

Abstracts from the 44th Annual Conference of the European Prosthodontic Association (EPA) 30th September - 2 October 2021 Athens, Greece

Main Program

Short Implants or Vertical Augmentation for Atrophic Mandibles?

Marco ESPOSITO

After a brief explanation on the importance of the study design for evaluating the efficacy of various interventions, this presentation will focus on how to rehabilitate with dental implants atrophic mandibles by comparing in randomised

controlled trials two alternative options: the use of short implants versus vertical bone augmentation procedures to allow the placement of longer implants. The most updated scientific evidence will be presented.

Clinical Practice Guidelines. How to link Periodontal and Restorative therapies

Mariano SANZ and Phophi KAMPOSIORA

In the newly developed EFP Clinical Practice Guideline for the treatment of Periodontitis patients, a stepwise treatment approach has been adopted in which the endpoints of therapy are evaluated after each step and more complex treatment modalities are indicated to fulfilling these endpoints. Periodontitis patients frequently suffer concomitant tooth loss, particularly stage IV periodontitis cases where tooth loss

due to periodontitis is one of the major criteria in diagnosis. In these patients, periodontal therapy is only a previous step towards oral rehabilitation of their function and esthetics. In this presentation we shall present the evidence based recommendations on how to implement prosthetic treatments, either implant or tooth supported within the context of the stepwise treatment of periodontitis.

The Prosthodontist's role in treating the aging population post COVID-19- challenges and opportunities

David FELTON

The COVID-19 global pandemic took an incredible toll on that segment of the population that was most vulnerable, aging adults, many of whom were residing in long-term care facilities. As we emerge from the pandemic, prosthodontists face the ravages of oral neglect in a large segment of the

population who have, unfortunately, foregone dental care for months. This presentation addresses those challenges, and provides guidance to treatment of aging adults in need of prosthodontics care. The pros and cons of extensive prosthodontic treatment, or no treatment, will be discussed.

Minimally invasive Prosthodontics from A (adhesive technique) to Z (zirconia)

Daniel EDELHOFF (Sponsored by 3M)

Minimally invasive treatment options have become increasingly feasible in restorative dentistry, due to the introduction of adhesive techniques in combination with restorative materials featuring optical properties similar to those of natural teeth. This enables primarily defect-oriented additive restorative methods guided by wax-up as a reference during tooth preparation. Similarly, the introduction of cantilever resin-bonded FDPs has essentially made it possible to preserve healthy tooth structure. Modern restorative concepts should be accompanied by a reliable adhesive technique. New adhesive systems

allow to simplify the sensitive process of bonding to tooth structures and different restorative materials.

Attendees will learn:

1. To differentiate minimal invasive preparation designs for single tooth restorations.
2. To understand material selection criteria for all-ceramic FDPs including resin-bonded FDPs.
3. To identify simplified procedures in adhesive technique.

Digital Smile Design as a Tool to Predictable Treatment Plannings

Andrea RICCI

Digital Smile Design is a multi-purpose tool that can help the dentist during different phases of treatment. From the first visit until the final cementation the DSD protocol can be utilized by the dental team and the patient to understand the esthetic issues, the elaboration of the proper treatment planning and also improving the effectiveness of the clinical sequence, facilitating the communication between clinicians and the technician. Lines and shapes drawn on extra oral pictures which give appropriate references can be transferred to intraoral photos and this help the team to widen the vision of the case, understanding the limitations, highlighting the esthetic issues and pre-visualizing the outcome. It also allows continuous re-evaluations of the treatments outcomes, providing valueless growth of the team's skills.

DSD changes the method that the clinician utilize to communicate with the patient. Most of the times we are not very good explaining procedures, sequences and rationales of the treatment plans. Videos, photos and presentations help

improve this communication. This is the reason why it can also be considered a philosophy, since the patient's education is improved, allowing to select the ideal treatment that is ethically customized to the patients' need and lead to superior results. Last but not least, will also increase case acceptance that is a critical aspect for the success of any dental office.

Learning Objectives:

1. The advantages of using the DSD Philosophy in a daily approach
2. How to design a smile that fits naturally in the face's esthetics
3. How to define predictably the Occlusal Plane, Incisal Length and Midline
4. How to effectively communicate with team members, dental technician and all patients
5. How to prepare a customized motivational video for the patient

The synergy of digital dentistry and biology in implantology- designing and treatment workflow

Stavros PELEKANOS

With dentistry becoming more computer controlled, dental profession has experienced an exciting amount of technological growth during the last years.

Implant placement through digitally designed guide stents becomes more and more popular as the accuracy, the efficacy

and handling of these procedure is evolving fast. On the other hand, CAD CAM prosthetic implant restorations have been already used since many years with the help of well-developed lab scanners and software's already implemented in the everyday lab work. The last missing link, the use of

intraoral scanners seems to gain more and more the trust of the practitioners in the daily practice.

The aim of the presentation is to analyze the implant abutment design and the digital workflow in the esthetic zone through scientific evidence and daily experience as well as the indications and the limitations of the digital process depending on existing

materials and known procedures. Chairside intraoral scanning, handling digital impressions, usual mistakes and all the full process from digitization to manufacture and final cementation through all the design steps will be clarified. Clinical cases will be presented discussing different clinical approaches, showing the synergy of older and newer biological concepts in the treatment workflow.

The role of provisionals in the architecture of a prosthetic work

Cosmin ULMAN (Sponsored by Coltene)

Oral rehabilitation is an everyday technique for many dentists. Today we have a lot of choices when it comes to choosing from different materials. We can achieve the desired results only if we follow the exact steps. This presentation is intended to show how to make provisionals, how to choose the proper material for them and what the field of use for this provisionals is.

This are essential steps for soft tissue health, for the vitality of the tooth, for the emergency profile, for stopping abutment movement and to preview the future rehabilitation.

It is extremely important for emergency profile to use provisionals and to modify that in order to obtain a good and stable transition from "pink" to "white".

We will see the extremely important role of provisionals in the architecture of a complex prosthetic work, in the architecture of an oral rehabilitation as well as in the integration of the temporary provisionals in the treatment scheme in order to obtaining of a long-lasting aesthetic work.

The Role of Digital Workflow and Technologies at the Service of Complex Full-Arch Immediately Loaded Implant Restorations

Eitan MIJIRITSKY

The most important phase in a complex implant case preparation is a precise pre-operative diagnosis and understanding of the treatment aims and the case limitations. With the aid of digital planning of the case through preview of digital modelling and softwares, the clinician can predict anatomic conditions, final teeth form and position, esthetics and occlusal limitations. It allows the clinician to transfer the planned 3-D implant position from the software into the surgical field, to plan in advance the restored teeth in respect to the occlusal relationship and to the optimal implant position, to produce in advance a Cad/Cam provisional restoration and

to decide regarding the surgical and prosthodontic protocols to choose such as late vs. immediate loading following a conventional flap vs. flap-less implant surgery. Can we follow a total digital workflow in those cases or should we still combine conventional analogue dentistry with digital dentistry? What about the precision of the available intraoral scanners in oral implantology? Are we there yet? During the presentation the relevant and most updated literature will be presented with an updated workflow protocol and few complex Full-Arch Implant Supported clinical cases.

Implant retained overdentures: success is the residue of planning

Eva ANADIOTI

Edentulism is prevalent in many parts of the world and removable prostheses have traditionally been used for its management with several limitations. As implant and digital dentistry advancements occur, improvements towards implant retained removable prostheses have changed the way we help the edentulous population. Despite the higher initial costs, those prostheses lead to higher oral health-related quality of life while they

are still more affordable compared to other implant supported treatment alternatives. This presentation will focus on the prosthodontically driven surgical treatment planning and sequencing of overdentures. Clinical cases with appropriate and inadequate planning will be reviewed as a learning tool for future success. Additionally, digital denture fabrication techniques with subtractive and additive manufacturing will be discussed.

Fixed Prosthetic Rehabilitation: Man and Machine together to achieve success

Stefano LOMBARDO (Sponsored by Kulzer)

Each fixed prosthetic rehabilitation requires several important decisions to achieve long-term success: from the formulation of the ideal treatment plan to the selection of the prosthetic abutment; from the care of natural teeth to the insertion of osseointegrated implants; from the choice of the fixture to its ideal positioning; from the different kind of surgery approach to the prosthetic development of peri-implant soft tissues;

from the traditional impression to the intraoral scan up to the choice of the working method of the dental technician and the development of modern CAD-CAM protocols.

Prosthetic workflows are now known to all, but the long-term biological and prosthetic success factors are many: we will analyze together the clinical and laboratory aspects from the traditional analogue point of view and from the most innovative digital point of view.

The Restorative Difficulty Evaluation System (RDES) of Endodontically Treated Teeth inside prosthodontic treatment planning

Marco FERRARI

The best plan for success is to begin with the end in mind. Before initiating treatment, the practitioner should carefully examine and evaluate the tooth and assess it for the feasibility of endodontic treatment, restorability, periodontal health, occlusal function, esthetic need.

Clinical diagnosis during the evaluation of the possibility to save an endodontically involved tooth has to be based on the capability to keep the tooth in function for a reasonable time.

For that, there is a need for new baseline parameters that will have to establish once the treatment goals to restore endodontically treated teeth (ETT) in different clinical conditions.

Under optical circumstances, the RDES would be able to maintain ETT in function for many years and also to give an idea of the difficulty that the operator will have to treat the single

case. The RDES may be evaluated based on several clinical factors, local and more generally related to the entire mouth, whereby no single parameter displays a more paramount role. The entire spectrum of local and mouth parameters ought to be evaluated simultaneously.

For this purpose, the following aspects will be examined:

1. Endodontic complexity and outcome,
2. Vertical amount of coronal residual structure and dimension of the pulp chamber,
3. Horizontal amount of coronal residual structure,
4. Restoration marginal seal,
5. Local interdisciplinary conditions,
6. The complexity of the treatment planning,
7. Functional need,
8. Dental wear and esthetic need.

Recent developments in resin composite luting agents

George ELIADES

Resin composite luting agents have dominated the field of luting of aesthetic restorative materials to tooth or hybrid implant abutments. Currently, the original multicomponent systems have been modified to simplified versions, employing universal primers (for tissue and restorative materials) or even primer-free universal agents. The complex chemistry of these agents has been associated with various problems such as reduced self-life, inadequate self-curing capacity of dual-cured materials, enhanced water plasticization of products with adhesive monomers in the set pastes and compatibility issues with light-cured adhesives. Several manufacturers have

launched new products with "touch-cure" primers to improve resin bonding to dentine, modified several agents to adhesive-free pastes for improved water stability or introduced silane containing pastes for simultaneous silanization and luting of etchable glass-ceramics. The aim of this presentation is to review the status of the latest developments and to assess their contribution to the performance of these materials.

Can the implant-abutment interface affect the success of dental implant treatment?

Lambis PETRIDIS

Implant dentistry has come a long way since the realization of osseointegration a few decades ago. Numerous advances have been made regarding surfaces, designs and materials for both dental implants and prosthodontic abutments. The initial external connection evolved into hundreds of internal connections, most of them unique in geometry. The result is an abundance of dental implant systems in the market today differing in macro-design, surface characteristics, and connections. Clinicians today have a choice between hundreds of implant companies and thousands of possible implant/abutment combinations.

Faced with so many choices the question is whether the implant-abutment interface plays any role in the success of dental implant treatment. How do clinicians choose the right implant systems and connections for their patients? Where does evidence and marketing meet?

This lecture will present a summary of the evidence and the possible clinical implications of using various implant-abutment combinations and geometries.

Optimizing the Restorative-Tissue Interface in Challenging Esthetic Treatments

Prof. Nitzan BICHACHO

In order to achieve a harmonious esthetic result of complex restorations at the smile zone, not only the restoration design and material should be carefully selected, but the abutment type, design and color should be carefully prepared - in order to achieve integration of the whole restorative complex with the surrounding tissue; whether of a natural tooth (vital or non-vital), or an implant.

One should plan ahead the different phases of the periorestorative treatment in order to end up with a harmonious natural looking result, by choosing the most suitable treatment

for each site, so that the combined abutment-crown complex will blend with the adjacent dentition and with the surrounding vital periodontium, in an esthetic and healthy manner.

State of the art strategies will be presented where different abutment types of teeth and implants are to be restored, utilizing diverse laboratory and clinical techniques.

The concepts of Model Based Cervical Design and Cervical Contouring will be presented and analyzed in a variety of esthetically challenging clinical cases.

Do I have to go digital?

George PAPAVALIOU

Digital intervention in Dentistry, especially in prosthodontics, is not considered a revolution any more but a reality. Fast track equipment evolution, high initial cost and steep learning curves, make many clinicians hesitate to get on the "train" of digital evolution.

This presentation will provide with an insight on where we should prefer using digital workflows and in which cases it is not efficient yet to use them. Examples will be given where digital interventions can improve and simplify everyday clinical practice in a justifiable and cost-effective way.

So, indeed we do have to go digital. Digital dentistry is not a panacea but it is also not high fashion with an expiration date. The destination is getting more and more clear. We need to train ourselves on how to read the road-map.

Digital Dentistry: The Challenge of Numbers

Francesco MANGANO

The digital revolution transforms the world of dentistry. Intraoral, desktop and face scanners, cone beam computed tomography (CBCT), computer-assisted-design / computer-assisted-manufacturing (CAD / CAM) software, milling machines and 3D printers, new materials represent an opportunity to improve

the quality of our work. In all this, the accuracy of the machines becomes essential, and the dentist enters the world of numbers. Mathematics is the new challenge for the digital dentist: the challenge of numbers.

Interdisciplinary Approach Between Dentist and Technician to Obtain Optimal Aesthetics

Nicola PIETROBON

A variety of highly aesthetic materials such as pressed ceramics and zirconia have been introduced to dentistry in recent years. As a consequence, both the clinical and technical procedures had to be adapted for a good long term result. New treatment standards have evolved for all the different esthetic materials redefining indications of their use.

Techniques may appear simple, but in reality they can be extremely technique sensitive. An interdisciplinary approach, sound knowledge and awareness of new materials are essential if we are to strive for optimal function and aesthetic harmony with long term predictability.

Collaboration between dentistry and dental technology is still necessary in order to design the optimal prosthesis, and to minimize potential risks during its creation as well as use.

This presentations will discuss the individual aspects of this collaboration based on a variety of tooth-supported and implant-supported restorations.

Occlusal Stability - the Key to Success in Tooth Wear Treatment

Teresa SIERPINSKA

Ideal occlusion may be defined as one that has no structural, functional, or neuro-behavioural characteristics that tend to interfere with occlusal stability. Occlusal stability can be impacted by how all of the differing occlusal forces act together on the teeth. Among factors that may lessen occlusal stability is the wearing away of tooth structure which affects the integrity of the supporting cusps. When advanced tooth wear occurs, immediately, the occlusal destabilization appears. Differing clinical scenarios can be taken into consideration in patients who demonstrate varying degrees of occlusal wear, so that each case should be individually managed both etiologically, and prosthodontically. When the full prosthetic

reconstruction is recommended, several concepts of occlusal stability can be employed during occlusal therapy. However, it is highly recommended to commence occlusal therapy from a stable maxillomandibular relationship with the condyle-disk assembly located in centric relation at a physiologic occlusal vertical dimension. The success of dental rehabilitation should be measured not only by initial comfort and esthetic results but, mainly, by long-term survival and stability of the final reconstruction.

