulated samples of human gingiva, perceptibility threshold (PT) and acceptability threshold (AT) for CIEDE2000 were 1.1 and 2.8, respectively. Corresponding CIELAB values were 1.7 and 3.7. The data on visual thresholds for healthy human gingiva are envisioned to be used as quality control tool/guide for selection and evaluation of dental materials, interpretation of color-related findings in clinical dentistry and research and for standardization in dentistry. It is of particular value that this study was based on in-vivo color evaluation of healthy keratinized gingiva of subjects of different ethnicities, age groups, and gender. These thresholds can be used to interpret color compatibility of gingival shade guides and gingiva-colored dental materials with healthy human gingiva. The CIELAB and CIEDE2000 coverage error of basic shades of different gingival shade guides and gingiva-colored dental materials was compared to a previously compiled database on healthy human gingiva. The majority of evaluated gingival shade guides and gingiva-colored restorative materials exhibited coverage error above the 50:50% AT and uneven shade distribution.

Providing a shade guide model with a small number of tabs and a coverage error lower than the 50:50% AT would be an optimal solution for shade matching in dentistry. However, no actual gingival or tooth shade guide complies with this. New proposals of colorimetric and spectral models of gingival shade guides that adequately represent the color of human gingiva have been introduced. Gingival shade guide models with only 4 tabs provided a CIELAB and CIEDE2000 coverage error lower than the 50:50% AT for gingival color. The clustering method, with optimization of both Coverage Error and Maximal Error, together with the spectral clustering that enables more reliable color formulation of cluster representatives in shade guide models, represents an advance when it comes to computer modeling in dentistry.

CONVENTIONAL FIXED PROSTHODONTICS: EVOLUTION OF INDICATIONS AND PROTOCOLS

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Current prosthetic therapeutics are based on the principle of tissue economy and tissue adhesion. As a result, invasive techniques and root anchors are less and less suitable when rehabilitation is being considered. However, certain specific clinical situations require the use of this conventional dentistry (e.g. extensive rehabilitations on a weakened periodontium, inability to receive dental implants, complex rehabilitations in a major parafunctional context, etc.). The objective of this lecture is to review its indications while developing some more current practices based on the therapeutic gradient principle. For this purpose, various simple then complicated clinical cases will be presented and their prognosis will be evoked.

PLATELET RICH FIBRIN AND ITS APPLICATION IN DENTAL MEDICINE: REVIEW OF LITERATURE AND REPORT OF CLINICAL CASES

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Introduction. Platelet rich fibrin (PRF) represents an innovative tool in regenerative dentistry, used particularly in oral and maxillofacial surgery, periodontics and implant dentistry. The technique of PRF preparation consists in extracting all the elements from a blood sample that can be used to promote healing and bone regeneration. However, current literature has stated that PRF has its limitation due to preparation, standing time, transfer process centrifuge and vibration. The aim of this paper was to assess the current literature onto the relevance of PRF in dentistry and to present 4 clinical applications.

Material and methods. A literature search of English language publications was conducted on PubMed database, until April 2018, using search terms in different combination including “platelet rich fibrin”, “PRF”, “implant”, “bone regeneration”, “periodontics”, “root coverage”, “gingival recession”. The relevant articles were evaluated and reviewed.

Results. Among the 485 articles, a total of 21 articles were considered eligible, consisting of 6 systematic reviews, 10 clinical trials and 5 case reports.

Conclusions. PRF was shown to have various use in different clinical settings in dentistry facilitating tissue regeneration. Promising results have been obtained for regeneration of infra-bone defects, furcation defects and root coverage of gingival recessions. The risk of infection and dimensional changes following tooth extraction can be reduced by the use of PRF. As it is a biomaterial easy to obtain, has a low cost, comes from an autologous source, further studies should be conducted to assess the use of PRF in dentistry.

Keywords: platelet rich fibrin, bone regeneration, implant dentistry

BIOCOMPATIBILITY ASSESSMENT OF ZIRCONIA-BASED MATERIALS USED FOR DENTAL PROSTHESES

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Zirconia (ZrO₂) is a ceramic material with adequate mechanical properties for manufacturing of medical devices. Zirconia stabilized with yttrium oxide (Y₂O₃) has the best properties for these applications. The mechanical properties of zirconia fixed partial dentures (FPDs) have proven to be superior to other ceramic/composite restorations. Zirconia's biocompatibility has been studied in vivo, leading to the observation of no adverse response upon the insertion of ZrO₂ samples into the bone or muscle. However, concern has been raised with regard to the low-temperature degradation of yttria-stabilized tetragonal zirconia polycrystalline for monolithic zirconia restorations. Current state of the art shows the strong variability of zirconia sensitivity to in vivo degradation as a consequence of the strong influence of microstructure and process on low-temperature degradation. Zirconia-toughened alumina represents one trend followed by ceramic manufacturers to improve the resistance of zirconia-based ceramics to aging.

The aim of this study was to evaluate the biocompatibility of three experimental zirconia ceramics comparing with three commercial dental zirconia products. For this study we made six study groups, each of them consisting of four laboratory rats, a study group for each of the studied ceramics. The samples were subcutaneously implanted in the backs of male Wistar rats and submucosal in the oral cavity.

The animals were sacrificed after 6 weeks and the local tissular reaction was investigated first by a clinical examination and then samples and surrounding tissues were carefully excised and evaluated using an optical microscope. In the end the samples were prepared for a histological study, in order to obtain sections of 5 to 7 µm stained with hematoxylin and eosin and Masson trichrome colorations.

The samples tended to be surrounded by fibrous connective tissue and usually there was no adverse reaction and only little evidence of any inflammatory response. In brief, the tested zirconia samples have been proved to be biocompatible, even the compositional changes may influence its soft tissue interactions. Their very good tolerance by the oral tissue, leading to the accumulation of collagen fibers in the area around the samples, make these materials promising candidates for their use in dental prosthetics.

Keywords: dental ceramics, yttria-stabilized tetragonal zirconia, histology

DETERMINATION OF JAW FORCES IN PATIENTS WITH DENTAL WEAR BY DYNAMIC SIMULATION USING KINEMATIC ANALYSIS AND FINITE ELEMENT ANALYSIS

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This study aims to evaluate the forces that develop in the jaw and dental arches in two patients with dental wear: one with attrition tooth wear and the other with erosive tooth wear, during mandibular movements by dynamic simulation using the kinematic analysis and finite element methods.

We used for this simulation the kinematic analysis method coupled with the finite element analysis method. For this, using several programs, we obtained a virtual skull with dental jaws attached to the virtual models of the dental arches of the two patients. For all the components of the skull and dento-maxillary apparatus mechanical properties were attributed. All the jaw movements like lifting, propulsion, retropulsion and laterality were simulated and the amplitude of the forces for the two cases of dental wear was determined.

The study highlighted a large amplitude of the forces in both cases, but higher for the patient with attrition tooth wear.

Keywords: dynamic simulation, kinematic analysis, finite element

THE INTAKE OF CAD/CAM SYSTEMS IN ORTHODONTICS

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Orthodontic treatment goal is the achievement of a functional and aesthetical outcome, within a reasonable timeframe. In recent years, Orthodontics has expanded its range from young adolescent patients to adults and therefore requirements for development of new devices, new techniques and individualization of each treatment plan have increased.

The presentation wishes to emphasize the development of the orthodontic specialty that is currently related to CAD/CAM/AM (Computer aided design/ computer aided manufacturing/ additive manufacturing) systems.

The presentation consists in a review of literature on the topic of applications of the CAD/CAM systems in the orthodontic field with illustrations from a few cases, treated by using some of the above mentioned applications.

If traditionally CAD/CAM systems have been a focus of the dental research community since the 1980s, primarily for the manufacturing of crowns and fixed partial dentures, nowadays the benefits of the technology have been brought to different areas of dentistry. In orthodontics, these systems include aids for diagnosis and treatment planning, customization of labial and lingual bracket systems, manufacturing of custom-made removable appliances, clear aligner therapies, robotically generated arch wires, machine-milled indirect bonding jigs and new applications are still in research.

The main objective of incorporating CAD/CAM technology into orthodontics was, and still is, to increase efficiency, quality and reproducibility of orthodontic treatment by also minimizing human errors.

NONDESTRUCTIVE ASSESSMENT OF SINTERING TEMPERATURE IN DENTAL CERAMIC TECHNOLOGIES

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Introduction. A major problem in the ceramic dental technologies is the fracture initiation due to the thermal stress.

This is induced by the increasing or decreasing of the real temperature inside the ceramic dental oven, compared to the temperature planning. The aim of this study is to observe a pattern inside the sintered ceramic materials for higher or lower real temperature inside the oven, using the optical coherence tomography (OCT).

Materials and methods. 50 samples of metal ceramic crowns were obtained. The samples were divided in 5 groups: first - the reference group (where the temperature is the same with the one recommended by the producers). The next two groups were done by increasing the temperature (with 30 and with 50 degree, respectively, above the recommended one). The last two groups were made by decreasing the sintering temperature with 30 and 50 degree below the recommended one. Then swept source (SS) OCT was employed to evaluate the pattern from the sintered ceramic samples, 1 mm under the surface for each group.

Results and discussions. Specific pattern was observed for the groups with sintered ceramic above the recommended temperature, when OCT was used. A different pattern was identified for the groups where the ceramic was sintered below the recommended temperature. Both described patterns differs in comparison with the one in normal sintered ceramic group (the reference group).

Conclusions. The OCT method could act as a valuable noninvasive evaluation method for sintered ceramic above or below the temperature recommended by the producers.

Keywords: thermal stress, metal ceramic dental prostheses, sintering temperature, swept source optical coherence tomography, noninvasive evaluation

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SYSTEMATIC REVIEW OF TOOTH SHADED CAD CAM MATERIALS

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Objective. Depending on the level of clinical evidence and the demand of the clinician or patient, different CAD/CAM materials can be selected to restore missing or compromised teeth. The lecture provides a clear guideline to select the material according to the indication and patient specific demand on the aesthetic outcome.

Materials and methods. The present presentation is based on the systematization of information from literature and presentation of cases in order to offer an update of practices and tendencies in restorative and aesthetic dentistry, with debate over the advantages and limits of the presented materials.

Results. The utilization of CAD/CAM systems is promising for all dental specialists, technicians and patients, for restoring and maintaining patient oral function and aesthetic, while providing high quality outcome.

Conclusion. Dental ceramics and subtractive processing technologies have evolved significantly in the past two decades, with most of the improvement being related to new microstructures and CAD- CAM methods. Also, hybrid-ceramic materials processed via CAD-CAM have become an interesting option for all clinicians, as they have intermediate properties between ceramics and polymers and are more easily milled and polished.

THEORETICAL AND PRACTICAL CONSIDERATIONS OF TRADITIONAL IMPRESSION TAKING

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In some instances, the clinical step of impression taking is underestimated in fixed and removable prosthodontics as well. After a demanding tooth/teeth preparation, sometimes including time consuming pre-prosthetic treatments, the clinician must transfer the prosthetic field in the dental laboratory. This clinical step requires different impression materials and devices, some of them being usable just in particular cases.

Mistakes in the pre-prosthetic and / or prosthetic preparation do not forgive any of us and sometimes the whole treatment should be resumed. Perhaps the majority of errors are committed, most frequently, during impression taking. The lack of time, a premature “relaxation”, the wrong choice of the material or impression tray, the insufficient gingival retraction, represent as many reasons to get an unusable impression.

From their launch on the market, synthetic elastomers have been continuously developed. Polysulfides were first elastomeric impression materials (1954). They were followed a year later by condensation silicones. Polyethers, launched in 1964, represented a true development, due to their precision, dimensional stability and hydrophilicity. Then followed the hydrophobic (1975) and hydrophilic addition silicones (1985). In 2006 a new class of hybrid impression materials became available, namely vinyl polyether silicones, but their prevalence is today less as it would have been expected.

This work is a literature study, which deals with some less considered facts about the precision impression materials. The incompatibilities related to some impression materials, impression-taking tips including the position of mandible and the removal direction of the impression are presented.

HOW THE MINAMATA CONVENTION IMPACTS YOUR DENTAL PRACTICE

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The Minamata Convention was signed in October 2013, has since then been ratified by more than 50 countries and is thus in force. The main focus of this worldwide and legally binding document is the reduction of the effluence of mercury into the environment. This document also includes regulations for the use and for the disposal of amalgam.

In May 2017, the EU has transferred the Minamata Convention into binding European legislation. On the other side, the EU has installed a Working group on the safety of dental restorative materials (SCENIHR), which has concluded in 2015 that the choice of material should be based on patient characteristics such as primary or permanent teeth, pregnancy, the presence of allergies to mercury or other components of restorative materials, and the presence of impaired renal clearance.

However, the political decisions of the EU were somewhat different: beginning July 1st, the use of amalgam shall be restricted in deciduous teeth and in teeth of patients younger than 15, if there is no severe medical reason for using amalgam. The same is valid for pregnant and lactating women. Amalgam separators according to ISO regulations must be installed (with a time line until January 1st 2021), even if amalgam is not placed; only removed. The consequences for the dental practice are related to the choice of non-amalgam restorative materials and to the installation of – rather expensive – separating devices.

DENTAL IMPRESSION BETWEEN CONVENTIONAL AND FUTURE APPROACHES

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Introduction. The dental impression classical methods tend to be replaced by the opto-electronical ones. Different authors in this research field considered that in 10 years from now, opto-electronical methods may replace all classical ones. The aim of this study is to present the advantages and the drawbacks of opto-electronical impressions, as well as their future perspective.

Material and methods. Optical coherence tomography (OCT) was presented in comparison to the chairside digital impression system Apolo Di, Sirona. The impression accuracy is focused on the cervical teeth preparations.

Results. The chairside system produced accurate 3D impressions after the cervical elevation of the teeth preparations. The OCT system is capable to produce similar impressions, but without any elevations.

Conclusion. Chairside opto-electronical impression systems could replace classical procedures, by offering accurate, fast and clean information. OCT could be used for such applications, and it has to be studied as a future research direction in this field.

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RAMAN/SER SPECTROSCOPY ON BIOLOGICAL FLUIDS

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Vibrational spectroscopy techniques such as Raman and Surface Enhanced Raman Spectroscopy (SERS) can provide fingerprint information of different types of investigated materials in a very rapid and easy to implement manner. From the theoretical point of view, it is unanimously accepted today that SERS is one of the most powerful analytical tool for molecular species identification in their native environment for concentrations that could reach even the single molecule level. As such, the newly envisaged diagnostic tools based on these techniques have the potential to revolutionize the actual clinical system mainly relying on “traditional” biochemical analysis. Despite this huge applicative potential in the

biomedical field, there are a few major challenges that must be understood and overcome, limiting their implementation in the clinical area. One of the major obstacle is represented by the lack of reproducibility of the experimental Raman/SERS spectra acquired on different biological samples (blood plasma and serum, saliva, cell lysates).

In this talk we propose a new and original strategy, developed in our research group, holding the potential to overcome these obstacles. The precise aim of this strategy is to produce high quality solid SERS substrates capable to generate very reproducible SER spectra. The experimental vibrational spectra acquired on the above mentioned biological samples will be highlighted. The experimental data will be compared with those existing in the scientific literature. The possible implementation of these techniques for dental applications will also be addressed.