Aspects in Comprehensive Prosthodontic Treatment: The Time Perspective and The X-1 Concept

Ami SMIDT

Proper consideration and evaluation of all implications of an extraction is needed before the action itself. It affects hard and soft tissues and brings inevitable changes in the jaw's topography. Restoring lost tissues or preserving them to begin with, is not an easy task, nor is it a predictable one and placing a dental implant is not a full answer to the challenge. In anterior area cases, this is a crucial issue and may create a problem later on, within the years.

The vulnerable labial bundle bone, a root related structure, is expected to lose the coronal thin portion due to lack of blood supply. Augmentation of the marginal labial bone volume, is a prerequisite for restoring anatomy, whether for an implant supported restoration or a pontic restoration. The anterior buccal bone behavior is a call to recalculate the use of dental implants in general and to dedicate efforts towards keeping teeth, even in compromised cases, as a first choice and in all mouth areas.

A tooth is under wear risks throughout its life in the mouth and when a structural damage occurs, it can be restored. The extent of the damage and the clinical approach used, shows

high correlation with a tooth's life cycle throughout the life span of its host. Each tooth has number of restorations that it can take until it turns "irrational to treat". This brought forward the term, "The X-1 Concept" which reflects the life cycle of any tooth, where each performed restoration cycle reduces the number of potential future cycles. So, if a minimal invasive approach is selected or a tooth is realigned rather than being prepared, remains and maintained intact in the arch, the total odds to stay a life time, definitely increase.

Synergism works well and is behind any successful treatment plan and when based on years of clinical experience with the evolving advances in techniques and materials, it is an advantage especially in cases with periodontal disease, dental trauma and extensive loss of teeth or teeth wear.

The presentation will discuss the dilemmas towards decision making in comprehensive prosthodontic treatment planning, the timing and therapy sequence.

Fusion of Digital Implantology and Prosthodontics. Practical Guidelines

Vygandas RUTKUNAS

The success of implant-supported prostheses directly depends on the quality of the planning and accuracy of implementation. Accurate planning and positioning of the implants enable to minimize tissue regeneration procedures and to simplify prosthetic procedures. Also, final prosthetic components can be fabricated before the surgical procedures and early loading protocols applied. The integration of digital implantology and

prosthodontics is the key to achieve better biological and technical outcomes. However, objective evaluation of the passive-fit is still challenging, and the knowledge of how the misfit could affect the treatment outcomes is still lacking. In this lecture, the practical guidelines of digital implantology and prosthodontics will be presented along with results of the newest research findings.

Minimal Invasive Dentistry to Maximize the Results

Francesco MINTRONE

In the lecture will be analyzed all the bases to obtain a predictable esthetic rehabilitation.

Esthetic analysis, wax-up, mock-up will be evaluated in detail to give a practical approach to maximize the dental structure preservation.

Moreover, will be analyzed the materials and the different approaches to obtain a really esthetic rehabilitation.

Contemporary concepts in managing the emergence profile and generating the soft tissues around implants

Minas LEVENTIS (Sponsored by Ultradent-G&C Dental)

Dental implants represent a unique complex system of human hard and soft tissues, mechanical components and oral bacteria/biofilm. Therefore, many different factors are critical for successful outcomes when placing, restoring and maintaining implants.

Prosthetic-driven implant placement is a well-known essential prerequisite while a growing body of evidence points towards the importance of the structure, anatomy and dimensions of the peri-implant soft tissues and the emergence profile of the restorations for the long-term implant health and stability.

The aim of this lecture is to discuss the concept of developing a customised emergence profile as a standard of care for every single individual implant patient and to present up-to-

date methods and techniques that can assist clinicians not only to place implants in the proper restorative position but also to simultaneously design, generate and condition chairside the peri-implant soft-tissues in simplified, predictable, reproducible and effective ways.

Understanding the scientific background and the contemporary clinical procedures is crucial for clinicians to successfully apply them to their everyday practice and create high-quality implant work that complies with all functional, biological, and aesthetic requirements.

Guided Esthetics, switching between Virtuality and Reality

Uli HAUSCHILD

The state-of-the-art team needs to move with the market and the new technologies. This represents not only a financial investment, but also demands to acquire a completely new set of know-how.

Esthetic in dentistry moved to computer screens where specialists evaluate highly resolved scans done with up to date inter oral scanners. We are now able to simulate the situation of the patient's mouth in software programs and we can construct or order all necessary components time before we have even started with the surgeries.

The big advantage is hereby, that decisions can be taken without hassle and can even be virtually tried and reversed. All information can be taken into consideration till the best possible solution is found.

Nevertheless, digital technology remains a tool and nothing more than that. It is a vehicle which, if properly applied, will lead to the destination of an excellent reconstruction. This tool supports the specialist's knowledge and becomes an excellent decision helper by providing information which otherwise might not have been given. However, the specialist's long-term experience is the fundamental base. Also from a technical point of view, a deep understanding of material and how they can be applied and combined is crucial.

Robots might overtake simple production tasks, but will never be able to find and apply solutions or take comprehensive decisions.

We will give you in this lecture a clear overview of new technologies, digital workflows and perfect teamwork between dentists and dental technician.

The new process is hence not only much faster, more precise, it also makes risks foreseeable.

The patient profits from short, minimal invasive intervention which a small likely hood for complications and often also from immediate loading, so does not encounter long healing periods without teeth or unsatisfactory solutions.

PRACTICAL/HANDS-ON SEMINAR: Digital Transformation: BE where the world IS GOING

George PAPAVALIIOU and Phophi KAMPOSIOIRA (Sponsored by Carestream)

This workshop with hands-on participation is designed to introduce the novice to digital technology for impressions, and to provide the experienced user with an insight to the unique features of Carestream scanners that makes them more user friendly than ever.

The presentation of pre-processing features will help to augment clinical use of the scanner and improve scanning speed.

Post-processing features will be presented as well. They are designed to improve digital impression quality, to enhance clinician-technician communication and make interaction of different digital sources feasible.

A step-by-step approach on mastering the digital impression learning curve will provide with a tool to avoid drawbacks in everyday clinical use of the scanner and lead to predictable restoration quality.

The presentation of Carestream scanner's advanced features is designed to be a guide on why we should invest to digital technology for our practices.

This workshop, part of which will be done in real-time on a patient, will be coupled with an extensive hands on session, both on specially designed models, as well as training on a live patient.

PRACTICAL/HANDS-ON SEMINAR: How to design and deliver a biologically and prosthetically sound anatomical healer

Ioannis VERGOULLIS (Sponsored by Ariston Dental)

The emergence and cervical soft tissue profile is a truly underestimated parameter of treatment in modern implantology. Even going back to the nineties, we can find research data that point out the biologic importance of the peri-implant soft tissue. However, the available techniques for the emergence profile management were never established as standard of care for all implant cases. This is mainly due to the fact that they require extra time, increase the cost of treatment and are somehow difficult to master. However, the new research data available on this topic along with the increased rate of cases affected by peri-implantitis worldwide point out the need for dentists practicing implantology to re-evaluate critically the currently applied treatment protocols and adapt to the new information available.

Theoretical part: During this presentation, the fundamental steps for prevention of peri-implantitis, following a step by step approach from implant selection to implant restoration, will be analysed.

Hands-on: Part 1: CSP Prosthetically enhanced ridge preservation on a posterior site. A molar extraction site will be evaluated and treated with the CSP ridge preservation procedure. The participants will be trained on socket evaluation and treatment approaches. The process of composite resin membrane selection, chair-side fabrication and application along with the selection and application of an ideal for the site bone replacement graft will be explained in detail and practiced by the participants. Part 2: Immediate implant placement and socket sealing on an anterior site. A maxillary central incisor extraction site will be treated with immediate implant placement. The participants will be trained on proper Implant selection and osteotomy 3D preparation; The site will receive an immediate implant along with proper regenerative procedures and the socket opening will be supported and sealed with the use of a properly selected anatomical healing abutment that will be fabricated chair-side.

KNOWLEDGE ON THE SPOTLIGHT 1: Rehabilitation with Complete Dentures

Argirios PISSIOTIS, Eleni KOTSIOMITI, Vassiliki ANASTASIADOU and Konstantinos MICHALAKIS

Pissiotis Argirios: Complete Denture Function

The successful treatment with complete dentures is associated with a quick and uneventful adaptation period that enables the neuromuscular mechanism to take control of the function with the dentures. Factors that enhance the quick adaptation of the complete dentures and allow for patient satisfaction are: the accurate impression of the denture bearing tissues, and thus the support, retention and stability that is therefore achieved and the stability that the occlusion provides to the removable dentures. The more attention given by the clinician to these items of denture construction the easier the adaptation will be and the faster the neuromuscular control is going to control the function of the complete dentures.

Kotsiomiti Eleni: Exploring the lower limits of the age spectrum: Complete Dentures in children.

Failure of teeth formation in young children, termed anodontia, is the clinical manifestation of extensive tooth agenesis, caused by genetic anomalies of the genes involved in tooth morphogenesis. Complete edentulism in the early years of life constitutes a severe impairment and generates strong needs, not only for immediate alleviation, but also for long-term control and restoration. It also poses a significant prosthodontic challenge, since it combines the special morphology and small size, the inherent cranioskeletal deviations, the sensitive child psychology and the impaired growth processes. The treatment must be early planned and patient-centered, designed towards the two main therapy targets, to cover the needs of each growth period and to establish optimum background for the

final rehabilitation. A well-structured protocol helps to maintain clear objectives and holistic control through the consecutive stages of the long-term therapy.

Anastasiadou Vassiliki: Essential protocol modifications in constructing complete dentures for older adults.

The scientific data highlight the need for complete denture restoration in an increasing number of older patients, whether it is constructing the first pair or its replacement in cases of long-term edentulousness. The clinical protocol should reflect the older patient's needs, expectations, and the aged substrate response. Therefore, modifications within the entire spectrum of management are essential. A detailed assessment leads from the accurate diagnosis and appropriate treatment plan to (a) the meticulous clinical and laboratory process using either dynamic traditional or modern techniques, (b) the foolproof delivery of dentures and relevant instructions to patient and (c) the individualised maintenance programme for successful long-term prognosis ensuring functionality, comfort and aesthetics.

Michalakis Konstantinos: The complete denture as a blueprint for digitally constructed fixed implant supported restorations

Complete dentures are very often used as provisional restorations during the transition from edentulism to a definitive implant complete fixed prosthesis. Although these complete dentures will be used for a limited period of time, they should be made following the guidelines for properly constructed complete dentures and ensure optimum stability, support, retention, esthetics and function. In this way the provisional complete dentures can serve adequately the patient and be used as a blueprint for the definitive fixed prosthesis that follows.

KNOWLEDGE ON THE SPOTLIGHT 2: Therapeutic protocols, methodology and techniques for the treatment of peri-implant diseases.

Ioannis KAROUSSIS and Spyridon SILVESTROS

A few years after incorporation of dental implants in clinical practice it was realized that peri-Implant tissues may be subjected to inflammation, which is initially limited to the soft tissues, and often extends to the underlying supporting bone, causing its destruction. Nowadays it is unanimously accepted that the incidence and progression of peri-implant diseases are of great concern to the dental community, due to the high frequency with which they occur and the particularly difficult therapeutic approach, at least for the more advanced cases.

The purpose of this presentation is two-fold. Firstly, to report the methodology followed for the earliest possible therapeutic intervention and to present all the treatment regimens applied today internationally, from the Guided Biofilm Therapy® to the promising EmunDo® treatment which achieves photothermal elimination of pathogenic microbes in peri-implant pockets.

Secondly, in cases of extended peri-implant bone loss treatment protocols include surgical resective or regenerative techniques in order to eliminate peri-implant tissues' inflammation, to that extent that stops the progress of their damage and to regenerate lost tissues where is feasible.

KNOWLEDGE ON THE SPOTLIGHT 3: Aesthetic zone implant placement and craniofacial growth: Risks, solutions and decisions

Ioannis FOURMOUSIS, Vasilios CHRONOPOULOS and Angeliki LAMPRIPOUDI

The absence of permanent anterior teeth can be a result of dental trauma or congenital aplasia. Treatment plans on replacing missing teeth are based on patients' development phase, number of missing teeth and general health condition. Dental implants are a common option of prosthetic rehabilitation. However, changes of implant position in relation to adjacent teeth during the life - long craniofacial growth can deteriorate periimplant condition and lead to biological, aesthetic and functional failures.

A series of complicated implant cases with compromised implant restorations will be presented. Discrepancies between teeth and implants in both vertical and horizontal direction created biological and functional problems. Custom made

prosthetic reconstructions can be a valuable solution after implant placement. However, conservative prosthodontic resin-bonded fixed dental prostheses can be an alternative treatment option for growing patients. Therefore, the implant placement should be postponed until the patients' skeletal growth is ceased. But it is ceased?

The aim of this presentation is to describe the craniofacial growth pattern of the aesthetic area and the impact on the existing implant position. Alternative treatment options ensure the right time of placing implants at the anterior maxilla. The patient should be aware of all the risks and possible complications of implant treatment, in order to make a decision.

KNOWLEDGE ON THE SPOTLIGHT 4: Treatment Options and Solutions on Challenging Oral and Maxillofacial Cases through a Team Approach with the Use of Contemporary Digital Techniques and Materials.

Dimitrios STAVROPOULOS, Charalampos APOSTOLIDIS and Christos ASIMOMITIS

Tumors of the maxillofacial region usually require extensive ablative surgical procedures for tumor-free specimen margins. Such resections often create defects with devastating effects on the patient's function (mastication and deglutition), phonetic ability as well as aesthetic form. The reconstruction of such defects to a satisfactory level for the patient is challenging.

Fortunately, advances in reconstructive surgery and prosthodontics, as well as computer-aided planning, are helping clinicians to both a more aggressive/oncological safer tumor extirpation and a more effective reconstruction.

The absence of vital neuromuscular as well as osseous and dental anatomical structures, the high variability of the healing progress of the resected areas, and the sensitivity and vulnerability of the marginal tissues of the defects are some of the parameters that need to be evaluated in order to choose the optimal treatment options.

The team approach of these patients and the close cooperation between all the involved disciplines, from the pre-surgical planning to the post-surgical rehabilitation, is imperative. In

addition, the contemporary development of techniques and materials offers us a variety of new and improved tools that widen the spectrum of our treatment options in these cases that often require from us to stretch the limits of our capabilities to the maximum. The continued progress of osseointegrated implant applications for the retention of prostheses, the use of free vascularized grafts during surgical procedures, and the application of digital technology during the planning, the surgical procedure and the prosthetic restoration phases are allowing us to not only establish an advanced level of communication between disciplines and towards the patient, but also significantly improve the therapeutic options we can develop for the best possible rehabilitation of our patients.

During this session we will present several cases of mainly malignant tumors of the oral cavity and the jaws that were treated by a team-approach: an oral/maxillofacial surgeon, a plastic surgeon and an oral/maxillofacial prosthodontist. All three specialists will discuss and analyze the beneficial effects but also the considerations of all the above mentioned procedures through the presentation of the clinical cases.

KNOWLEDGE ON THE SPOTLIGHT 5: Is zirconia the material of choice for implant-supported restorations?

Aspasia SARAFIANOU, Meni CHATZINIKOLAOU and Paris RAVANIS

Material selection may influence the clinical outcome of implant-supported prostheses in terms of success, survival rate, and technical and biological complications. The use of implant-supported metal ceramic restorations has been considered the gold standard for many years, exhibiting high prosthesis survival rate. Metal ceramic frameworks may be fabricated using CAD/CAM technology, providing excellent fit to the implant interface, while being more time- and cost-efficient than traditional cast fabrication. However, the manual veneering process remains time-consuming, while the fracture of the veneering ceramic ("chipping") is the main technical complication.

With the development of high-strength ceramic materials, zirconia emerged as a viable alternative for implant-supported restorations. This is mainly due to its high biocompatibility, low bacterial surface adhesion, high flexural strength, toughness,

faster processing time with CAD-CAM and favorable esthetic properties. Zirconia may be used as a monolithic restoration or as a porcelain-veneered framework. The most usual complication of veneered zirconia frameworks is chipping, due to the dissimilar zirconia- porcelain interface. In order to minimize these complications, monolithic zirconia has been introduced. However, the long-term outcome of these restorations remains unknown, due to the lack of sufficient clinical studies.

There is little evidence on the impact of the restoration material on the success of the implant treatment. Clinician and patient preferences play an important role in the choice of the restoration material. In any case, care should be taken considering the handling properties of the chosen material, the design of the supporting framework and the veneering material build-up.

KNOWLEDGE ON THE SPOTLIGHT 6: Digital tips & tricks for enhanced treatment predictability in fixed prosthodontics.

Alexandros MANOLAKIS (Sponsored by Miltiadis Vitsaropoulos - DMG)

Precise treatment planning is prerequisite for successful dental rehabilitation. During prosthodontic treatment dentists and dental technicians often face the challenge of implement the diagnostic wax-up into provisional restorations accurately. Even in the phase of manufacturing the final restorations, information regarding teeth position, midline, implant emergence profile, pontic shape or even the occlusal level cannot always be transferred precisely from the provisional restorations. This loss of detail leads to frustration and the need to perform multiple corrections or remake restorations.

Digital implant planning & digital wax-up facilitate a faster and more accurate evaluation of diagnostic parameters and treatment planning procedure. Utilising intraoral scanning and 3D printing enables the exact capture and transfer of information from one treatment step to the next by scanning established emergence profile and pontic shapes as well as performing virtual cross-mounting of different scans. This presentation will demonstrate how CAD/CAM technology can assist in providing quicker and more precise dental treatment in a predictable way.

KNOWLEDGE ON THE SPOTLIGHT 7: PRF Facial Aesthetics - Cleopatra Technique™

Cleopatra NACOPOULOS (Sponsored by John Tsaprazis S.A.)

In aesthetic medicine, different derma-filler materials are used for superficial and deep soft-tissue augmentation. Natural filling materials include collagen and hyaluronic acid. However, regenerative medicine is towards developing natural concepts without the use of external biomaterials. Micro-needling was introduced as a minimal invasive procedure that is based on natural wound healing concept, which leads to minimum trauma to the skin and induces its regeneration by the production of

autologous collagen and elastin. Furthermore, autologous concepts have gained a lot of attention in regenerative medicine recently. Among others Platelet-rich-Fibrin (PRF) is an autologous blood concentrate system that is produced by the centrifugation of the patient's own peripheral blood without any additional substances, such as anticoagulants. Liquid PRF consists of platelets, leukocytes, growth factors and stem cells. The development of the so-called low speed centrifugation

concept (LSCC) allowed the preparation of highly regenerative PRF liquid matrices. The release of cytokines associated to the niche of mesenchymal stem cells activates the regenerative process and angiogenesis for better oxygenation of the skin, in order to convert the undifferentiated cells in to mature cells. This procedure stimulates the fibroblasts to produce collagen and elastin fibers which are imbedded in the fibrin matrix. Moreover, the plasma contains proteins, minerals, vitamins and other nutritional substances, which lead to skin

rejuvenation. Cleopatra Technique™ is an innovative treatment, using PRF liquid which is then injected intradermally or applied superficially resulting to skin rejuvenation and augmentation. The procedure is totally autologous and safe and very well accepted by the patients as it is a life-style treatment giving them an improvement in skin texture, firmness, fine lines and wrinkles with long term results, up to two years.

KNOWLEDGE ON THE SPOTLIGHT 8: The Digital Implantology era. A paradigm shift or too much too soon?

George MICHELINAKIS, Dimitrios NIKOLIDAKIS and Dimitrios APOSTOLAKIS

In recent years, the rise of digital technologies such as Cone Beam CT, Surface Scanning, Rapid Prototyping and their implementation into everyday Dentistry, has led Prosthodontics into a new era. Particularly in the field of Implant Prosthodontics, the completion of a restoration following a full digital workflow needless of a physical stone or plastic cast is now feasible. The accessibility of CBCT and its reduced x-ray dose compared to MDCT, the availability of suitable software, the increase in IOS accuracy, the advent of new aesthetic monolithic materials and

their improved production methods have enabled dentists to realize an implant fixture placement and restoration workflow that promises shorter and fewer clinical and laboratory steps, increased aesthetics, greater patient acceptance and thus greater overall treatment efficiency. Certain shortcomings and limitations do exist however, which will also be outlined in the course of this lecture, thus assisting the dentist in reaching an informed decision regarding the indications of digital dental technologies in implant therapy.

Oral Presentations

OP01

Minimal-Invasive Laser-Assisted Procedures in Implant-Prosthetic Rehabilitation To Young Adult Edentulous Patients

Doriana Agop-Forna,¹ Lorenza Donea,² Norin Forna,² Claudiu Topoliceanu¹ and Norina Forna³

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Implant-prosthetic rehabilitation to young edentulous patients is challenging in relation to the complete recovery of both esthetic and masticatory functions. The rehabilitation of mucosal and alveolar bone support imposes the use of various surgical procedures that can be attended with fear or discomfort by patients. Laser-assisted techniques represent an alternative solution to classic surgical techniques. The use of minimal-invasive techniques based on surgical lasers has progressively spread in oral surgery due to the emergence of a wide range of wavelengths and possibilities of transmitting the laser beam to the affected tissues. The advantages of lasers use in prop-prosthetic and pro-implant procedures to

young adult edentulous patients are given by the selective and precise interaction with the oral mucosal tissues, with the reduction of trauma, bleeding, pain and postoperative complications compared to classical surgical techniques. Also reducing masticatory discomfort and accelerating healing time are major benefits for patients who encourage the expansion of surgical laser-assisted techniques in oral mucosal surgery.

Keywords: young adults, implant therapy, laser techniques, minimal invasive

Fatigue Life Estimation of Dental Implants Using Classical Fatigue Methods

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Objectives of Investigation: Dental implants are subjected to variable loads during their life span due to mastication or other reasons, as bruxism for example. Finite Element Analyses are widely used to see how these loads affect dental restorations. In several publications FEA are used to compare different implant designs. Nevertheless, these analyses do not predict fatigue behaviour of the implants. In this work, a different approach is adopted to estimate fatigue life using FEM and classical fatigue analysis methods.

Methods Used: FE analyses of a dental restoration composed by a BTI INTERNA® IIPSCA4513 implant, INPPTU44 abutment and an INTTUH prosthetic screw were performed to obtain the

loads in the screw, and the resulting stress state. In parallel, experimental fatigue tests of the same dental restoration were performed in an INSTRON E3000 Electroplus direct stress test bench according to ISO 14801.

Results: Combining both tools and using classical fatigue analysis method, the fatigue behaviour of the screw of the dental implant can be characterized.

Conclusions: The developed methodology can be useful for dental implant manufacturers and designers to evaluate the different design alternatives on the fatigue behaviour of dental implants in preliminary design stages.

Fatigue Life Estimation of Dental Implants Using Classical Fatigue Methods (Part II): Influence of Different Geometry Parameters and the Importance of the Screw Tightening Torque on Fatigue Life.

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Objectives of Investigation: In a previous work, a simple and intuitive methodology was presented to estimate fatigue life of a dental restoration when the prosthetic screw is the critical component. In this work, a further research is developed to verify if the theoretical tool is able to predict fatigue life in different scenarios: implant geometries, tightening torques, and so on. Furthermore, the effect of these variables is quantified.

Methods Used: A previously developed methodology based on Finite Element Analyses (FEA) and classical fatigue formulation was used to estimate fatigue behaviour of different dental restorations. FE analyses were performed to obtain the contact forces in the screw head, and then, nominal stress of the critical section and fatigue life was analytically estimated. Thus, the influence of implant body diameter, platform diameter and connexion type was studied. Same procedure was carried out to analyse the effect of different screw tightening torques (15, 25 and 35Ncm). BTI INTERNA®IIPSCA4513, IIPSCA5513, IIPACA5513 and EXTERNA® IRPS4513 dental implants were

used for comparison purposes in this work. Finally, the predicted fatigue lives obtained from the methodology were validated through 35 experimental test in an INSTRON E3000 Electropuls.

Results: It was proved that the theoretical tool provided very accurate results. Wider implants and larger platform diameters showed better fatigue life results. Internal and external butt-joint connections showed similar fatigue behaviour. Finally, an insufficient tightening torque was related to a poor fatigue performance.

Conclusions: Within bone space limitation, wider implants and larger platform diameters are desirable from a mechanical point of view. The applied tightening torque to the prosthetic screw is crucial not only minimizing screw loosening and IAC microgaps, but also enhancing restoration fatigue behaviour.

Implant Abutments in the Anterior Region: A Systematic Review of Clinical Outcomes.

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Objectives of Investigation: To systematically review the survival rate, biological, mechanical and esthetic outcomes of different type of implant abutments used in the anterior region.

Methods Used: An electronic search was conducted by 2 independent reviewers by using the PubMed/MedLine, Scopus and Embase databases for studies published up to April 2020, following the focused PICO question. Application of inclusion/exclusion criteria lead to the final list of articles which was reviewed in depth.

Results: 33 relevant articles were identified. No significant differences were detected between Titanium (Ti), Zirconia (Zr), and Gold (Au) abutment on survival rate, even though Ti had the highest cumulative ranking of survival rate. Additionally, no

statistically significant differences were noted between Zr and Ti abutments on soft peri-implant tissues. Alumina (Al) abutments had the lowest marginal bone loss and Zr abutments had the least discoloration of soft peri-implant tissues. The most common mechanical complication was abutment screw loosening.

Conclusions: Ti abutment had the highest survival rate but comparable with other abutment material. A tendency for lesser gingival discoloration is reported with Zr abutments. Overall, no obvious advantage was noted of Ti over Zr abutment.

Keywords: dental abutment, anterior implant, ceramic abutment, metal abutment, complications

Implant-Prosthetic Rehabilitation in Various Stages of Alveolar Resorption

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Patients with severe alveolar resorption are a challenge for practitioners in the implant-prosthetic field. The treatment plan for patients with atrophic alveolar bone include the following stages: CBCT exam; digital evaluation and planning of implant system selection, pro-implant surgical procedures and implant surgical stage; digital planning of implant placement guide and its fabrication; sinus lifting and alveolar augmentation in maxillary posterior area; immediate implantation; provisional restoration; early or delayed loading with implant-supported definitive fixed bridge or overdenture. Implant-prosthetic rehabilitation ensures recovery of esthetics, phonetics and function and confidence of patient as fast as possible. The rehabilitation of alveolar bone support is performed by various grafting materials (autogenous bone, alloplasts, xenograft) and augmentation techniques as follows: alveolar grafting,

guided bone regeneration, vertical augmentation, horizontal augmentation, screw-guided bone regeneration, distraction osteogenesis. Combination of various techniques (distraction osteogenesis and vestibular bone augmentation) can also be performed for optimal results. Pro-implant procedures for the rehabilitation of alveolar bone with medium or severe resorption, immediate implantation and early loading are therapeutic solutions of choice for the patient candidate to implant-prosthetic therapy.

Keywords: alveolar resorption, implant, rehabilitation, grafts, augmentation techniques

Short-Implants with a Cantilever Restoration Show an Increase Radiodensity over Time in a 5-Year Randomized-Controlled Clinical-Trial.

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Objectives of Investigation: to analyze changes in radiographic density of short implants with and without cantilevers after 5 years in function.

Methods Used: thirty-six patients with two missing posterior teeth participated in this randomized controlled clinical trial. All patients were randomly allocated to receive either two 6mm one-piece implants with single unit restorations (group TWO) or one 6mm one-piece implant with a cantilever restoration (group ONE-C). Patients were re-examined at 6 months, 1 year, 3 and 5 years. A radiographic analysis was performed, through an arbitrary grey scale value (GSV) of the peri-implant bone, evaluating the changes in radiodensity in between groups and over time. Descriptive statistics were applied, and differences were assessed with nonparametric methods (Wilcoxon-Mann-Whitney test).

Results: at 5 years, 26 patients remained in the study (15 in group ONE-C; 11 in group TWO). The survival rate amounted

to 84.2% in ONE-C and to 80.4% in TWO (intergroup $p=0.894$). No restoration failures were observed for the implants re-examined at 5 years. The radiographic evaluation revealed higher GSV of group ONE-C (85.00) than group TWO (74.33) at 5-years follow-up (intergroup $p=0.07$). When changes in GSV were compared over time, group ONE-C showed a greater increase in radiodensity (13.50) than group TWO (4.16) (intra-group $p<0.0001$). When arch location was considered, implants in the mandible showed an increase in GSV and implants in the maxilla a slight decrease over time.

Conclusions: the radiodensity around short dental implants demonstrated to be higher and increase over time with cantilever restorations at 5 years, especially for those implants placed in the mandible.

Keywords: short implants, cantilever, radiographic density, implant supported crowns

Dimensional Changes of Yttria-Stabilized Zirconia under Different Preparation Designs and Sintering Protocols

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Objective of investigation: the purpose of this project was to evaluate the linear and volumetric dimensional changes that occur throughout the fabrication process of monolithic 4.5-6% yttria-stabilized zirconia copings under the influence of different preparation designs and two sintering protocols.

Methods Used: a titanium master die was fabricated using Atlantis core file. Six copings were designed virtually according to different finish line offsets and coping thicknesses, with four equidistant occlusal posts for linear measurements. Zirconia copings were milled using IPS e.max ZirCAD LT zirconia blanks. The experimental groups according to the coping designs were the following: G1: 0.5mm finish line offset, 0.5mm thickness; G2: 0.5mm finish line offset, 1.0mm thickness; G3: 0.5mm finish line offset, 1.5mm thickness; G4: 1.2mm finish line offset, 0.5mm thickness; G5: 1.2mm finish line offset, 1.0mm thickness; G6: 1.2mm finish line offset, 1.5mm thickness. Six samples per group were sintered by standard sintering (SS) and the

other six by fast sintering (FS). Linear and volumetric measurements were taken at the three fabrication stages (designing, milling, and sintering) by using an intraoral scanner and imported as the .stl file to Meshmixer software for analysis. Statistical analysis was performed by a linear mixed effect model via statistical software R (R Core team, 2018).

Results: there was a significant interaction between the coping design, stage of fabrication and sintering protocol on the linear (F value =4.451, p-value <0.001) and volumetric (F value= 2.716; p <0.001) dimensional changes. Standard sintering G1 showed the smallest linear and dimensional changes among the groups compared to the designing stage.