THE ATTITUDE OF CHILDREN TOWARDS DENTAL TREATMENTS

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Dental treatment still represents a psychological stress factor in the majority of patients, however dental interventions can be performed without pain nowadays. Dental fear and anxiety affects a considerable number of children and is linked to avoidance of dental treatment, often resulting in pain and the need to undergo more invasive interventions.

The aim of this presentation is to give an overview of the methods used in the assessment of patients' behavior towards dental treatments; in addition, it will be presented a review of our studies, performed in this domain at the University of Medicine and Pharmacy of Tîrgu-Mureş, România. The aims of these studies were: 1) to assess dental fear and anxiety of children, aged 7-18 years, using epidemiological surveys and 2) to investigate dental anxiety using a salivary biomarker of stress in children aged 7-10 years. There were conducted cross-sectional questionnaire-based randomized studies among schoolchildren living in the central part of Romania. Dental anxiety and dental fear was assessed using the Modified Dental Anxiety Scale (MDAS) and the Dental Fear Survey (DFS). General anxiety was investigated by Spielberger's State and Trait Anxiety Inventory (STAI-S and STAI-T). Children's opinion about dentists was evaluated with the Dental Belief Survey (DBS). The variation of salivary alpha-amylase activity, as a biomarker of stress, was analyzed in children who have viewed a short video on dental treatments. Quantitative determination of salivary alpha-amylase was performed by Spectrophotometry using Wohlgemuth's starch reduction method.

ORAL PRESENTATIONS

IN VITRO COMPARISON OF THE ACCURACY OF DIRECT AND INDIRECT OPTICAL IMPRESSION SYSTEMS

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Objectives. This experimental study aims to highlight and compare the resolution and accuracy (precision and fidelity) of five scanners (two intraoral and three laboratory types).

Materials and methods. Two experimental models were designed and milled for this purpose: a polymethylmethacrylate die (A) and a full-arch polyurethane model with several standard preparations for full coverage all-ceramic crowns (B). The reference models were scanned with an industrial CT to obtain the virtual reference models. Then the models were scanned with all five scanners. Model A has been scanned 15 times with each scanner, and Model B -5 times with each scanner. For the assessment of precision, comparisons were made with virtual reference models by using a metrology software, and for fidelity, the first scan from the series was compared with the following scans.

Results. In regards to the single die, the smallest recorded deviation was 6 µm for the laboratory scanners and 20 µm for the chairside scanners. When the virtual models of the dies were compared among each other, the smallest recorded deviation was 4 µm for laboratory scanners and 17 µm for chairside scanners. When the scans were performed for model B, the smallest deviation was 13 µm for the lab scanners and 82 µm for the chairside scanners. The Shapiro-Wilk test indicated an abnormality in the data distribution, so a Kruskal-Wallis test was used; a significant difference was found for all types of measurements; in addition Mann-Whitney U test indicated significant differences in pairwise comparison, with a few exceptions.

Conclusions. Scanner accuracy is influenced by the length of the scanned segment. Even though the single die scans were within the clinically acceptable limits, when scanning an entire arch, the deviation doubled for laboratory scanners and increased 4 times for chairside scanners.

MEDICAL APPLICATIONS OF BIO-FUNCTIONALIZED SILVER NANOPARTICLES WITH NATURAL EXTRACTS FROM FRUITS

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A simple and eco-friendly biosynthesis of silver nanoparticles, using Cornus mas fruit extracts (AgNPs-CM) was developed. AgNPs-CM was characterized by UV-Vis, FTIR, transmission electron microscopy (TEM) and zeta potential measurement. The modulatory effects on experimental inflammation in rats and antitumoral properties on dysplastic oral keratinocytes of AgNPs-CM compared to gold nanoparticles (AuNPs-CM) were investigated.

The effects of nanoparticles on inflammation were studied in rats compared to the effects of the extract (CM) and vehicle at 4 and 24 hours after induction of plantar inflammation. The paw tissues were harvested and used for TEM and evaluation of the metal content. In addition, Raman spectroscopy, histopathology and prostaglandin (PG) E2 levels assessment were performed at 24 hours.

TEM revealed varying degrees of alterations of dermo-epidermal junction and capillaries, especially in tissues treated with one dose of AgNPs-CM and vehicle, in parallel with increasing of PGE2 levels. Raman spectral analysis showed that AuNPs-CM and CM restored the normal composition of unsaturated fatty acids while the specimens treated with AgNPs-CM were dominated by the protein component.

The biological effects (cytotoxicity, oxidative stress, inflammation and apoptosis) induced by AgNPs-CM compared to AuNPs-CM on dysplastic oral keratinocytes were also investigated. AgNPs-CM showed a dose-dependent toxicity and induced early apoptosis after 24 hours compared to AuNPs-CM. The formation of lipid peroxides, TNF- α and TRAIL levels diminished after both nanoparticles administration suggesting the involvement of other mechanisms in induction of cellular death. The promising results obtained create perspectives for using AgNPs-CM in conditions associated with inflammation and dysplasia.

ANTIMICROBIAL NANOCOMPOSITE MEMBRANES FOR DENTAL APPLICATIONS

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Introduction. In guided bone regeneration (GBR), a barrier membrane is used to prevent fibroblastic cells from colonizing an intraosseous wound during healing, allowing slowly migrating bone cells to fill the defect, resulting in direct bone regeneration.

Compared with poly(lactic acid) (PLA) the degradation of poly(ϵ -caprolactone) (PCL) does not produce a local acidic environment and degrades very slowly. Nanohydroxyapatite (nHAp) shows good biocompatibility, bioactivity, high osteoconductive, and/or osteoinductive properties. Antimicrobial property of GBR is very important to control and/or reduce bacterial contamination of the periodontal defect, to enhance periodontal regeneration.

Materials and methods. In this study, porous matrices composed of PCL and nHAp loaded with amoxicillin (AMX) were prepared as material designed for biomedical applications. Different electro spun antibiotic-loaded nanocomposites were obtained by varying AMOX/nHAp ratio, to produce a series of PCL/AMOX, PCL/nHAp and PCL/AMOX/nHAp matrices. The structural, morphological, surface and thermal properties were characterized by using X-ray diffraction (XRD), scanning electron microscopy (SEM, EDAX), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), contact angle measurements, AMX release. The antimicrobial activity of the AMX-loaded membranes was tested with four bacterial strains: *Staphylococcus aureus* (ATCC 6538P), *Staphylococcus aureus* (collection strain), *Salmonella typhimurium* (ATCC 14028) and *Micrococcus luteus* (lizeideikticus).

Results. Extensive mineralization in simulated body fluid (SBF) was evidenced by SEM/EDX analysis after 21 days. The results reveal that these electrospun nanocomposite amoxicillin-loaded scaffolds could be a promising antimicrobial biodegradable material for biomedical application.

OPTICAL PROPERTIES OF NEW MATERIALS FOR CHAIRSIDE CAD/CAM RESTORATIONS

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Objectives. The aim of the present study was to assess translucency parameter (TP), whiteness index (WID), and masking effect of new materials for chairside CAD/CAM restorations, and the correlation between translucency and the masking effect.

Methods. Sixty-five 1mm-thick samples (A3 shade, high and low translucency) were obtained (n=5): direct composite resin: Filtek Ultimate (F) and Charisma (C); CAD/CAM composite-resins- Lava Ultimate (L), Crios Brillant (CR), Shofu blocks (S); hybrid-ceramics- Enamic (E); feldspathic ceramics-VITA Mark II (VM II), and lithium-disilicate ceramics- e.max CAD (EX); CIELAB parameters were recorded on black background, white, gray, A3 colored backgrounds, and TP and WID were computed. Masking effect was expressed as the color difference between samples on gray and A3 backgrounds and was calculated using $\Delta E76$ formula. Data were analyzed statistically (one-way ANOVA, Tukey's HSD, $\alpha=0.05$ and Pearson's correlation coefficient).

Results. TP of the tested materials ranged between 17.79 (EX_LT) and 23.87 (C); WID ranged between -9.36 (E_T) and 35.28 (E_HT). Significant differences between the tested materials for TP, WID, and $\Delta E76$ ($p<0.001$) were found. However, the multiple comparisons showed no significant differences in TP between E_T, E_HT, EX_HT; CR_LT, VM_II; and F, L_HT, CR_HT, S_LT ($p>0.05$). The best masking effect was observed for E_T and EX_LT, while C, L_HT, and S_HT showed the worst masking properties. A good correlation was found between TP and the masking effect ($r=0.849$, $p<0.01$).

Conclusion. Although the same shade was selected for the tested materials (A3), the optical properties differed significantly. Ceramic based materials had lower translucency levels, and consequently higher masking properties than composite resins.

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DENTAL AND ORAL STATUS SELF-PERCEPTION IN A STUDENT POPULATION

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Objectives. Evaluation of the variations in oral status perception, within three distinct student samples: Romanian/English dental medicine study lines students, and students in the field of economic sciences.

Material and method. Each student sample completed, in written format, the OHIP-49 index: the students of the Dental Medicine Faculty, Romanian section, Cluj-Napoca (N=63) and those attending the Faculty of Economic Sciences,

Cluj-Napoca (N=63) completed the questionnaire's Romanian version; the students of the Dental Medicine Faculty, English section (N=63) completed the original, English version of the index. Informed consent was attained from each subject. Mean scores were obtained for each subscale and inferential statistical procedures were applied: one-way/two-way ANOVA and t-test. Variations regarding age and study line were assessed.

Results. In respect to the whole sample (N=189), the highest scores were acquired in respect to the functional limitation (mean scores: 5-15), pain (mean scores: 5-15) and psychological discomfort (mean scores: 5-10) subscales. The one-way analysis of variance indicated statistically significant differences between the scores of the three samples, for the functional limitation ($F(2)=4.931$, $p=.008$) and social disability ($F(2)=5.128$, $p=.007$) subscales. The t-test revealed statistically significant differences between the male and female subjects, within the Dental Medicine English section, for the pain ($t(61)=-2.292$, $p=.025$) and psychological disability ($t(61)=-2.464$, $p=0.17$) subscales.

Conclusions. The usage of the OHIP-49 index suggests statistically significant variations in the self-assessment of the oro-dental status, between the three study lines. The study recommends a more extended ethnic frame and larger sample sizes, in future research.

STUDY ON THE PERCEPTION OF DENTAL DYSCHROMIC CONDITION

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Objective. To compare the patients' and dentist's perception regarding the localized dental discoloration.

Materials and methods. A group of 160 patients were asked to self-assess their dental color and to indicate, in a dedicated questionnaire: the teeth considered as dyschromic as well as a tooth regarded as having a pleasant color. The same questionnaire was answered by a dentist, on the basis of clinical examination. The color parameters of the reference teeth and teeth with dyschromia or dental crowns were further evaluated using a dental spectrophotometer (VitaEasyshade, Vita), in "single tooth" or "verifying restoration" mode and the color differences were calculated (ΔE_{ab}).

Results. On the bases of the answers, three situations were identified:

1. Perfect agreement between patients and dentists' regarding identification of dyschromic teeth were found in 36% of cases (teeth with extrinsic dyschromia, nonvital teeth, deficient composite or ceramic crowns.) The color difference (ΔE_{ab}) ranged between 1.57-35.86. Two ΔE_{ab} values were between perceptibility (PT = 1.2) and acceptability threshold (AT=2.7), none below and most values were above AT;

2. Cases where the patients and dentists acknowledged absence of teeth with dyschromia (26%);

3. Cases where disagreement regarding the teeth with dyschromia, between the perception of dentist and patients was recorded (38%).

Conclusions. A perfect agreement between patients and dentist regarding the perception of dyschromic teeth may be encountered. In these cases, the values of ΔE_{ab} between the dyschromic and reference teeth exceeded PT and AT; however, in many circumstances, the patients have different perception than the dentist when judging the dyschromic teeth.

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GENETIC AND EPIGENETIC IMPLICATIONS IN ORAL CANCER EVOLUTION

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Oral cancer is a highly prevalent disease, and one of the malignancies with the worst survival rates, despite the great progresses in cancer diagnosis and therapy. This is due to late diagnosis, caused by the lack of specific symptoms in the early stages of oral cancer, despite its accessible location.

From a molecular point of view, cancer is the result of multiple genetic and epigenetic dysregulations which, in association with various risk factors, promote the malignant phenotype. The result of these modifications is the activation of oncogenes and inactivation of tumor suppressor genes.

Epigenetic mechanisms are responsible for normal development of organisms and tissue heterogenicity, by modulating gene expression. Dysregulation of these mechanisms has been linked to cancer development and progression. Therefore, targeting altered epigenetic mechanism for cancer treatment is a promising novel therapeutic approach, knowing the reversible nature of these mechanisms. In addition, identifying a profile of epigenetic alterations in oral cancer can prove to be a valuable tool for early diagnosis and screening. The presentation summarizes the most important genetic and epigenetic modifications associated with oral cancer and also their potential to be used as biomarkers and therapeutic targets.

SHADE MEASUREMENTS USING DIGITAL PHOTOGRAPHY AND SPECTROPHOTOMETRY- A COMPARISON

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Objective. The aim of the study was to evaluate and compare the CIEL*a*b* (L*=lightness, a* colour coordinate in red-green axis, b* colour coordinate in yellow-green axis) parameters recorded using digital photography with direct light, polarized light and a spectrophotometric computer-based system (MHT SpectroShade™).

Materials and methods. Color differences were calculated between CIELAB parameters measured on all the 26 shade samples from a Vita 3D Master shade guide, using three methods: digital photography with direct light (non polarized) (1), polarized light (2) and a spectrophotometric computer-based system (MHT SpectroShade™) (3). Data were analyzed statistically with univariate ANOVA tests, having CIEL*a*b* parameters as dependent variables and measurement methods

as independent variables. Multiple comparisons were adjusted by LSD method (the least significant difference). Intra class correlation coefficients were calculated for assessing the inter-device agreement.

Results. Except b^* parameter, significant statistical differences were found between CIEL a^*b^* parameters recorded with the three measurement methods ($p < 0.001$). However, when analyzing the multiple comparisons, no significant difference was found between the L^* parameters recorded with Spectroshade and non-polarized photography ($p > 0.05$). The values of the ICC indicate a high agreement between the CIEL a^*b^* values recorded with the three measurement methods.

Conclusion. The use of digital photography and polarizing filters can be considered as alternatives to the current methods for shade matching.

IMPLEMENTATION OF HOLOGRAPHIC RESEARCH IN PERIODONTAL DISEASE

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Periodontal disease is often present in patients with fixed partial dentures, especially after a longer period of wearing the denture. One of the signs of periodontal disease is gingival retraction. Evaluation of the extent of gingival retraction is important to establish a complete diagnosis and a correct treatment plan. Holography is defined as a 3D image on a generally bi-dimensional support; it can be considered as an advanced form of photographic technique.

The present research aims to evaluate from a quantitative and qualitative point of view the retraction of marginal periodontal tissues, using a holographic technique, subsequently validated through digital measurements accomplished with a dedicated software.