Conclusions: The linear and volumetric dimensional changes did not differ significantly between SS and FS protocols, and the preparation designs had more influence on the dimensional changes compared to sintering protocols.

Evaluating of the Shear Bond Strength of Core Build-up Composites to Dentin

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Objectives of Investigation: The purpose of the present study was to compare shear bond strength (SBS) of different core build-up composites to dentin.

Methods Used: Thirty-six extracted, caries-free human molars' occlusal surfaces were reduced with a double-sided diamond disc until clean and flat dentin surfaces were exposed. A round area of 3 mm in diameter were marked on the dentinal surfaces and treated for adhesive systems. Five dual-curing core build-up composites, Core X Flow (Dentsply), Oxford Zircore Nano (Oxford Scientific), Oxford Flo Core (Oxford Scientific), SDR Plus (Dentsply Sirona) and Clearfil DC Core Plus (Kuraray), and one bulk-fill composite, Filtek Bulk-Fill Restorative (3M ESPE) as a control group, were prepared in a cylindrical shape on the treated dentinal areas. All samples were tested for SBS in a universal testing machine (Shimadzu AGS-X Universal).

Results: The SBSs of the study groups were not statistically different from the control group ($p > 0,05$) and no significant difference was observed between the SBSs values of any core build-up composite brands. The SBS values were the highest with Filtek Bulk-Fill Restorative (mean 5.35 MPa), followed by Core X Flow (4.45 MPa), Oxford Zircore Nano (4.25 Mpa), SDR Plus (4.22 MPa), Clearfil DC Core Plus (3.16 MPa), and Oxford Flo Core (2.90 MPa).

Conclusions: Although the dual-curing core build-up composites used in the present study have different compositions, shear bond strength to dentin was not different.

Keywords: composite resins; shear strength; dentin

Impact of Simulated Gastric Acid on Color Stability of Different Types of Dental Ceramics

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Objectives: Different dental ceramics are used to restore eroded dentition. However, the influence of gastric acid on their color is still unclear. The purpose of this *in vitro* study was to evaluate the impact of simulated gastric acidity on color stability of different types of dental ceramics.

Methods: Fifty specimens were constructed according to type of the material into five groups ($n=10$), as follows: partially stabilized zirconia (Prettau), fully stabilized zirconia (Prettau Anterior), lithium disilicate ceramics (IPS. Emax), zirconia-containing lithium silicate ceramics (Vita Suprinity) and hybrid ceramics (Vita Enamic). All specimens were cut with a low-speed diamond saw (Isomet) into a rectangular shape with the following dimension: 12mm width x 14mm length x 1 mm thickness. Each specimen was immersed in 5 ml of the simulated gastric acid of pH 1.2 for 96 h in 37°C incubator. Color stability was evaluated by reflective spectrophotometer. Each specimen was measured three times before and after exposure to synthetic gastric acid. One-way ANOVA was used to compare mean difference between groups.

Results: There was highly significant difference ($P=0.000$) between all groups. Prettau group showed the least amount of color change (2.97 ± 1.27), while vita enamic group showed the highest color change (5.97 ± 3.29).

Conclusions: The gastric acid changed the color of all types of dental ceramics. Except for Partially stabilized zirconia and lithium disilicate ceramics, the color change of all other ceramics was noticeable to the human eye and then was clinically unacceptable.

Impression Coping Splinting Material and Time Effect On Accuracy

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Purpose: This study aimed to evaluate the positional discrepancies of impression copings splinted with different methods.

Materials and methods: A stainless steel bar was fabricated, into which ten implant analogues were placed. A total of eight groups were formed, with ten pairs of splinted impression copings in each (n=80 specimens): splinted with type I impression plaster (Snow White Plaster No. 2, Kerr), (PLA); splinted with auto-polymerising acrylic resin (Pattern Resin LS, GC Europe), cut and rejoin technique, (PTR); splinted with light-cured acrylic resin (Individuo Lux, Voco), cut and rejoin technique, (ILC); splinted with light-cured acrylic resin (Individuo Lux, Voco), no cut, (ILN); splinted with VPS bite registration material (Blu-Mousse Classic, Parkell), (SBR); splinted with bis-acryl bite registration material (Luxabite, DMG), (LXB); splinted with bis-acryl composite resin (Protemp, 3M ESPE), (PTP); splinted with 3D printed splint (DentaGUIDE, Asiga), (3DP). Scanning protocol included three scans: first scan - unsplinted impression copings (control group), second scan - splinted impression copings, 2 hours after splinting, third scan - splinted impression copings, 24 hours after splinting. The CAD files retrieved from

each group were analysed for positional distortions of impression copings.

Results: After 2 hours of polymerisation, the lowest distance deviation was recorded in PTR (15,4±6,15µm), vertical deviation - in ILC (19,2±27,37µm), angle deviation - in ILC (0,08±0,1°), rotation - in LXB (0,2±0,24°) groups. Statistically significant deviations, comparing results after 2 hours and 24 hours of polymerisation, in distance deviation were recorded in groups PLA(-5,6µm), PTR(5,5µm), ILN(19,2µm), PTP(23,8µm). LXB group had a statistically significant angle deviation (0,03°), comparing 2 hours and 24 hours of polymerisation time. Additionally, PTP had statistically significant rotation (-0,21°), comparing 2 hours and 24 hours of polymerisation time.

Conclusion: There are positional distortions of impression copings when splinting materials are used. ILC and 3DP groups showed the least dimensional deviations after polymerisation.

Keywords: Dental Implants, Dental Impression Materials, Dimensional Measurement Accuracy, Splints, 3D Printing.

Effect of Chemical Aging on Mechanical Properties of Bilayered Zirconia Ceramics

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Objective of the investigation was to evaluate the effect of chemical aging on biaxial flexural strength and micro-hardness of bilayered zirconia discs with two different surface finishing and two different veneering techniques.

Methods: Eighty bilayered veneer/zirconia discs were divided into 2 main groups according to the veneering technique used (E.max Ceram veneer + E.max ZirCad core and E.max Press veneer + E.max ZirCad core, Ivoclar Vivadent). Each main group was then divided into 2 groups with different surface finishing methods (glaze/polishing) which were divided into 2 subgroups according to chemical aging application or no chemical aging application. Ultrasonic testing was performed before and after chemical aging. All samples were tested for biaxial flexural strength. Stresses generated at the core and the veneer, at the top and the bottom surfaces, and the interface of bilayered discs were calculated using Huesh's solutions. The fractured samples were also examined for vickers microhardness. The data of flexural strength and vickers microhardness were statistically analyzed

with ANOVA and Tukey's *post hoc* multiple comparison tests ($p \leq 0.05$).

Results: No significant difference was seen between the corroded and non-corroded samples' biaxial flexural strengths ($p > 0.05$). IPS e.maxZirPress veneer ceramics recorded significantly higher flexural strengths than IPS e.max Ceram applied on IPS e.max ZirCad core material ($p < 0.05$). Vickers microhardness strengths were increased in glazed groups after chemical corrosion ($p < 0.05$). According to ultrasonic test results, there were no delamination seen between core and veneer after chemical corrosion in any groups, but ultrasonic velocities decreased after chemical corrosion from 8285 m/sec to 7985 m/sec in all groups.

Conclusion: Although microcracks in the veneering ceramic increased during chemical fatigue, no negative influence was seen mechanically in any of the groups due to the support of zirconia substructure.

Keywords: zirconia, fatigue, bilayer, flexural strength

Rehabilitation of Severe Hypodontia with Aesthetic and Occlusal Challenges

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Introduction: Dental implants are commonly used to rehabilitate hypodontia patients. This clinical case demonstrated the management of severe hypodontia with fixed implant prostheses.

Case Description: A medically fit 33-year-old male displayed severe hypodontia of the UR4, UR2, UL2, UL3, UL4, UL5, LL5, LR4, LR5. The primary ULD, ULE, LRD, LRE, and LLD were retained. The UR5 had a short root and grade II mobility. An existing resin bonded bridge (RBB) replacing the UR2, UL2 was previously debonded seven times. Radiographic analysis revealed a horizontal mid-root fracture on the UL1 due to past trauma. The treatment involved the RBB removal as well as extraction of the UR5 and primary teeth. Immediate upper and lower interim partial dentures were provided. Following endodontic and periodontic assessments and patient's wishes, the vital UL1 was retained. Prosthetically-driven implant planning included diagnostic work-ups, which were converted to radiographic and surgical stents. Type 2 implant placements were adopted with a one-stage approach in the mandible and two-stage procedures

with bone grafting in the maxilla. Conventional loading of the implants was undertaken with group function occlusal scheme on the left quadrants and canine guidance on the right. Composite-resin restoration was used to restore a midline diastema, as a result of tooth migration post RBB removal.

Discussion: Dental implants could yield successful results and improved oral-health related quality of life in hypodontia patients. Timed extraction of deciduous teeth could preserve alveolar bone and reduce the need for extensive bone grafting, hence reducing the surgical complexity. Advantages of diastema closure with composite-resin include aesthetics, conservative management and splinting effect between the UR1 and UL1. The dynamic occlusion was designed to prolong the survival of the UL1, which was an aesthetically strategic tooth; considering that no robust evidence was available to support an occlusal scheme to prolong implant longevity.

Keywords: Hypodontia, Fixed Dental Prostheses, Dental Implants, Occlusal Schemes.

Prosthetic Rehabilitation of a Head And Neck Cancer Patient With Extreme Trismus: A Tight Fit.

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(Eastman Dental Hospital, University College London Hospitals NHS Trust)

Introduction: Head and neck cancer is the fifth most common cancer worldwide, and the treatment journey can have devastating impact on the function and psychological wellbeing of patients. Successful oral rehabilitation has shown to have significant influence on the quality of life post-oncology treatment. However, there are number of patient and clinical factors that present prosthodontic challenges in restoring function and aesthetics.

Case Description: The case presents a 59 year old woman with a previous history of adenoid cystic carcinoma, that was treated with chemo-radiotherapy and partial maxillectomy. She was referred for replacement of her failing maxillary obturator worn for the last 5 years, which she now finds very difficult to insert due to her limited opening, from radiotherapy-related trismus. She also informed that the obturator has become increasingly loose and that she now experiences escape of oral-nasal fluids. The case was managed through careful design and

planning of the denture stages, to facilitate the impression of the maxillopharyngeal defect and palate and jaw registration, including a designed two-part tray and modified occlusal rim plate. A final cobalt chrome maxillary obturator with hollow bulb was fabricated, with a specific insertion technique to allow for successful wear, comfort and function.

Discussion: Oral rehabilitation of cases with large oranasal defects can present with prosthodontic challenges, which in this case was exacerbated by the patient's extreme trismus. The classic denture principles were applied, with adaptation of the treatment stages and denture design to the patient's clinical presentation for successful management. This case was a gentle reminder that each head and neck cancer case is unique and as specialists we continue to learn and innovate, as we play a crucial role in the multidisciplinary management and long-term rehabilitation of these patients.

Monolithic zirconia fixed dental prosthesis in the posterior region: a multicentre randomized clinical trial

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Objectives of Investigation: To test whether or not the use of monolithic zirconia fixed dental prostheses (FDPs) performs similar to veneered zirconia FDPs in the posterior region.

Methods Used: Sixty-two patients with single tooth gaps in the posterior region of the mandible or maxilla were recruited. Patients were randomly allocated to three groups: 1) monolithic zirconia FDP (n=21); 2) partially veneered zirconia FDP (n=21); 3) conventionally veneered zirconia FDP (n=20). Clinical parameters including probing pocket depth (PD), bleeding on probing (BOP), plaque index (PI) as well as patient-reported outcome measures (PROMs) were evaluated at baseline and one-year follow-up. In addition, technical complications were evaluated by means of standardized USPHS criteria at one-year follow-up. The comparisons of the group metric variables were performed either with Kruskal-Wallis test or ANOVA. The proportions of the categorical parameters were compared with chi-squared test.

Results: A total of 62 patients were available for re-examination. At one-year follow-up, PD amounted 2.0 ± 0.4 in monolithic zirconia, 2.2 ± 0.4 in partially veneered zirconia and 2.0 ± 0.5 in conventionally veneered zirconia, with no significant differences between the groups ($p=0.22$). Similarly, BOP and PI did not differ between the groups ($p>0.05$). PROMS revealed a high satisfaction with FDPs at one year, amounting to 85.7% with monolithic zirconia, 94.7% with partially veneered zirconia and 90.9% with conventionally veneered zirconia, without significant differences between the groups ($p=0.62$). Technical complication rates, namely chipping, amounted to 9.5% in monolithic zirconia, 10.5% in partially veneered zirconia and 22.7% in conventionally veneered zirconia, with no statistical differences between the treatment groups ($p=0.39$).

Conclusions: At one-year follow up, monolithic zirconia FDP yield similar outcomes to veneered zirconia FDPs in the posterior region.

Challenging the Marginal Integrity of Non-Invasive Laminate Veneers versus Invasive Laminate Veneers. A Comparative *In-vitro* Study.

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Porcelain laminate veneers are part of the prosthodontic field and one of the best ways to reach esthetic excellence with minimum invasive procedures. Nowadays, porcelain laminate veneers placed directly on intact tooth surface gain interest on the clinical field. This is because these restorations need no tooth preparation and therefore no temporization, no anesthesia during the procedure and effortless impression technique since it is supra-gingivally. By utilizing non-invasive veneers, we can close tooth diastemas, reshape tooth contour and thus reach patients' esthetic expectations with minimum loss of tooth structure.

This study challenges the marginal integrity of non-invasive laminate veneers against the traditional invasive veneers. For this task two porcelain materials were used, feldspathic and lithium disilicate. Twenty (n=20) non-invasive veneers were fabricated from each material forming Group A (feldspathic veneers) and Group B (lithium disilicate veneers). Each veneer

group was cemented on twenty extracted frontal intact teeth with no preparation performed. Accordingly, two groups of invasive veneers were fabricated and cemented on extracted frontal teeth after tooth preparation was performed, forming the control groups D1 and D2. All the veneers were cemented with the same cement and were tested under the same aging procedures of thermocycling and brushing.

The results of this study will compare the marginal integrity of each material during the aging period of four (4) and twelve (12) months and the integrity of the veneers as a whole structure both in the invasive and non-invasive prosthodontic approaches.

Lastly, the study will conclude if the non-invasive veneers have the resilience needed to gain their place in the prosthodontic map and thus be a valuable choice for clinicians and a rewarding treatment for patients.

Prosthodontic Management of Patients with Sleep Apnea and Tooth Wear.

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Introduction: Obstructive sleep apnea (OSA) is a common and serious medical disorder that can significantly impair a patient's quality of life and increase morbidity due to medical complications. Typical signs and symptoms of OSA are snoring, tiredness and daytime sleepiness but often patients may not present these clinical characteristics, which makes the diagnosis more difficult. On the other hand, there is growing evidence that many OSA patients present with symptoms of sleep-bruxism and signs of tooth wear. Dentists play an important role in the management of these patients, since they can contribute to the early diagnosis of OSA as well as the treatment through the fabrication of mandibular advancement devices (MADs).