A RISK FACTOR ANALYSIS FOR CHANGES IN THE APPEARANCE OF ENAMEL DUE TO ORTHODONTIC TREATMENT

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Orthodontic treatment aims to improve dental and facial aesthetics with no adverse outcome on dental structure.

The aim of this in vitro study was to assess the enamel surface-characteristics before and after: brushing with different toothpastes, acid etching and orthodontic bracket placement and removal.

Material and method. A group of 15 healthy and sound premolars extracted for orthodontic purposes, were used

for this in vitro pilot-study. Roots were embedded in acrylic resin and crowns were brushed twice a day, for 21 days, with different toothpastes: Biomed Sensitive (Splat®), Aslamed (Farmec®) and one experimental toothpaste containing nanohydroxyapatite. Consequently, teeth were etched with 37% phosphoric acid and the brushing algorithm was repeated for testing remineralization effects. Several types of braces (metallic, ceramic and sapphire) were bonded on teeth, using as bonding agent the Opal Seal™ (Ultradent, SUA) and then debonded.

SEM (Inspect F, FEI Company) images of the dental surfaces were obtained and analysed by one examiner in order to assess differences in enamel structure.

Results. Differences were not observed in enamel appearance when using toothpastes containing fluoride or nano hydroxyapatite. The type of bracket used (metal, sapphire or ceramic) was found to influence the enamel appearance, indicating that there should be differences in the debonding and finishing procedures in accordance with the brackets used.

Conclusion. Correct oral hygiene algorithm preserve enamel characteristics and toothpastes with specific formulas can represent alternatives to fluoride for mineralisation. From a clinical point of view, our study confirms that orthodontic treatment with fixed appliances is a risk factor for changes in the enamel surface.

TECHNOLOGICAL ALTERNATIVES IN THE ACHIEVEMENT OF POLYMERIC FIXED PROSTHESES

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Introduction. Thermoplastic polymers are successfully used for more than 20 years in achieving dental prostheses due to the high performance and biomechanical behavior. Obtaining non-metallic framework made of thermoplastic polymers enables the restoration of both frontal and lateral edentulous areas. Non-invasive investigation with micro-CT of polymeric prostheses, for detecting structural defects, is the main objective of the study.

Materials and methods. The non-metallic framework of a long-term temporary fixed partial prosthesis was made in thermoplastic polymers Pekkton® (Cendres+Métaux), and BioHPP (Bredent). A wax pattern of the non-metallic framework was fabricated with the following dimensions: retainers -axial walls 0.6 mm thickness, occlusal-surface 0.8 mm thickness; and connector size of 14 mm². Brevest for 2 Press (Bredent) was used for the investment process. In the resulting molds at 350°C, the pellets of thermoplastic polymers Pekkton® (Cendres + Métaux), and BioHPP (Bredent) were pressed with the Bredent PEKK injecting device. The non-metallic frameworks were veneered with the light-curing composite Nexco (IvoclarVivadent). The prostheses were investigated for surface and in depth defects detection with Scan Report Equipment (NIKON XTH 225ST) Software: VG Studio Max 2.2.

Results. Non-invasive investigation of frameworks and prostheses allowed the detection of structural defects prior to insertion into the oral cavity. The defects were of variable size both in the pontic's areas and in the connectors area.

Conclusions. The advantages of thermoplastic polymers are good aesthetics and the property to be bio-inert. The disadvantages are the limited use (up to 180 days) and the additional equipment required. Non-invasive evaluation allows the prosthesis to be investigated before insertion into the oral cavity.

PREDICTING THE VERTICAL DIMENSION OF OCCLUSION BASED ON PRELIMINARY CASTS-PILOT STUDY

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Objectives. This study was conducted to identify if there are any correlations between vertical dimension of occlusion (VDO) of complete edentulous patients and certain measurements made on preliminary casts, in order to preview the VDO from the first stage of treatment, before determining the mandibulo-maxillary relationships.

Materials and methods. An analytical study was performed in the Department of Prosthodontics, Faculty of Dental Medicine, Cluj-Napoca, Romania. Ten maxillary preliminary casts were scanned and then digitally measured. We studied these variables by descriptive statistics techniques. We analyzed the correlations between VDO and the indicators independently (using the Pearson and Spearman correlation tests) and then combined (multiple regression).

Results. VDO had values ranging from 56 to 72 mm with an average of 59.3 mm [CI 95%: 55.6 - 63.0]. VDO correlates significantly with the mean distance Incisive Papilla - Tuberosities (Pearson $R = 0.688$, $p = 0.03$), distance Incisive Papilla- Fovea Palatinae (Pearson $R = 0.65$, $p = 0.04$), median height of Tuberosities (Pearson $R = -0.57$, $p = 0.084$ Spearman $R = -0.74$, $p = 0.014$).

Conclusions. The results of our study suggest that there are statistically significant correlations between VDO and certain anatomical distances from the upper jaw.

PHYSICAL PROPERTIES OF DIFFERENT EXPERIMENTAL ORTHODONTIC CEMENTS

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Objectives. Dental cements are used intraorally to secure fixed orthodontic devices. The objective of the present study is to analyse the effect of the new nanofiller type, TiO₂-Ag-GO, on the physico-chemical properties of four experimental orthodontic cements with Bis-GMA / TEGDMA / UDMA matrix.

Materials and methods. Materials used in this study were five orthodontic cements, four of them were experimental cements with TiO₂-Ag-GO as filler in different percentages. As reference material, we have used a commercial orthodontic cement: BluGloo (Ormco, Italy). We have determined the water sorption and solubility, according to ISO 4049. The specimens were made in a teflon mold (15x1 mm) and light cured with visible light (Woodpeker LED Lamp). Further, the specimens were immersed in water and artificial saliva for 28 days and measured at 1, 7, 14, 21 and 28 days. After 28

days, the immersion liquid was analysed in High Performance Liquid Chromatography (HPLC) to determine the monomer release. FTIR spectroscopy was used to determine the residual double bonds (RDB) and the degree of conversion after 1 and 21 days of orthodontic cements immersion in distilled water at 37°C.

Results. Experimental cement with higher percent in TiO₂-Ag-GO presented significantly higher solubility values than other cements after water immersion ($p < 0.001$), and also a higher amount of residual unreacted monomer and RDB.

Conclusions. Our results revealed that the materials with higher percent of TiO₂-Ag-GO have higher solubility and water absorption values and lower degree of conversion, but others present close values with commercial cement.

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RESEARCH ABOUT DIFFERENT METHODS IN DENTAL ALLOYS CASTING STRUCTURES

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Introduction. Dental prosthodontics means the rehabilitation of the edentulous patients' lost function.

The comfort of wearing prosthodontics pieces will be the first thing that patients feel. This research is about precision fitting of casing alloys as parts of the prosthetics ensemble.

Materials: In this study Co-Cr alloys were used, with different composition of elements like Co, Cr, Mo, W and different characteristics of each material use.

Methods. Dental Co-Cr base alloy are selected from Mo and W percent content in each alloy used. The samples for research are casted of principal piece and secondary piece. After the joining of the two pieces in one ensemble, the fitting quality is microscopically analyzed.

Discussion. The casting method and the method of obtaining the refractory molds in other ways than classic methods, are innovative technologies in dental prosthetics field.

Results. The casting's advantage is the quality and the precision of cast pieces, and also the high rate of the ensemble functionality inside the oral cavity. Function efficacy of the precision ensemble is supplemented by the alloy's biocompatibility and stability in the oral environment.