Case description: In this case series we will present the rehabilitation of excessively worn dentition and the management of the OSA, during the prosthodontic treatment and after the end of it, in two male middle-aged patients. Both presented

complaining about functional and esthetic problems due to their worn teeth. None of them presented typical symptoms of OSA like sleepiness or tiredness and none of them was obese. Nevertheless, they were referred for a sleep study. One had mild to moderate OSA and the other had severe OSA. The severe OSA patient was referred to a sleep physician and started using a CPAP device. In the mild to moderate OSA patient a provisional MAD was fabricated and was used throughout the provisional phase of his dental reconstruction. Full-mouth rehabilitation was performed in both cases for the restoration of their worn dentition and in both patients MADs were fabricated for the management of OSA as well as the protection of the restorations.

Discussion: Tooth wear may be a sign of undiagnosed OSA. Full-mouth rehabilitation in combination with MADs is the appropriate approach for the effective management of both of these diseases.

Up to 44 Months Evaluation of Nanoceramic CAD/CAM-Restorations Placed by Undergraduate Students.

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Objectives of Investigation: To evaluate mid-term clinical outcomes of nano-ceramic intra-coronal CAD/CAM restorations in a prospective cohort study; to assess patient and operator satisfaction immediately after placement of the restoration.

Methods Used: Fifty-eight nanoceramic restorations (Lava Ultimate, 3M) were placed by supervised undergraduate students of which 43 restorations were followed over a mean period of 28-months (range 14–44 months) and evaluated using USPHS-criteria. Patient and operator satisfaction were assessed using a Visual Analogue Scale (VAS) after restoration placement (3 and 7 appraising positions respectively). Statistical analysis was performed using the Kruskal-Wallis, Wilcoxon and Spearman tests.

Results: Eleven patients with 12 restorations did not respond to follow-up and were considered dropouts, in which 37 patients and 46 restorations were included for further study. Three teeth were extracted, 2 due to extensive drug-induced secondary caries in the same patient after one and three years of service. One tooth due to large periapical periodontitis after 44 months of service. Overall survival rate was 93,5% and success rate

was 89,1%. USPHS categorical scores remained unchanged for retention, secondary caries and anatomic form. Differences between baseline and endpoint scores were significant for marginal discoloration ($p < 0,05$) and adaptation ($p < 0,001$) which was correlated with inlays/onlays. Color match ($p < 0,05$) and surface texture ($p < 0,001$) differed significantly, affecting all restoration types. VAS-scores for patient and operator satisfaction showed a significant rank correlation ($p < 0,01$) and pairwise comparison showed significant differences for mean overall patient and operator VAS-scores ($p < 0,001$). 95,6% of operators preferred IOS over conventional impression taking.

Conclusions: CAD/CAM Lava Ultimate may be considered a suitable material for overlays and endocrown restorations when combined with IDS, sandblasting and MDP-containing adhesive systems. Marginal disintegration may present in inlays and onlays over time. Patient and operator satisfaction with IOS procedures and restorations is high.

Keywords: Computer-Aided Design; Dental Restorations, Permanent; Undergraduate; Students

Full Arch Immediate Loading Using Surgically Driven Prosthetics with the MSoft and MGuide. A case Report

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Introduction: Immediate implant placement and loading in edentulous mandible is a reliable surgical and prosthetic protocol. It is well documented with predictable workflows, high implant survival rates and rather low complications. Computer Guided Surgery with the use of templates offers the clinician accuracy and predictability during the drilling and implant placement procedures to a greater extent than free hand.

Case Description: A 63 years old female patient presented with a terminal dentition in the mandible supporting a full arch metal-ceramic fixed-dental-prosthesis (FDP). Intraoral scanings providing STL files and a CBCT were performed. A special software (MSoft) was used for the fabrication of three templates. The first one was designed over the existing dentition; it was used for pin placement. The second one was designed for guided implant placement. This template was used after teeth extraction. The third one was carrying the PMMA provisional shell in the exact position (maximum intercuspation) guided by the pins. Because

of the last template, there was no need for occlusal adjustments after the provisional PMMA shell was inserted.

Discussion: Both full arch immediate implant placement and immediate loading procedures are complicated and time consuming. Traditionally, after implant placement, an impression is taken and the provisional prosthesis is delivered within the next few days. This means an extra appointment, further time and discomfort for the patient. However, the suggested digital workflow can accelerate the process. The presurgical planning with the MSoft and the opened MGuide facilitates an easier and faster workflow both for clinicians and patients. The greatest advantage of this procedure is the accuracy in terms of occlusal adjustments due to the accuracy of the predesigned templates (Surgically Driven Prosthetics).

Keywords: Immediate placement, immediate loading, templates, Guided surgery, MGuide, MSoft

Immediate Implant Placement with Partial Root Retention in the Aesthetic Zone: A Case Report

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Introduction: Clinical studies have suggested that after tooth extraction, tissue changes may be avoided through retaining roots of hopeless teeth.

Case Description: Patient clinically presented a crown fracture of left lateral incisor (2.2), making it impossible to restore. Clinical evaluation showed inflammation around the gum and tooth. Cone-beam computed tomography (CBCT) revealed apical radiolucency and extruded filling material. Also demonstrated thin buccal plate and adequate residual bone apico-palatal to place an immediate implant. Type 1 socket according to the Kan classification (2011). We decided to use the socket shield technique with partial extraction of the root and immediate implant placement with milled provisional crown. The tooth was decoronated with a diamond bur, the shield was segmented and prepared by osteotomy drills. Atraumatic extraction of the

palatal root fragment was done with perioste and forceps. Implant bed preparation at the palatal wall of the socket was performed and a root form implant was placed. After 4 months intraoral scanning was made with Scanbody. CAD/CAM: the sub gingival contour was extracted from the CBCT to design the final crown.

Discussion: Retaining the buccal aspect of the root during implant placement does not appear to interfere with osseointegration and may be beneficial in preserving the buccal bone plate.

Keywords: Immediate Implant, Socket Shield, Aesthetic Zone

Implants Placement with Ridge Split, Socket Shield and Root Submergence Techniques in the Anterior Maxilla

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Introduction: The aesthetic zone is a demanding management because of patients' expectations and the tissue changes after extraction and implant placement.

The main purpose of the treatment is preservation and regeneration of the surrounding tissues.

Case Description: Patient clinically presented crowns fractures of left lateral incisor (2.2), left central incisor (2.1), right lateral incisor (1.2) and absence of right central incisor (1.1). Clinical evaluation showed inflammation around the gums and teeth. Cone-beam computed tomography (CBCT) revealed type 4-sockets according to the Kan classification (2011). We decided to use the submergence root technique in lateral incisors, ridge split technique in right central incisor and socket shield technique with immediate implant placement. The ridge

split was made with piezoelectric device and versah burs. The left central incisor was segmented and prepared by osteotomy drills. Two implants were placed at central incisors sites. Lateral incisors were prepared for root submergence technique.

After 4-months digital impression was made with scanbodies. The final prosthesis was screw-retained crowns in central incisors, with cantilever crowns in lateral incisors.

Discussion: The treatment of the aesthetic zone is a challenge, if the tissues are preserved and regenerated adequately, the prognosis is favorable. Cantilever crowns are a convenient option.

Keywords: Ridge Split, Immediate Implant, Socket Shield, Aesthetic Zone, Cantilever

Survival rates, patient-satisfaction and prosthetic-complications of the Straumann-ProArch design: An up to 1.5-year prospective study.

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Purpose: To determine the survival rates, patient satisfaction, incidence and distribution of prosthetic complications affecting implant fixed complete dental prostheses (IFCDPs) admodum Straumann-ProArch design after an observation period of approximately 1.5 years.

Materials and Methods: Eligible participants were recruited according to specific inclusion and exclusion criteria. Two calibrated periodontists performed all implant surgeries, and four prosthodontic residents performed all prosthetic procedures under faculty supervision. Definitive IFCDPs were fabricated according to the Straumann-ProArch protocol and consisted of milled titanium bars veneered with acrylic-resin and denture teeth. Prosthodontic complications, divided into major and minor, were monitored. Parameters such as gender, jaw location, bruxism and occlusal scheme were evaluated for potential association with reported complications. A questionnaire, administered at follow-up visits was used to assess patient satisfaction. Poisson regression as well as repeated measures of ANOVA were used for the statistical analysis.

Results: Twenty-eight subjects were enrolled (14-males and 14-females). The enrolled subjects were followed-up for 3, 6 and 12 months. Most frequent observed minor complication was the loss of access hole material. Most frequent observed major complication was chipping of acrylic teeth, followed by wear of prosthetic material. Gender, jaw location, bruxism and occlusal scheme were not significant predictors for total minor complications. On the other hand, gender and bruxism were significant predictors regarding total major complications as well as gender and occlusal scheme were significant predictors for major chipping. Patient's satisfaction significantly increased from the baseline appointment while no statistically significant difference was observed between the follow-up visits.

Conclusions: IFCDPs demonstrated high prosthetic survival rates and overall high patient satisfaction. Major prosthetic complications were more common than minor prosthetic complications.

Early implant placement with or without alveolar ridge preservation renders similar esthetic, clinical and patient-reported outcome measures: one-year results of a randomized clinical trial.

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Objectives of Investigation: To test whether early implant placement with alveolar ridge preservation (ARP) results in different esthetic, clinical and patient-reported outcome measures (PROMs) compared to early implant placement without ARP.

Methods Used: Seventy-five patient requiring single tooth extraction in the anterior maxilla were recruited. Following tooth extraction, the patients were randomly allocated to three groups: 1) ARP using demineralized bovine bone mineral containing 10% collagen (DBBM-C) covered by a collagen matrix (CM) (n=25), 2) ARP using DBBM-C covered with a palatal graft (PG) (n=25), 3) spontaneous healing (control) (n=25). Eight weeks after tooth extraction early implant placement was performed in all patients. Esthetic, clinical and PROMs were evaluated one-year post-loading.

Results: A total of 70 patients were available for re-examination at one-year post-loading. The mean mid-facial mucosal margin change amounted 0.1±0.6 mm in group CM, -0.2±0.8

mm group PG and -0.1±0.3 mm for control, without significant differences between the groups. PES scores amounted to 7.0±1.4 in group CM, 7.1±1.5 in group PG and 7.3±1.7 in control group with no significant differences between the groups. Plaque, bleeding on probing, and probing depth did not differ between treatment groups. PROMs revealed no significant differences between the groups.

Conclusions: Early implant placement with ARP using either a collagen matrix or a palatal graft rendered similar esthetic, clinical, and PROMs compared to early implant placement without ARP. When a failing tooth can be replaced with an implant within 2 months after tooth extraction, the added value of ARP might be clinically negligible

Keywords: Clinical trial, Early implant placement, Alveolar ridge preservation, patient centered outcomes

Influence of the Cement Type on its Removal Quality from the Zirconium Oxide Implant-supported Restorations

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Objectives: To assess cement excess removal after cementation of implant-supported cement-retained restorations using different cements

Materials and Methods: A model with soft tissue imitation, 20 individual zirconium oxide abutments and 20 zirconium oxide crowns were fabricated. Half of the restorations were cemented using resin cement (RX) and other half - with resin modified glass-ionomer cement (GC). After cement cleaning each crown-abutment unit was removed from the model, photographed and analyzed from 4 surfaces, resulting in a final sample size of 80 measurements. Radiographic examination and computerized planimetric method in Adobe Photoshop were used to determine amount of the cement left and evaluate ratio between area of cement residue and all crown-abutment surface. Significance was set to 0.05.

Results: GC resulted in 7.4% more cement residue on all surfaces (p<0.05) than RX. The p-value on three (except mesial) surfaces was <0.05, meaning that the data are statistically significantly different between groups and surfaces. Absolute removal of the cement was impossible in all cases (100%), 95% of the cases cement remnants could not be detected radiographically.

Conclusions: More undetected cement remains when using resin modified glass-ionomer cement. It was impossible to remove excess of both types of cements completely. Most of the cement remains on the distal surface. Radiographic examination could not be considered as a reliable method to identify cement excess.

Keywords: cement excess, cement-retention, zirconium oxide, implant abutments, undetected cement

Simplifying Treatment Planning and Construction of Tooth-Supported Prosthetic Restorations by Digital Technology: A Case Series

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Introduction: Nowadays, digital technology has become an integral part of the workflow for the construction of prosthetic restorations. Digitally driven prosthodontics offers tools and possibilities in clinical procedures, including treatment planning, abutment teeth preparation, transitional restorations, digital impression and bite registration procedures, computer-aided design (CAD), followed by computer-aided manufacturing (CAM)-based procedures. Furthermore, various digital/conventional steps can be sequenced depending on the selected material and the clinical case's functional and esthetic requirements. This presentation aims to highlight- through a case series - the tools and possibilities offered by digital technology, aiming at simplifying and improving conventional clinical procedures in prosthodontics.

Cases Description: Four clinical cases, including a case with severely compromised occlusal scheme requiring full-mouth rehabilitation and changes in the vertical dimension, a case of substantially compromised occlusal scheme requiring partial rehabilitation and re-establishment of the anterior guidance, a case of aesthetic rehabilitation in the anterior zone with limited inter-occlusal space and a case of smile design

and rehabilitation with ceramic veneers will be presented, highlighting the assets of digital technology in various steps.

Discussion: Digital design and manufacturing of dental prostheses has reached clinically acceptable limits. Important tools and possibilities include digital aesthetic and functional diagnostic analysis and transfer of the diagnostic data from the initial situation through the transitional to the final restorations. In terms of clinical procedures, preparation of abutment teeth is facilitated by digital design for minimally invasive tooth preparation and identification of the need for further treatments (intentional endodontic treatment, crown lengthening, etc.). In addition, digital impression using intraoral scanners offers the possibility of a fully digital workflow; its accuracy for long-span restorations still needing, however, further investigation. Lastly, in highly aesthetic cases, combining digital design with conventional porcelain layering to achieve ideal customization is highly recommended, highlighting the current limitations of new technologies.

Keywords: digital technology, tooth-supported fixed partial dentures, CAD/CAM, treatment planning, clinical and laboratory workflow

In Vitro Assessment of Digital Implant Impressions Accuracy Using Artificial Landmarks

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Objectives of investigation: The aim of this *in vitro* study was to compare the trueness and precision of digital implant impressions (DII) scanned with five different IOS (intraoral scanner) when scan bodies and artificial landmarks were attached to the models.

Methods used: Two types of maxilla models were printed with 3D printer. In the partially edentulous model Straumann BL implants were inserted in the first premolar and the second molar area. In the fully edentulous model four implants were inserted at second incisor and first molar areas. The models were scanned with coordinate measuring machine to form the reference scans. DII was taken with Primescan, Trios3, Trios4,

CS3600, Medit i500 IOS ten times each (n=10). When the tablets of hardened glass-ionomer cement were attached at edentulous areas as artificial landmarks, the models were scanned with five IOS again. The trueness and precision of distance, angle, and vertical shift parameters between scan bodies were compared in exported scanning data.

Results: For partially edentulous model PS IOS showed statistically significantly the best trueness in distance ($-25.13 \pm 20.77 \mu\text{m}$ without landmark and $-17.45 \pm 16.1 \mu\text{m}$ with landmark), angle ($0.22 \pm 0.04^\circ$ without landmark and $0.18 \pm 0.04^\circ$ with) and vertical shift ($40.26 \pm 12.08 \mu\text{m}$ without landmark and $36.73 \pm 10.82 \mu\text{m}$ with) scanning without and with artificial landmark of all IOS

used. For the fully edentulous model, PS IOS also showed the best results scanning with landmarks, but deviations were higher in the longest distances between scan bodies in all parameters. The best results of precision had PS IOS for both partially and fully edentulous models in all parameters measured ($p < 0.05$).

Conclusions: Artificial landmarks did not have a statistically significant impact on scanning accuracy nor in partially, nor in

fully edentulous models. The longer the distance between scan bodies, the more deviations in measured parameters arise, despite the usage of artificial landmarks.

Keywords: Digital implant impressions, artificial landmark, digital splint

OP26

Digital smile restoration in oral oncology oral rehabilitation

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Introduction: The restoration of a smile for a person who has lost half their jaw is more than just aesthetics – it is about the restoration of their dignity! Traditionally, this was achieved through conventional analogue methods. With the advances in digital technology, it is now possible to use a person's original smile/teeth positions and recreate that in the new restoration.

Case description: This is the journey of a patient who lost their right maxilla due to oral cancer and was reconstructed with a fibula free flap with immediate implant installation (Alberta Reconstructive Technique). With a high smile to consider, it was incumbent on the management team to recreate the lost dentition and soft tissue as it was before. Since the digital images of the dentition and soft tissues were available, the team

attempted to employ novel digital technologies in the pursuit of this restoration. The aim of this oral presentation is to highlight how digital technologies can be exploited in this pursuit and the advantages associated with it.

Discussion: Recreating a person's appearance after the ravages of cancer is one of the best possible outcomes that a clinician can hope for in rehabilitating a head and neck cancer patient. It is presented to the delegates that a restoration of a patient's smile is providing dignity to them – and this should be one of the outcomes that oral rehabilitation should strive for. And when advanced digital technologies are utilized to achieve this, it enhances the oral rehabilitation journey for patients and brings its attendant advantages.

OP27

Influence of Different Material Substrates on the Accuracy of 3 Intraoral Scanners: A Single-blinded *in Vitro* Study.

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Objectives: Measuring trueness and precision of an intraoral scanner (IOS) on different material substrates will provide thorough understanding of its accuracy.

The purpose of this *in vitro* study was to measure trueness and precision of 3 IOS when scanning different dental material substrates and compare them using a laboratory scanner as reference.

Methods: A master maxillary complete dentate typodont model with 11 different dental material substrates was prepared and scanned with 3 IOS (TRIOS3; 3Shape, CS3600; Carestream, and Emerald S; Planmeca) using their latest software versions. The reference model was also scanned with

a reference laboratory scanner (7series; Dental Wings). Files were exported in standard tessellation language (STL) format and inserted into metrology 3D mesh comparison software (CloudCompare).

Results: Regarding influence of different material substrates on IOS trueness, statistical significant effect of substrates on performance of TRIOS3 ($F(2.226, 20.038) = 70.314, P = .000$), CS3600 ($F(2.294, 20.648) = 57.658, P = .000$) and Emerald S ($F(2.938, 26.438) = 45.756, P = .000$) was revealed. Effect of IOS brand on substrate material revealed statistically significant effect of IOS brand on performance of intraoral scanners for all 11 substrates. Concerning the accuracy of different intraoral scanners when scanning more translucent and

reflective materials, pairwise comparisons revealed statistically significant differences among scanners. Regarding complete-arch trueness, pairwise comparisons revealed that TRIOS3 had significantly higher trueness compared to CS3600 ($P=.000$) and Emerald S ($P=.000$). Complete arch trueness of CS3600 and Emerald S did not differ significantly ($P=.393$). Regarding complete-arch precision, statistically significant differences were detected ($\chi^2=7.091$, $P=.029$). TRIOS3 had statistically higher precision compared to CS3600 ($P=.044$) and Emerald S

($P=.044$). Complete-arch precision of CS3600 and Emerald S did not differ significantly ($P=.286$).

Conclusions: Different dental material substrates influenced accuracy of all 3 tested scanners. In terms of complete-arch accuracy, TRIOS3 had statistically higher trueness and precision compared to CS3600 and Emerald S. There was no significant difference between CS3600 and Emerald S. All 3 tested IOS exhibited complete-dentate arch average accuracy below $100\mu\text{m}$ *in vitro*.

Keywords: intraoral scanner, accuracy, substrates

OP28

Full digital workflow for the esthetic treatment of altered passive eruption, using soft and hard tissue crown lengthening guides and laminated veneers

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Introduction: Altered Passive Eruption (APE) is a clinical situation originated by excessive gum overlapping over the enamel limits, resulting in a short appearance of clinical crowns. Nowadays digital dentistry has revolutionized both prosthetic and surgical workflows.

Case Description: A 39-year-old female attended our University, reporting dissatisfaction with her smile, due to the size of her teeth and the great gingival exposure. The proposed treatment plan included, surgical crown-lengthening followed by the application of ceramic veneers, implementing a full digital workflow. After digital impression, a digital wax up was performed based on a digital smile design. Initial intraoral scans, wax up and a cbct scan were superimposed in order to plan the crown-lengthening and create 2 surgical guides. For the reduction of the bone and soft tissue correspondingly. This set of data facilitated the planning of the guides, taken also into account the individualized biologic width of each tooth. After the surgery a new mock up was performed based on new clinical conditions, and the teeth were prepared over it. 3d-printed

prototypes was used in order to confirm the fitting and the esthetics of the final restoration, before the bond of the heat pressed lithium disilicate veneers. After the bonding of the final restorations, a Lucia-jig deprogrammer was designed and printed, in order to take the records for the milling of a stabilization splint.

Discussion: This digital workflow seems to lead to a more detailed diagnosis and combination of surgical and prosthetic clinical phases. The design of the final smile esthetics, the increased control during the prosthetic phase and the fabrication of the crown-lengthening guides, implementing references for gingival and bone resection, seems to lead to more predictable esthetic results.

Although this technique requires additional time and increases the patient's cost, the benefits seem to outweigh the limitations.

Keywords: Veneers, Full digital workflow, Crown lengthening, altered passive eruption

OP29

Bionic TM robotic articulator: new prospects and future developments

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Objectives of the investigation: in dentistry, it is a known necessity to record the chewing movements of the patient in order to replicate the mastication of each person.

For this purpose, articulators are widely used, but they are able to detect only the patient's limit movements. In order to improve the performance of the articulator, it is necessary to integrate its use together with digital pantographs.

However, these systems have a few limitations, that are mainly related to the difficulty of utilization, as well as a difficult reproducibility of the measurements made in the oral cavity.

In the last few years, we have decided to seek help in robotics. In this study, it is presented the use of the Bionic Jaw Motion system that seems to be able to greatly simplify the recording of masticatory movements.

Experimental methods used: The Bionic Jaw Motion system integrates the use of a jaw movement scanner with a robotic articulator; this system works with the positioning of two markers with a special geometry placed in a specific position, linked to two circular devices that do not interfere with occlusion and masticatory function.

A software composed of a high-speed recording camera that sends data on a computer recognizes the geometry of markers and their deformation during the recording of movements. This recognition takes place with a precision of 140 fps and the software is able to digitize the movements and provide a kinematic path that represents them.

Essential results: As a result, a robot reproduces recorded movements of the patient. The great innovation is that Bionic robot is a system definable as a gyroscope because it uses three engines that work in translation and other three that work in rotation; as a consequence, there will be a point where the different axes converge. In this way, no mathematical transformations will be needed to move the robot.

Conclusions: Therefore, this system allows us to obtain valid results in a short time at a reduced cost and can also be used by non-expert operators. With this work we wish to update you on the recent developments of this technology and its clinical implications.

OP30

Evaluation of IL-6 Production Induced by Contemporary Indirect Restoration Materials

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Objectives of Investigation: The production techniques in dentistry are advanced parallel to the technology. The aim of this in-vitro study was to investigate whether different indirect restoration materials fabricated by three production techniques; subtractive manufacturing, additive manufacturing and conventional indirect manufacturing effect Interleukin-6 (IL-6) production.

Methods Used: Total number of 36 disc-shaped samples (h=2mm, Ø=15mm) were fabricated for each production technique group [Conventional Group (Gradia Plus; GC, Japan) (n=12), Subtractive Group (Grandio Blocs; Voco, Germany) (n=12), Additive Group (Saremco print-CROWNTEC; SAREMCO Dental AG, Switzerland)(n=12)], according to the manufacturer's instructions. After all samples were polished using aluminum oxide-coated discs (OptiDisc, Kerr, USA), they were cleaned and then air-dried. The sterilization process was performed for 20 minutes under ultraviolet light in a laminar flow

sterile cabin (Class II, Heraeus, Germany). After exposure periods of 1st, 3rd, and 7th days, the IL-6 production was determined by using Mouse IL-6 ELISA Kit (Elabscience). One-way ANOVA and Tukey HSD multiple range tests were used for statistical analyses. In all tests, p<0.05 was considered significant.

Results: The IL-6 release of the tested materials showed statistically significant differences on the 1st, 3rd, and 7th days (p<0.05). Gradia Plus material showed the highest IL-6 release all incubation periods (p<0.05).

Conclusions: Despite the high cell viability of all materials, the Gradia Plus indirect composite resin material showed the highest IL-6 release. Since the IL-6 is an inflammatory mediator which is associated with tissue damage, inflammatory effects of resin materials should be considered.

Keywords: 3D Printing, CAD/CAM, Composite Resin, Interleukin-6

OP31

Retentive Strength of Orthodontic Brackets Bonded to 3D-Temporary Crowns After Surface Treatment and Aging Printed-vs-Milled

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Objective of investigation: The aim of this study was to evaluate the shear bond strength (SBS) of orthodontic brackets bonded to 3D-printed temporary crowns after various surface treatments and aging in comparison to CAD-CAM polymethyl methacrylate (PMMA) milled temporary crowns.

Methods used: Eighty cylindrical specimens were 3D-printed with 3D-printing material and divided into 4 subgroups (n=20) Group A: sandblasted with 50 µm aluminium oxide particles (SA) and aging; Group B: sandblasted with 30 µm silica-coated alumina particles (CO) and aging; Group C: SA without aging;

Group D: CO without aging. For the control group, 20 CAD-CAM PMMA milled cylindrical specimens were sandblasted (SA) and aged. SBS was tested using universal testing machine (0.25mm/m), inspected for failure mode classification using magnification loupes X2.5 and statistically analysed (two-way ANOVA, $p < 0.05$).

Results: No significant statistical difference in bond strength was found between all 3D-printed provisionals (groups A-D) and the PMMA provisionals (control group) ($p = 0.092$). SA surface treatment generally tends to increase bond strength compared to CO surface treatment ($p = 0.29$), while aging tends to decrease bond strength among test groups ($p = 0.13$). Control

group (PMMA) showed totally adhesive failure mode within the cement-provisional material interface. Groups A-D predominantly exhibited specimen fracture mode.

Conclusions: Orthodontic brackets bonded to 3D-printed temporary crowns exhibited adequate bonding strength. Sandblasting with aluminum oxide produced higher bond strength while ageing reduced bond strength. However, 3D-printed crowns are more prone to cohesive failures which may result in crown fracture.

Keywords: PMMA, 3D printing, Shear bond strength

OP32

Pre-appointment touchpoints of the dental patient journey: How to gain competitive advantage before patient's first visit

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Objectives of Investigation: Consumer journey analysis is an increasingly popular strategic management tool praised by both academics and practitioners for its usefulness in understanding an organization's consumer experience. In the dental sector, this could also be a useful tool to enhance the experience and improve strategic tools of modern dental services, long before the patient comes to the dental office. It seems that as care becomes more patient-centered, care teams need a "single pane" view of the entire patient journey.

Methods: For this presentation, we gathered articles from PubMed, Google Scholar, Academia, and ResearchGate. We first highlighted consumer engagement for a good branding framework. Secondly, we defined touchpoints' meaning and clarify how they are used today in the world of marketing. Thirdly, we explored the specific engagement behaviors of dental patients according to the relevant touchpoints of a normal dental journey and focused on the ones that happen before the actual appointment at the dental office takes place.

Results: In the business marketing, there are specific key strategic initiatives at each pre-appointment touchpoint that could be used in the dental field. This initiative can result in a cross functional input aimed to advance dental service innovation with collateral benefits for both the dentist and the patient. The outcome will be the improvement in the quality of the dental services resulting in a more profitable dental practice.

Conclusions: Even though few articles exist on touchpoints and branding for dentistry, there are numerous advantages and application of the dental patient's touchpoints in every day clinical dentistry. Small private dental offices can incorporate pre-appointment touchpoints' advices over their social image, to enhance the patient input of the office even before their first visit. Developing a stronger understanding of patient's experience and choices of a dental brand, in an era of increasingly complex consumer behavior, will provide experience satisfaction of both the dentist and the patient.

Keywords: dental patient's touchpoints, pre-appointment touchpoints, consumer journey mapping

OP33

Diagnosis and Treatment of Proximal Caries Lesion in 2020 - an Update and Review of Latest Position Papers

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Objectives of Investigation: To update and modernize the treatment of proximal caries lesions (PCL) in accordance to the position papers published in 2012-2020. And to simplify the treatment decision making.

Methods Used: A literature review of the diagnosis and treatment has been performed. A Classification of the radiographic appearance of PCL is accepted to 6 distinct advancement levels, and

the therapy is selected based on the depth of the radiographic lesion and the specific patient relevant information/data.

Diagnosis of PCL is not conclusive; it is based on bitewing radiographs without the ability to examine the lesion directly. Reliability and interpreting bitewings radiographs is not objectionable and inconclusive. It is affected directly from the quality of the x-ray, human interpretation, development software, screen monitor quality and more. Furthermore, the carious lesion is dynamic and reversible in its early stages, it can become inactive and turn into arrested caries with similar radiographic appearance to the active lesion. Since the progression rate of PCL is usually slow and the activity of the lesion is influenced by several factors; quality and quantity of saliva, carbohydrates consumption, oral hygiene, fluoride usage and more, it is possible, when there is the right

indication, to use prevention and follow-up methods instead of invasive treatment plan.

Results: Treating caries can be non-invasive, using chemical compounds and changing hygiene habits and nutrition. Invasive treatment involves removal of healthy tooth tissue, drilling and filling with restorative material, leading to a chain of retreatments in a timeline of 5-10 years causing enlargement of the defect and a future damage to tooth structure and the dental pulp.

Conclusions: The treatment of a PCL that penetrates dentin, should be chemical and conservative, followed by close follow-up, while invasive treatment that includes drilling and filling can be a suitable alternative only in selective, more advanced cases. A table is presented to allow the practitioner easy decision making to treat PCL.

OP34

Lightness Difference Thresholds, associated with smile attractiveness, of a maxillary central incisor in digital simulated portraits

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Objectives: To assess the visual perceptibility and acceptability thresholds for lightness differences of a single central incisor on digital facial portraits, to investigate possible differences in these thresholds between the gender or the age and to associate them with smile attractiveness.

Methods: A series of images with varying lightness(L), were created by altering the maxillary central incisor of a male Caucasian, on a frontal view of full-portrait image. 15 different images for the right central incisor, one image serving as the control and half with increased and half with decreased lightness, were created by modifying digitally in each step 1 ΔL unit($\Delta L = \Delta E = 1$). The images were presented in random order in a digital calibrated monitor. 160 participants (80 dentists, 80 laypersons) were instructed to fill out a questionnaire, giving a score using a Visual Analog Scale and evaluating every image for a perceptibly or an acceptable mismatch of central incisor color.