Keywords: precision in prosthetics ensembles, casting alloys technique, Co-Cr alloys, biocompatibility

POSTER PRESENTATIONS

EFFECTS OF GRAPHENE SILVER NANOPARTICLES ON COMPRESSIVE, FLEXURAL AND TENSILE STRENGTH OF A COMMERCIAL DENTURE BASE ACRYLIC RESIN

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Introduction. Although PMMA based acrylic resins have been the most frequently used materials in constructing denture bases for more than 60 years, their mechanical properties have some limitations.

This study aimed to evaluate the effect of adding two different concentrations of graphene silver nanoparticles on the compressive, flexural and tensile strength properties of a commercial acrylic resin.

Materials and methods. PMMA graphene silver nanoparticles specimens were prepared, using a commercial acrylic resin for denture bases (Castavaria, New York Dental) as control.

Results. This study showed that the compressive, flexural and tensile strength properties of the reinforced acrylic resin were better than those of the unmodified material.

Conclusion. The results showed that the graphene silver nanoparticles added to the acrylic resin improved the three mechanical properties, the effect depending on their concentration.

Acknowledgement. This study is part of a research project (PCD 7690/76/15.04.2016) funded by UMF „Iuliu Hatieganu” Cluj-Napoca.

REHABILITATION OF THE FIRST MANDIBULAR MOLAR USING LITHIUM SILICATE REINFORCED WITH ZIRCONIA CAD / CAM CERAMIC BLOCKS

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The application of CAD/CAM in modern dentistry has been a turning point toward the future of dentistry. Each year, new materials arise, with improved qualities and properties.

The objective of this work was the rehabilitation of the mandibular first molar, using 2 different lithium silicate reinforced with zirconia ceramics manufactured via CAD CAM technique.

Materials and method. On a mandibular first molar, a preparation for a CAD CAM crown was realized. After the classical impression was taken, a stone model was manufactured. The model was then scanned using an extraoral scanner (inEos X5 – Sirona) and the virtual model was obtained using the Cerec 4.2 software. On this model, a crown was designed and then milled using 2 different lithium silicate reinforced with zirconia ceramic blocks: Vita Suprinity- Vita and Celtra Duo – Densply. The 2 crowns were glazed, individualized and tried in the oral cavity. The patient had the chance to choose the crown that had the best fitting and after that, the crown was cemented on the prepared tooth.

Results. Even though the morphology of the crowns was the same, the individualization was slightly different. The patient chose the material with the better individualization.

Conclusions. Both materials were perfectly adapted to the demands of restoring a posterior tooth, but the individualization has a major role in the patient choice.

MECHANISMS OF DEGRADATION OF THE HYBRID LAYER IN ADHESIVE DENTISTRY - AN ANALYSIS OF THE SPECIALTY LITERATURE

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Introduction. The adhesive dentistry success is based on long lasting restorations. There are specialized studies which demonstrate that this goal is not always achieved. Resin-dentin bond is studied in current researches. The purpose of this work is to examine the mechanisms involved in the degradation of the adhesion between the resin and the surfaces with which they come into contact.

Materials and methods. The studies from the specialty literature were analyzed through the virtual library PubMed. The articles included in the study were those who analyzed the degradation of the hybrid layer. Based on the researches, there were identified 176 articles, of which only 128 were eligible, written in English from 1990 to 2015.

Results. The specialty literature shows that the mechanism of degradation of the resin-dentin bond is a complex one, realized through the hydrolysis of the resin and the collagen fibers from the hybrid layer. Collagen fibers are influenced by the mechanical and hydraulic activity, as well as biochemical degradation.

Conclusions. Most of the adhesive systems used currently describe good results regarding the retention and sealing between the involved surfaces. At the same time, there may be a risk that the effectiveness of adhesion to dentin is not a good one, being influenced by the “aging” and long term degradation of the hybrid layer. Many studies included the working technique as a determining factor in the degradation of adhesion to dentin. Capable techniques to create stable resin-dentin bonds resistant to collagenolytic hydrolysis will probably be available in the next years.

EFFECT OF WHITENING GEL BASED ON HYDROGEN PEROXIDE ON THE METALLIC ALLOYS FREQUENTLY USED IN PROSTHETIC DENTISTRY. STUDIES BY ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY

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Objectives. The possible negative effects during tooth bleaching could be associated with the pH value, oxidative effect and compositions of whitening products. The purpose of this study was to evaluate the effects of a whitening gel

containing 6% hydrogen peroxide (H₂O₂) on the corrosion of the metallic alloys frequently used in prosthetic dentistry (*i.e.*, Cr-Ni and Co-Cr).

Materials and methods. The studied alloys were encapsulated in Teflon devices in order to obtain a constant exposed surface. For electrochemical measurement, a computer controlled potentiostat type PGStat 302N (Autolab, The Netherlands) was used. The electrochemical impedance spectroscopy measurements at open circuit potential (OCP) were performed in order to estimate the values of the resistance to corrosion of the studied alloys treated for different time interval with whitening gels and the comparison of the results with data from literature was made.

Results. The electrochemical impedance spectroscopy applied for studying the behavior of the alloys employed in dental prosthesis, treated with whitening gel containing 6% H₂O₂, and tested in artificial saliva predicts information about the type of corrosion and allowed to quantitatively evaluate their resistance to corrosion.

APPLICATIONS OF 3D PRINTING IN MODERN DENTISTRY. IMPLANT INSERTION SIMULATION ON 3D PRINTED MANDIBLE

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Introduction. The 3D prints of human organs have often been a tool used by surgeons in recent years, as they can provide a more detailed picture of some anatomical aspects than classic 2D models or 3D computer imagery. In this way, surgeons can physically assess the replicas of those organs, bone structures or other aspects of interest.

Objectives. The aim of this study is to provide an instrument for the dental practitioner's self-training, *ex-vivo*, on a 3D printed mandible, before the *in-vivo* surgery.

Materials and methods. In order to do this the dental practitioner must scan the patient's dental field; using CBCT is obtained a 3D virtual model of the scanned mandible. Furthermore, it can be obtained a precise 3D printed mandible to be used for insertion *ex-vivo* of the implants.

Results. Therefore, two 3D printed mandibles were obtained. Before *in-vivo* insertion of implants, it was possible to perform a simulation of future surgery. Thus it was chosen the optimal positioning of future implants.

Conclusions. The use of 3D print models can be of benefit for implantologists, but especially to students (undergraduates and postgraduates) during training in Oral Implantology, for simulation of implant insertions.

EFFECT OF PRELIMINARY ACID ETCHING AND DOUBLE-LAYER APPLICATION ON THE SHEAR BOND STRENGTHS OF SELF-ETCH ADHESIVES

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Objectives. The aim of this study was to evaluate the influence of double application and the optional preliminary acid etching on the shear bond strengths of two self-etch adhesives to dentin.

Materials and methods. Two self-etch adhesive systems (Gluma Bond Universal and Futurabond U) were tested in this study using one type of light-cured microhybrid resin restorative material (Super Cor). Vestibular surfaces of 40 extracted human teeth were prepared to expose flat dentin surfaces. Teeth were randomly divided in three subgroups and adhesives were applied on the dentin surfaces: single application with and without a preliminary acid etching and double application. Restorative material was placed and light cured following the instructions. After 24 hours of immersion in artificial saliva, a microshear bond test was carried out. Data were analyzed statistically.

Results. The mean bond strengths of Gluma Bond Universal with a single application was 7.16 MPa and with a double application 13.66 MPa ($p=0.04$). Futurabond U showed mean bond strengths value of 6.41 MPa with single application and 7.71 MPa with double application. The difference was statistically not significant. In case of preliminary acid etching the mean bond strengths of Gluma Bond Universal and Futurabond U were 11.28 MPa and 9.48 MPa, respectively.

Conclusions. Microshear bond strength increases when double-layer application is used, but this improvement is adhesive dependent. The use of optional preliminary acid etching does not improve significantly the bond strength to dentin.