Essential results: 50% perceptibility thresholds were significant lower in dentists compared to laypersons. A significant difference was found regarding 50% acceptability thresholds between the type of observer. Dentist group presented a higher false rate compared to layperson. For both dentist and layperson group, a significant difference in smile attractiveness score was presented in a lower lightness value,

compared to 50% acceptability thresholds. Smile attractiveness score presented a different curve, compared to perceptibility and acceptability frequencies.

Conclusions: Difference in lightness between the two central incisors, is tolerated with various degrees among dentists and laypersons. The age and the gender of the observer plays an important role in the perception of differences in lightness. Perceptibility thresholds were significantly lower than acceptability thresholds. The Assessment of smile attractiveness complements the perceptibility and acceptability estimation, assisting in a better interpretation, of the influence of color difference in clinical reality.

Keywords: Color difference, Lightness difference, Single anterior, Smile attractiveness, Digital simulation

CAD/CAM Complete Dentures: A Requiem for Conventional Complete Dentures?

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Objectives of Investigation: Conventional fabrication of complete removable dental prostheses (CRDPs) is a well-established technique with very good results and a relatively low cost. Quite recently CAD/CAM technology has been applied for fabrication of CDRPs. The aim of this systematic review was to examine certain success criteria of CRDPs associated with misfit, retention, occlusion, patient-satisfaction and post-insertion visits, and compare the two different techniques.

Methods Used: An electronic search was conducted in Pub-Med/MEDLINE and it was supplemented by hand search in major prosthodontic journals, to identify relevant studies. The search was extended from 2000 to 2020, and was performed by related MeSH and free-text words, satisfying the focused PICO question.

Results: Both the conventional and the CAD/CAM techniques have advantages and disadvantages. Digital CRDPs showed similar or even better adaptation than the conventional ones. The greatest misfit of the intaglio surface was reported in the

posterior palatal- and border-seal areas. Occlusal trueness seems to be better in conventional CDRPs. The CAD/CAM approach requires standard procedures and instruments, that require small amount of training. The conventional technique presents lower material cost but requires more appointments and high skills. Materials in the digital technique are more expensive, but cost and time can be reduced by adoption of certain protocols. After insertion different complications are encountered: digital CDRPs need relining and removal of pressure spots, while conventional ones lose their retention and provoke irritation. Digital dentures require more time for patient satisfaction but there are no statistically significant differences in the number of visits for adjustment between the two methods.

Conclusions: The popularity and interest in CAD/CAM CDRPs are increasing. However, long observation periods and data concerning survival and success rates are not available yet. Each case should be evaluated individually before deciding which one of the presented methods is appropriate for the patient.

Suggestion on a global colour code for removable partial denture components

Nasr Mohamed Ahmed Elsheikh








(The National Ribat University, Sudan)

Objectives of Investigation: To propose a universal color code for the components of Removable Partial Denture (RPD).

Methods used: In the present study, scientific articles in the English language published in MEDLINE database (PubMed) and Google Scholar until April 2021 were reviewed. The following search terms and their combinations were used: "color," AND "code," AND "removable partial denture," AND "design."

Results: No results were found, except one article, and published in 2000 and based on the function of the RPD components rather than the components themselves. Therefore, we proposed the following color codes.

The suggested codes are as follows:

	Code	Colour	Components
1	Black		Base of the denture
2	Yellow		Major connector
3	Violet		Minor connector
4	Green		Retentive arm
5	Red		Reciprocal arm
6	Blue		occlusal rest
7	Brown		Indirect retainer

Conclusions: There is no universal code color that explains the components of a removable partial denture, this is a strong motivation for this suggestion. The application of the suggested color codes will promote the prosthodontics profession.

Oral Status and Clinical Problems of Toothless Patients Of Older Age Suffering From Blood Dyscrasias - Prosthodontic Treatment Modalities?

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Objectives of investigation: Clinical signs of blood dyscrasias' in the mouths vary.

Methods used: Inspection with additional specific and non-specific laboratory tests.

Results: Hyperchromic, macrocyte, pernicious anemia, Addison-Biermer anemia leads to the formation of Hunter's glossitis which gives the tongue the appearance of bright red tissue. Anemia caused by iron deficits, microcyte hypochromic anemia, Plummer-Vinson syndrome (hyperchromal anemia) and sideropenic anemia lead to tongue atrophy, cheilitis angularis, generalised atrophy of oral mucous membranes and occurrence of ulceration with secondary candidiosis. Haemolytic normocyt and normochromic anaemias cause pallor of oral mucosa with generalized superinfected ulcerations. Drepanocytosis and sickle cell anemia lead to the occurrence of pale and slight yellow color of mucosa with the development of jaw osteoporosis. Thrombocytopenia leads to purpura of skin around the mouth as well as oral mucosa. In patients with macroglobulinemia (Waldenstrom's disease), persistent gingival hemorrhages, petechiae, ecchymoses, mucosal ulceration, and intermittent epistaxis are characteristic features of the patients' mouth. Patients with chronic myeloid leukemia have jaw osteosclerosis. In patients with acute leukemia throughout

the mucosa of the mouth, petechiae and ecchymoses with accompanying necrosis, ulceration of the mucous membranes in the mouth and adenopathy of the submandibular and cervical glands are formed. In patients with cyclic neutropenia of the mucosa, the oral cavity produces painful ulcerations covered with whitish deposits, which are limited by the discrete erythema of the surrounding mucosa.

Oral manifestations of disorders during hemophilia are hemorrhages that may extend to the TMJ and the skin of the mouth. In patients with hemangiomas, changes in the mouth occur either as a consequence of solitary hemangioma, or as hemangiomas that occur as part of various syndromes. Hypertrophic changes in the mouth in Klippel - Trenaunay - Weber syndrome are most commonly in the hard palate causing facial asymmetry and changes in occlusion. In erythroplasia, changes in the mucous membranes of the mouth have the appearance and texture of red velvet, usually in the floor of the mouth, soft palate or towards the tonsils.

Conclusion: Various prosthodontic- therapeutic plans should be applied with local and general prevention implemented.

Keywords: Dentures, Blood dyscrasia;

Assessment of Viability and Proliferation of Gingival Fibroblasts in contact with Silver Nanoparticle-doped Ti6Al4V Surfaces

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Objectives of Investigation: Titanium implants have very high success- and survival-rates when replacing single or multiple missing teeth. However, inflammatory diseases still affect their lifespan. The peri-implant mucosal attachment plays important role in dental implants' success, by producing a peripheral seal to invading microorganisms. Previous work by the same research group has demonstrated that silver nanoparticles (AgNPs) possess antibacterial properties against common periopathogens. However, a possible cytotoxicity against human gingival fibroblasts (hGFs), which would prevent AgNPs

use, has not been investigated yet. Therefore, this study aimed to develop AgNP-doped Ti6Al4V alloy surfaces and investigate their potential cytotoxicity on hGFs.

Methods Used: AgNPs of different size distributions (8nm and 30nm) were incorporated onto Ti6Al4V surfaces by electrochemical deposition, using colloid silver dispersions with increasing AgNP concentrations (100ppm, 200ppm and 300ppm). Cells were cultured in direct contact with the specimens for 24h and 72h. Cell attachment, viability and proliferation were investigated by SEM, live/dead staining, MTT and BrdU assays.

Results: The cytotoxic effect of silver was time-dependent and showed an increasing trend when AgNP concentration increased. A statistically non-significant transient concentration-dependent cytotoxic effect was detected at 24h, for both 8nm and 30nm-sized groups in contrast to the control group. This effect became more intense for both sized groups at 72h, especially for the 300ppm concentration groups, where a significant decrease in metabolic activity was noted in both sizes ($p < 0.05$). A statistically significant, concentration-dependent decrease in cell proliferation rates was induced at 24h in all

AgNP groups ($p < 0.05$), followed by a recovery at 72h in all groups except from the one coated with 300ppm AgNP concentration.

Conclusions: Overall, cell viability and proliferation on the AgNP-doped surfaces, suggested adequate cytocompatibility at all concentrations. AgNPs incorporated on Ti6Al4V surfaces could be potentially utilized for the prevention of implant-associated infections, without compromising gingival fibroblasts' biologic response.

OP39

Digital Complete Denture Fabrication Workflow. Cases Presentation.

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Introduction: The evolution in digital technology and robotics have resulted in becoming quite popular the fabrication of complete dentures by computer-aided design and computer-aided manufacturing (CAD/CAM) methods. Basically, there are two CAD/CAM techniques available for complete denture fabrication; a computerized subtractive milling process and an additive manufacturing process known as 3D printing.

Cases Description: The dentures bearing surfaces were digitized by scanning the mouth with an intraoral scanner or scanning the casts. Maxillomandibular jaw relationships, vertical dimension, occlusal plane, lip support, midline, etc. were recorded with the aid of 3D printed baseplates and wax rims. The baseplates and wax rims were scanned and the files were matched with digital casts. Teeth were selected from a digital "library" and a three-dimensional tooth set was performed. A virtual articulator was used and the occlusion with the opposing dentition was established. The intaglio and

cameo surfaces were designed on the digital casts. 3D printed trial dentures were used to clinically evaluate the overall process till this stage. Denture bases and teeth were milled from a pink prepolymerized polymethylmethacrylate puck and tooth shade disk respectively. Teeth were bonded to the milled denture base sockets with a methacrylate-based bonding agent and the dentures were finished according to standard protocol.

Discussion: Comparing with the conventional compression molding technique, the "digital denture" is expected to have better fit of the intaglio surfaces (lack of polymerization shrinkage) good biocompatibility (lower surface roughness, less candida albicans adherence and less residual monomer) improved biomechanical properties, reduced number of appointments, less overall chairside time and less number of postinsertion visits. Literature supports the above statements.

OP40

Enamel wear caused by monolithic zirconia crowns following three months of clinical use

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Aims: To compare the amount of tooth wear induced by monolithic zirconia crown restorations placed in posterior region with natural tooth wear on the contralateral side.

Methods: Twenty-five patients in need for single crown restoration were included in this study. Crown preparation was performed according to clinically indicated guidelines and definitive crown impressions were obtained using PVS material. Gypsum master cast models were fabricated and single crown dies were sectioned. Crowns were milled using a CAD-CAM

procedure from monolithic-zirconia blocks, Prettau-Anterior-Multistratum (ZirconZahn, South Tirol, Italy). The crowns were cemented and adapted intraorally. An impression was obtained immediately following crown insertion of both dental arches. Following three months of functional loading, the patients were recalled to obtain a second impression using the same procedure. The casts models were then optically scanned using a lab scanner (ZirconZahn S600 Arti scanner) and the resulting 3D surfaces were exported in STL-file format and imported

into CloudCompare reverse engineering software for analysis. The zirconia crown antagonists as well the contralateral tooth antagonists for all 25 cases were segmented and tooth wear was assessed as the negative space (wear surface difference) between the two surfaces. The root mean square (RMS) surface difference in millimetre between the two impressions was quantified. The resulting tooth wear was quantified in an excel sheet and saved for statistical analysis.

Results: All patients presented for recall with no dropouts. SPSS statistical analysis software was used for analysis. Mean

tooth wear of the zirconia crown antagonist was ($10\mu\text{m}\pm 1.05\mu\text{m}$) and in contralateral was ($8\mu\text{m}\pm 1.4\mu\text{m}$) following three months of functional loading and the differences were statistically significant at $P=0.48$.

Conclusions: Within the limitations and the short follow up period of this study, it can be concluded that tooth wear induced by monolithic-zirconia restoration did not differ from naturally induced wear on the contralateral side.

OP41

Sand Blasting Effects on Mechanical Properties of Ceramic Coated Co-Cr Alloys

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Abstract: The purpose of this *in vitro* study was to determine the influence of grit blasting on microstructure and mechanical properties of cobalt chromium alloys coated with porcelain layer.

Materials and Methods: Thirty Co-Cr metal substrates were fabricated according to ISO 9693-1, by Direct Melting Laser Sintering. Ten of them were sandblasted with $50\mu\text{m}$ Zinc oxide nanopowder and another group of ten substrates were treated with $250\mu\text{m}$. The third group of ten substrates were left as received. A commercially available feldspathic porcelain was placed on the $50\mu\text{m}$ and $250\mu\text{m}$ sandblasted substrates, and then the specimens were tested for metal-ceramic bond strength with the 3-point bend test, according to ISO 9693-1. The fractured specimens were observed with optical and scanning electron microscopy to define the mode of failure. X-ray diffraction spectroscopy was conducted to determine changes in crystalline phases after fabrication and the 3-point bend test.

Results: The bigger the particles of the sandblasting are, the more elasticity the substrate reveals. The metal-ceramic bond strength for both of the groups was cohesive. The metallographic analysis of the as-received, the after porcelain firing, and the after 3-point bend test specimens revealed changes in microstructure. The crystallographic microstructure revealed that the patterns had minor changes among the groups. The profilometry, also indicated that the bigger the sandblasting particles were used, the smoother the surface was.

Conclusion: Sandblasting does not affect to the adhesion between the metal substrate and the ceramic layer. The study revealed that all of the techniques showed similar results. The modulus of elasticity revealed that the bigger the particles of the sandblasting is the higher the mechanical properties are.

OP42

Optical properties of translucent monolithic zirconia after artificial aging and different milling strategies

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Objectives of Investigation: The purpose of this study was to examine the optical properties of translucent monolithic zirconia before and after aging, along with different milling strategies.

Methods Used: The zirconia materials that were examined were; inCoris TZI C and Katana STML. The materials were subdivided into two sub-groups according to the sectioning method that was used; dry sectioning or wet sectioning. Each sub-group was further divided to two groups according to the type of the solution that the specimens were submerged and

suspended in direct contact after the sectioning and before the sintering; distilled water or used contaminated water. After the sintering procedure, optical properties were calculated. All specimens were subjected to accelerated aging. The surface of the materials tested before and after the aging procedure was evaluated by X-Ray Powder Diffraction Analysis and the morphology of surface topography and microstructure were examined by scanning electron microscopy. When the data were normally distributed, one-way ANOVA analyses were used

to indicate significant interactions of the dependent variables. When the data were not normally distributed Mann-Whitney U test was used, and the level of significance was set to 0.05.

Results: The optical properties of both types of zirconia were affected by the milling strategies and the type of the immersion solution. Zirconia ceramics showed the highest translucency when it was dry milled and the lowest when it was milled and

immersed in direct contact for 15 minutes with used contaminated water.

Conclusions: Zirconia ceramics are affected by artificial aging and by the milling strategy chosen.

Keywords: CAD/CAM, hydrothermal degradation, translucency, monolithic zirconia.

OP43

The Effect of Different Polishing Protocols on the Surface Topography of Zirconia Abutments.

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Objectives: The formulation of an appropriate polishing protocol for zirconia custom abutments is critical, since abutment surface roughness affects soft-tissue health and stability. However, there is no evidence available regarding the optimal protocol for polishing ceramic abutments. The aim of this study was to evaluate and compare the surface topography of zirconia specimens following different polishing protocols.

Experimental Methods: 50 zirconia specimens were fabricated and divided into 5 experimental groups. In the control group (ZP1) no processing was performed. The remaining group specimens (ZP2-ZP4) were processed using two different polishing systems, with and without polishing paste. Polishing was performed in an experimental unit, under controlled pressure and time. Specimens were then studied under an optical profiler and parameters Sa, Sz, Sdr, Sds, Sci, Std were recorded without any filtering. High pass 20µm and 50µm Gaussian filters were then applied for a selected number of specimens from each test group.