THE ABILITY OF DIFFERENT IRRIGATION DELIVERY METHODS TO REMOVE DENTINAL DEBRIS FROM ROOT CANALS WITH ARTIFICIALLY CREATED PITS

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Objectives. The aim of this study was to compare the effectiveness of conventional syringe irrigation (CSI) and passive ultrasonic irrigation (PUI) to remove debris from prepared root canal walls.

Methods. The root canals of 20 maxillary incisors were enlarged to size 40, taper .04 (Hyflex, Coltene), and then split longitudinally into two halves. Three standardized pits were prepared at 3, 6 and 9 mm from the apex and filled with a mixture of dentine debris and 5.25% NaOCl. The two halves were reassembled with composite resin. Each canal was irrigated for 1 minute with 2ml of 5.25% NaOCl using CSI and an endodontic syringe needle. Photographs of the exposed root canals/pits were taken prior to and after irrigation. The images were evaluated for the remaining dentine debris in the pits with the aid of an image analysis software. The pits were refilled with the same debris - NaOCl mix, the root halves reassembled, and irrigated 1 minute with 2 ml 5.25% NaOCl using PUI. A new set of images was taken and evaluated. Data was analyzed statistically.

Results. The average surface covered in dentine debris before irrigations was 0.46 mm², after CSI this value dropped to 0.34 mm², and after PUI to 0.19 mm². The difference between the debris which covered surfaces after CSI and PUI was statistically significant ($p<0.05$).

Conclusions. Ultrasonic irrigation removed more of the experimentally dentin debris than plain syringe irrigation in simulated endodontic therapy.

THE COMPRESSIVE STRENGTH AND FLEXURAL STRENGTH OF FLOWABLE RESIN COMPOSITES

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Objectives. The purpose of the present study was to evaluate the compressive strength, the flexural strength and the flexural modulus of eleven flowable resin composites (FRC).

Materials and methods. We used for mechanical investigation eleven FRC: Tetric EvoFlow (A3, Bleach L), Latit Flow (A2), PermaFlo DC (A2), Filtek Supreme XT (A3), Accolade SRO (A2), Accolade PV (A2), StarFill 2B (Dentin), StarFlow (A2), SYNERGY Nano Formula (A3.5/B3, A4/M5, A2/B2, A3/D3, Super White), els extra low shrinkage (A3) and Wave (A3).

Specimens (n=7) were prepared for compression testing (4 mm in diameter and 8 mm long) and flexural strengths (parallelepiped with $2\text{ mm} \pm 0.01 \times 2\text{ mm} \pm 0.01 \times 25\text{ mm} \pm 0.01$). Samples were cured using XL3000 photocuring source (3M Dental Products, St Paul, MN, USA) for 60sec. The test specimens were water stored at 37 °C for 24 h before the mechanical tests. The mechanical test was carried out in a universal testing machine at a loading rate of 0.75 mm/min until fracture.

Results. The results recorded were statistically different ($\alpha = 0.05$) when was evaluated with ANOVA statistical analysis. Mechanical properties were well correlated with filler volume fraction. Mechanical testing of materials tested was between 182.87 – 310.38 MPa for compressive strength, 59.59 – 96.95 MPa for flexural strength and 2.34 – 6.23 GPa flexural modulus.

Conclusions. Future flowable resins composites are recommended to have higher mechanical properties in order to improve the clinical lastingness of the fillings.

Keywords: flowable resin composites, mechanical properties, compression strength, modulus of elasticity

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NOVEL HYBRID FORMULATIONS FOR INTERNAL BLEACHING OF NON-VITAL TEETH

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Objectives. This study aims to develop new materials based on titanium dioxide (TiO₂), silica dioxide (SiO₂) and ascorbic acid (Aa) for internal bleaching of non-vital teeth, trying to reduce the reported side effects of commercially available bleaching materials.

Material and method. Three novel formulations of: TiO₂ /Aa; TiO₂ /SiO₂ /Aa and TiO₂ /SiO₂ /small amount of sodium perborate were studied, the first and the second one being hybrid compositions. A number of sixty extracted teeth

were divided in groups of teeth and have undergone treatments such as root canal therapy (RCT) and artificial discoloration. For each group of teeth, a certain bleaching material was used. There were performed spectrophotometry tests as well as mechanical analyses in order to demonstrate the optical and mechanical properties of treated teeth.

Results. The best spectrophotometric and mechanical results were obtained for the mixtures containing TiO_2 / SiO_2 /Aa and TiO_2 / SiO_2 /small amount of sodium perborate.

Conclusions. The proposed hybrid bleaching material based on an inorganic oxides mixture, achieves a mild oxidative stress on dentin and enamel. Two of the novel bleaching agents show relevant bleaching effect and the treated teeth show values of hardness, elastic modulus and fracture resistance similar to those of the endodontically treated teeth only. Moreover, the new bleaching agents have similar efficiency with sodium perborate but they are less aggressive towards the tooth than the peroxides. The results of this study demonstrate the importance of oxidative systems for dental bleaching.

THE INCIDENCE OF BRUXISM AMONG STUDENTS IN CLUJ-NAPOCA

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Bruxism is a masticatory parafunction characterized by the grinding, rubbing or clenching of teeth, during night time or during the day, consciously or not, affecting 8-31% of the general population.

The **objective** of the study was to evaluate the incidence and the characteristics of bruxism among students of Cluj-Napoca.

Material and method. A study was carried out on a sample of 300 students from the universities among Cluj-Napoca, to whom an online questionnaire with 10 multiple-choice questions was applied. Along with the general data (age, sex and university), the questions concerned aspects related to the existence of bruxism, the etiological factors, the associated symptomatology and the level of information of the subjects. The questionnaire was anonymous, with no time limit. The data were entered into tables and statistically analyzed using SPSS.

Results and discussions. Most subjects were young people, females and considered they had a medium-high stress level. 25% were suffering of nocturnal bruxism and 14% of diurnal, and more than half claimed they have acquaintances who have the pathology. The main symptomatology associated was dental sensitivity, followed by pain in the temporomandibular joint.

Conclusions. Within the limits of this study it can be stated that bruxism is a widespread pathology among the students from Cluj. Even though there is good information of the pathology's characteristics, a more detailed investigation of the factors involved is needed.

Keywords: questionnaire, students, bruxism, stress

OBTAINING, CHARACTERIZING AND SELECTING NEW ORGANIC PHASE PRECURSORS USED IN THE FORMULATION OF RESTORATION COMPOSITES

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Objectives. The aim of the study is the formulation and characterization of the organic precursors variants obtained from the urethane acrylic oligomer – UDMO as well as selection of the optimal version of the organic phase precursor.

Materials and methods. The organic matrix has the following composition: Bis-GMA: 2,2-bis [p- (2'-hydroxy-3'methacryloxypropoxy) phenyl] propane, TEGDMA: triethylene glycol dimethacrylate, UDMO: acrylic urethane oligomer containing polyethylene glycol. It was used a photochemical initiation of polymerization. A group of 12 variants of organic precursors have been produced and characterized by: flexural strength (with INSTRON testing machine), residual monomer (extract in chloroform/ High-Performance Liquid Chromatography) and conversion of polymerization (comparing the absorption band intensity at the 1640 cm⁻¹ wave number from the liquid spectrum with that of the cured resin spectrum / Infrared Spectroscopy).

Results. Determination of the flexural strength on cured samples was performed according to ISO 4049 and the maximum values recorded were: modulus of elasticity: 3554.75 MPa, elastic force 72.69 MPa and flexural tension at the maximum load: 119.09 MPa. The maximum residual monomers values [%] were: Bis-GMA: 0.591, TEGDMA: 0.282 and UDMA: 0.344; the maximum conversion rate obtained was 67.429%.

Conclusions. The organic precursors obtained from the acrylic urethane oligomer containing polyethylene glycol (PEG) - UDMO - induce a high degree of conversion, i.e., polymerization efficiency. The results obtained for the analysed samples demonstrate the reproducibility of the behaviour of the acrylic resins polymerized under the test conditions.

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THE INFLUENCE OF THE TYPE OF BEVEL ON THE AESTHETICS OF THE CLASS IV CAVITIES

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Objective. Class IV cavities have as their etiology the carious processes on the proximal surfaces of the frontal group or the incisal angular fractures. The aesthetics of these direct restorations is important for the patient, so the dentist will consider multiple parameters in their restoration, the type of cavity bevel, the layering technique and the color. This study proposes the aesthetic evaluation of direct restorations, comparing three different types of bevels.

Materials and method. The study included a group of 30 central acrylate incisors, color A2. Following the realization of the cavities on the distal angle, the central incisors were divided into 3 groups (n = 10): group 1 - bevel in 45 °, group 2 - round bevel, group 3 - concave bevel. Using the stratification technique proposed by Dr. Vanini, 30 direct

restorations were performed. After polishing, an anonymous questionnaire was distributed to compare the aesthetics of the three types of bevel.

Results. After the completed questionnaire from 55 people, asked to respond which restoration was the most aesthetic, the results were: between group 1 and group 2, 55% chose group 2, between group 1 and group 3, 70% chose group 1, and between group 2 and group 3, 64% chose group 2. Comparing all three groups, 44% chose group 2 as the most aesthetic, 38% chose group 1 and only 18% chose group 3.

Conclusions. Following our results, we can affirm that the round bevel was appreciated as the most aesthetic one compared to the other two bevels.

STUDY ON PHYSICAL, CHEMICAL AND MECHANICAL PROPERTIES OF NATURAL REVELATORS USED IN PHOTODYNAMIC THERAPY

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Objectives. The purpose of this study is to physically, chemically and mechanically characterize 6 experimental photosensitizers used in photodynamic therapy, in comparison with a commercial one, from the point of view of their composition and structure.

Materials and methods. The commercial HELBO Blue Photosensitizer and 6 experimental photosensitizers, consisting of essential oils of incense (T), oregano (O) and thieves (H), arnica oil (Ar), methylene blue (AM) - 2% and curcumin (Cu) were studied. They were physically and chemically characterized by UV-Vis spectroscopy (Unicam) to determine their maximum absorption. The samples were analyzed by the GC-MS gas chromatograph (Agilent 19091S-433M) and high performance liquid chromatography (HPLC - Jasco).

The mechanical properties of the prepared materials were determined by standard traction tests. The Young module (MPa), traction resistance σ (MPa) and elongation (ϵ) for each composition were tested on three samples, the data reported being the mean values of three measurements.

Results. The samples with experimental revelators studied by GC-MS chromatography showed the presence of active compounds in the essential oils used. There is a well-defined peak in the photosensitizer with methylene blue at 667 nm, and at 437 nm in the curcumin and arnica oil photosensitizer. The photosensitizer with thieves absorbs at 308 nm, the oregano at 290 nm and the incense at the test concentration does not have a very pronounced shoulder. Regarding the mechanical properties, the highest value for traction resistance was obtained for the curcumin photosensitizer and the elongation has better values for the essential oil products of oregano and incense.

Conclusion. Experimental photosensitizers have physicochemical and mechanical properties appropriate for their use in photodynamic therapy, except for those with incense.

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SHEAR BOND STRENGTH OF SELF-ETCH AND TOTAL-ETCH EXPERIMENTAL ADHESIVE SYSTEMS WITH TiO₂

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The objective of this study was to evaluate the dentin shear bond strength of four experimental adhesive systems (A1, A2, A3, A4) and one commercial, on the buccal and lingual surfaces.

Materials and methods. Four experimental TiO₂ based adhesives were tested: two “etch and rinse” systems (A2, A3) and two “two-step self-etch” systems adhesives (A1, A4). As a reference was used a commercial adhesive, 2Bond (Heraeus Kulzer GmbH), “etch and rinse” adhesive system. This experimental in vitro study was performed on 40 extracted molars. The teeth were randomly divided into five groups, one for each adhesive. After preparing the flat enamel surfaces on buccal or lingual sides and applying adhesives, composite was built to the surfaces; after 24 hours storage at 37°C, shear bond strength was tested with an universal testing machine Lloyd LR5K.

Results. Within the limitations of this in vitro study, it can be concluded that all the adhesive agents evaluated showed optimal shear bond strength 17-20 MPa, except 2Bond. The shear bond strength of A2 was significantly higher than A1, A4. However, shear bond strength of experimental adhesive with TiO₂ to dentin is better with etch-and-rinse adhesive systems, and the TiO₂ improve the adhesive properties.

Conclusions. The shear bond strength of etch-and-rinse adhesive systems was higher than self-etch adhesives except for one adhesive (A4) and the bond strengths of self-etch adhesive were not significantly different.

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OPTICAL BEHAVIOR OF HOT PRESSED DENTAL CERAMICS AFTER DIFFERENT SURFACE FINISHING IN AQUEOUS ENVIRONMENT

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The evolution of ceramic systems has allowed obtaining restorations that are highly aesthetic and resistant, despite the difficulty of matching the optical properties of natural teeth. A lot of factors such as light absorption, reflection and transmission, influence the tooth color. In ceramics, the final color depends among other factors on the degree of opacity, translucence, opalescence and the type of surface finishing.

The aim of this study is to find how the surface finishing and the aqueous environment affects both the optical properties and the roughness of pressed dental ceramics.

Two types of ceramics (feldspathic and lithium disilicate) were chosen different surface finishing (polishing and glazing) were applied. The samples were immersed (24, 48, 72 hours) in distilled water. The following parameters were

calculated: TP (Translucency parameter), OP (opalescence parameter), CR (contrast ratio parameter), Ra (arithmetical mean roughness parameter) and Rz (maximum roughness) after immersing the samples in distilled water.

This study results showed that the optical properties with the chosen parameters are influenced only by the type of the material. Roughness of the ceramics is influenced by the surface finishing, especially at the feldspathic glass ceramic.

Keywords: optical properties, roughness, hot pressed ceramics, distilled water

MICRO-CT ANALYSIS OF DENTAL ADHESIVE REINFORCED WITH NANOPARTICLES

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Aim of the study. The purpose of this study is to analyze by modern imaging methods a dental adhesive loaded with ferric nanoparticles, which is applied by conventional methods on the prepared surface of the teeth, in order to fill them with composite materials.

Materials and methods. Teeth used in this study presented Class 1 and Class 2 Black cavities. The dental adhesive used in the study was Evetric Bond (Ivoclar), applying it to dental surfaces by conventional method after selective demineralization of the teeth.

The dental adhesive was loaded with nanoparticles featuring Fe₃O₄-SiO₂ multicore shells. The multicore-shell is represented by magnetic composites that were synthesized by SiO₂ covering colloiddally stabilized multicore magnetite nanoparticle clusters. The actual scanning (CT Scan) was performed with a tube voltage of 90 microA by rotating 360 degrees of samples for scanning around the center of rotation, during which 1000 projections were performed.

Results. Image samples loaded with nanoparticles generated areas of adhesive with thicknesses within the same range, areas between 0.1 and 0.4 mm thick being noticeably diminished.

Conclusion. Loading dental adhesives with nanoparticles and applying them to the surface of the teeth by brushing can reduce the thickness of the adhesive film from the tooth interface to the obturation material.