Results: The control group gave the highest values for all recorded parameters. No statistically significant results were

recorded for the different polishers (ZP2+ZP4). The addition of polishing paste (ZP3+ZP5) resulted in statistically significant differences for most recorded parameters (Sa, Sz, Sdr, Sds) compared to using polishers alone (ZP2+ZP4), resulting in a flat and homogenous surface with some prominent peaks. A trace left by the manufacturing process was observed, which no polishing protocol was able to erase. The application and type of filters used impacted considerably the results - even eliminating the manufacturing trace on occasions.

Conclusions: Application of polishers and paste affects significantly zirconia abutment surfaces, making it more flat and homogenous. Manufacturing processes leave a trace which seems difficult to eradicate. Filtering influences profilometry, yielding significant variations in the obtained results and their interpretation. Finally, this study underlines the need of standardized protocols for the topographic evaluation of implant abutments.

Keywords: zirconia abutments, profilometry, surface roughness

OP44

Correlation Between Erosion and Using of Fizzy Drink

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Dental erosion is jointed with dental structure melting by using of acidity of foods, fizzy drink without micro-organism presence. The erosion process comes by several external and internal factors. The external factors are consuming of fizzy drink, acetous foodstuff, lemonade, wines.

Aim: To investigate the correlation exists between using of fizzy drink and erosion of teeth region at dental structure.

Material & methodic in study were involved about 187 subjects, 18-32 age groups, who filled a questionnaire during October 2019-March 2020. The questionnaire contents as well the

using of fizzy drink by above subjects, and presence or not of the erosion at these subjects. According these interpretations was made the math-statistical data processing, to determine the correlation exists between using of fizzy drink and erosion of teeth region at dental structure.

Results & discussions: Study results shown about 73, 8% of subjects were females, and 2% were males. By above 187 subjects, about 74,3% have used fizzy drink and by these subjects about 35, 8%, have shown erosion, meantime 64,2 % have not shown erosion of teeth region at dental structure.

We found an important statistical correlation between using of fizzy drink and presence of erosion with $p=0.012$ value, and in the same time was confirmed an important statistical correlation between gender and using of fizzy drink, as well between age group and region of carried teeth with $p=0.198$ value.

Meanwhile we found an important correlation between using of fizzy drink and carried teeth region with $p=0.352$ value of study subjects.

Conclusions: According to our study was concluded, exist a significant correlation using of fizzy drink and erosion with $p=0.012$ value of the total number of our subjects.

Recommendation: We have recommended especially to 18-23 age group do not to use fizzy drink, because the erosion phenomena is relatively most noticeable in natural dental system with $p=0,352$ value.

Keywords: erosion of teeth, fizz drinking, acetous foodstuff, math-statistical correlation.

OP45

Retention Force of Different Materials on SynCone Double Conical Crowns

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Objectives of investigation: In this this study we measured the difference in retention force by using different materials and different manufacturing methods for double crowns on implants.

Experimental methods used: in this study have been used three different materials and three different manufacturing procedures for the outer double crown. Titanium, gold and semiprecious alloy have been used for the outer crown. The outer crowns were produced by casting, CAD-CAM method and also prefabricated outer crowns. For the inner crown the original SynCone abutment was used. The samples were divided in 5 groups combining materials and method of manufacturing whit 10 samples in each group. All the samples were mounted in dynamometer Chewing Simulator CS 4, SD Mechatronik, Feldkirchen Westerham, Germany. Each sample was conducted thru 10.000 cycles of joining and separation, simulating the wear of 10 years of using the double conical crowns.

Results: All the samples showed similar retention force, except for the semiprecious alloys produced by casting, which showed higher values of retention force. Samples made of gold, regardless of the method of manufacturing, showed smoothly increase of retention force from the beginning to the end. Samples made of titanium, regardless of the method of manufacturing, firs showed a decrease of retention force and then a smoothly increase of retention force to the end.

Conclusion: By choosing different materials and manufacturing methods it can be chosen how big is going to be the retention force and according to the clinical situation it is possible to choose the best combination for our patients.

Keywords: Double crowns, retention, dental materials, manufacturing

OP46

Translucency of monolithic zirconia of different thickness after immersion in acidic beverages

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Objectives: Monolithic zirconia of high translucency has gained considerable interest in the last few years in esthetic restorations requiring high mechanical strength, as it presents superior translucency and better mechanical properties compared to other ceramics. However, factors such as acidic conditions within the oral cavity or systematic consumption of acidic beverages may negatively affect the translucency, especially of thin zirconia restorations. This *in vitro* study aimed to investigate the effect of thickness and immersion in common acidic beverages on monolithic zirconia translucency after different surface treatments.

Materials/Methods: The specimens (120 in total) were divided into two groups depending on thickness (0.5 and 1mm). Half of the specimens in each group were polished and the rest were glazed. Measurements of color parameters (L^* , a^* , b^*) were recorded before and after immersion in common beverages (Fanta or Coca cola) with a spectrophotometer at black and white background and translucency parameter (TP_{00}) was calculated. Statistical analysis was performed with significance set at 0.5. The specimens within each subgroup ($n=15$) remained in the acidic beverages for 90h, simulating 5 years of clinical time within the oral cavity.

Results: At baseline, lower translucency was recorded for all specimens of 1mm thickness regardless of surface treatment. For the 0.5mm specimens, a reduction of TP₀₀ was recorded after immersion in both beverages; however it was statistically significant only after immersion in Coca Cola. For the 1mm specimens, the immersion in beverages resulted in either increase or decrease in TP, however the differences were not statistically significant.

Conclusion: Under the limitations of this *in vitro* study, it can be concluded that thin (0.5mm) monolithic zirconia restorations are more prone to translucency decrease after immersion in acidic beverages such as coca cola, while thicker specimens (1mm) remain unaffected.

Keywords: Dental Prosthesis [E06.780.346], Prosthodontics [E06.780, Dental Polishing [E06.298], Carbonated Beverages [J02.200.300]

OP47

Use of Carbon Fiber-Reinforced Screw for Zirconia Implant-Abutment Connection: A Comparative Biomechanical Study

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Objectives of Investigation: Since the beginning in the 1960s, titanium and their alloys implants have dominated dental implantology. The research, the products and solutions, and the development and performance of this treatment are mostly based on titanium implant systems (TIS). However, since titanium implants have a are not aesthetic and the possibility of metal allergy reaction exists, researchers have focused on metal-free implant material alternatives to the titanium. Zirconia implant systems (ZIS) with proven osseointegration and soft tissue adhesion, generally with less mucosal discoloration and bacterial adhesion than titanium implants, and restorative flexibility of a two-piece and screw option have emerged as predictable and reliable alternative implant materials.

Three-dimensional finite element analysis (3D-FEA) has become an increasingly useful tool to understand the biomechanical performance of dental implant systems. Therefore, the present study was used 3D-FEA to evaluate the biomechanical behavior of zirconia implant using a carbon fiber-reinforced screw for implant-abutment connection and compare it with that of the titanium implant.

Methods Used: Two models of implant systems with their respective components were created for 3D-FEA: (1) a single titanium implant (Q4.5-10mm) with a titanium abutment (Q5.5mm) and titanium screw and (2) a single zirconia implant (Q4.5-10mm) with a zirconia abutment (Q5.5mm) and carbon-fiber-reinforced screw. Then, 100N-oblique force is applied to the disto-occlusal surface of the mandibular first molar to obtain the resultant stress contours. The stresses occurring on implant, abutment, screw, crown, and the surrounding bone were evaluated and compared.

Results: The ZIS showed better biomechanical performance in the surrounding bone, abutment screw, and crown whereas the TIS performed well in the implant and abutment.

Conclusions: Considering that biological complications occur in bone and mechanical complications mostly occur in screws, using the ZIS may be more biomechanical favorable than the TIS.

Keywords: Zirconia, titanium, carbon fiber-reinforced screw, three-dimensional finite element analysis (3D-FEA).

OP48

Tetragonal zirconia nanoparticles reinforced luting cements: shear bond strength to translucent zirconia.

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Objectives: Different types of hydrogen/ionic bonds are formed between zirconia and the phosphoric/carboxylic acid resin cements' monomers (10-MDP, 4-META). This resulted to their incorporation in new generations of primers and adhesive luting cements. Based on this bonding, it was hypothesized that tetragonal zirconia nanoparticles (NPs) incorporation in luting cements would increase their shear bond strength (SBS) to zirconia.

Methods: Forty disk-shaped specimens were fabricated from yttria-stabilized zirconia (5Y-TZP). One resin-modified glass ionomer (RMGI), one MDP-containing self-adhesive resin (MDP-RC) and one 4-META- containing self-adhesive resin cement (META-RC) were selected. Film thickness and flexural strength were measured according to ISO16506/2017. Each specimen was coated with a MDP-containing one-component adhesive primer

(MDP-UA) before cement application and subjected to SBS using a universal testing machine (1mm/min until failure). The MDP-RC was used with and without MDP-UA to investigate possible effects from different application routes. Statistical analysis was performed with one-way ANOVA and Games-Howell multiple comparison tests ($\alpha=0.05$).

Results: The optimum concentration of nanoparticles was 2.5% w.t. based on film thickness (25-41 μ m). A non-statistically significant increase of SBS was recorded in all cases after NPs addition. The highest SBS values were recorded for the MDP-RC+MDP-UA, being statistically significant compared with the same cement without MDP-UA, with or without nanoparticles. Non-statistically significant differences were found between the 4-META-RC and MDP-RC after MDP-UA application. In RMGI-

cemented specimens MDP-UA application resulted in similar SBS with the MDP-RC.

Conclusion: Under this *in vitro* study's limitations, zirconia nanoparticles can increase the adhesive potential of luting cements to zirconia, however this increase is not expected to be statistically significant. This may be attributed to an increased load of other fillers that prohibited higher amounts of NPs loading and to limited uniform distribution of NPs though hand mixing. The application of the MDP-UA is fundamental for high bond strength in all cements.

Keywords: Dental Restoration, Permanent [E06.780.346.737], Dentistry, Operative [E06.323], Dental Bonding [E06.095], Cementation [E06.095.170]

OP49

Light Energy Attenuation Through Ceramic and Ceramic-Like Materials.

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Objectives of Investigation: The aim of this study was to evaluate the total light energy transmission through different types of ceramic and ceramic-like materials and two different types of resin based luting cements utilizing by high-power LED light curing unit EliparTM DeepCure-L, 3M-ESPE) with 10 seconds irradiation time.

Methods Used: Five different CAD/CAM indirect restorative materials: Lava Ultimate/3M-ESPE; VITAEnamic/VITAZahnfabrik; VITABLOCKS MarkII/VITAZahnfabrik; Cerasmart/GC; IPS e-max CAD/Ivoclar-Vivadent and two different types of luting cements: dual cure self-adhesive resin cement (G-CEM ONE, GC) with A2 shade and dual cure composite resin cement (RelyX Ultimate, 3M-ESPE) with A1 shade were used.

Using MARC Resin Calibrator (Blue Light Analytics), mean irradiance and time required to reach 16J/cm² were measured with four study set-ups. Group1: 10 seconds light irradiation through 2mm thick A1 shade five different types of indirect restorative materials. Group2: Group 1 plus 100 μ m thick two different types of luting cements. Group3: 10 seconds light irradiation through

100 μ m thick two different types of luting cements. Group4: 10 seconds light irradiation without intervening indirect restorative materials and luting cements was applied. For each group ten readings were recorded.

Result: To reach 16J/cm²: For Group1: Lava Ultimate 212 mW/cm² and 75.4 seconds; VITAEnamic 164 mW/cm² and 97.77 seconds; VITABLOCKS MarkII 276 mW/cm² and 57.88 seconds; Cerasmart 244 mW/cm² and 65.56 seconds; e-max 311 mW/cm² and 51.42 seconds. For Group2: It gave similar results as Group1. Group3: It provided similar results as control group. Group 4: The result was 2015 mW/cm² and 7.94 seconds (SPSS, at 95% confidence level P = 0.05).

Conclusion: Finally, 2 mm thick indirect restorative materials had considerable effect on attenuation of light irradiation depending on types of materials. However, by adding 100 μ m thick layer of resin composite cement under the restorative material had only minor effect on attenuation of light irradiation.

Keywords: Ceramic Materials, Luting Cement, Light Curing

Poster Presentations

PP01

Digital Smile Design as a planning tool in a multidisciplinary approach treating Amelogenesis Imperfecta

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Introduction: Amelogenesis Imperfecta (AI) is a group of hereditary conditions affecting the structure and appearance of dental enamel, often in conjunction with changes in other intra-oral and/or extra-oral tissues. The structure and clinical appearance of dental enamel of nearly all teeth are affected and characterized by hypo-mineralization and/or hypoplasia with dis-coloration, sensitivity and fragility. A multidisciplinary approach and meticulous strategic planning should be the basis of the treatment. Using digital dentistry tools can also aid in designing those cases before execution. An example is the Digital Smile Design (DSD). DSD is a digital tool that allows creating and visualizing a digital mockup of a new smile design before the treatment starts.

Case Description: A 22-year-old female diagnosed with hypoplastic and hypo-mature types of AI in posterior and anterior teeth. The patients' chief complaint focused on poor appearance and sensitivity of her teeth. The patient presented with an anterior open bite, mixed dentition, impacted teeth, carious lesions and gingival hypertrophy. The main objective of

the treatment plan was using tooth-supported rehabilitation to retain esthetics and functional rehabilitation. Periodontal gingivectomy and a provisional bridge were performed following the DSD protocol. Endodontic treatments were indicated, followed by the prosthodontic treatment which consisted of precious alloy metal-ceramic fixed partial dentures (FPD). At the end of treatment, function and esthetics were improved to a level acceptable to both the patient and the dental team.

Discussion: This case report exhibits the esthetic and functional considerations when treating AI in a 22-year-old patient. Using digital dentistry and with the co-operation of several dental specialists, we managed to preserve the patient's teeth and design an esthetic FPD. The complex management of patients with AI supports the belief that the dental profession ought to be familiar with appropriate methods and possess sufficient knowledge and skill for the rehabilitation of rare dental disorders.

Keywords: Amelogenesis imperfecta, AI, dental enamel, gingivectomy, restoration

PP02

In Vitro Accuracy of 3D-Printed Models from Composite Digital Techniques for Obturator Prostheses

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Objectives: Assess the trueness and repeatability of 3D-printed models produced from composite digital techniques (CBCT, intra-oral scans), compared to gypsum casts fabricated from conventional impressions, and compare these models to scans of the reference model.

Methods: A partially dentate reference model with a palatal defect was reproduced using polyvinyl siloxane which were poured in type IV dental stone (n=5). Intra-oral scans of the reference model were taken using 3M™ True Definition (T) & Planmeca Planscan® (I) (n=5 each). The model was scanned in two CBCT scanners Planmeca ProFace® (P) & Accuitomo 170® CBCT (A) (n=5 each). Scans were imported to Geomagic Control 2014 software to create composite digital models by merging

the 2 CBCT with 2 IOS. The composite models were printed by Objet260@Connex1 3D-printer and were scanned digitally using 3Shape™ R700™ reference scanner. Twenty composite models were 3D-printed (n=5 of A+T, A+I, P+T, P+I). Repeatability was measured by repeated superimpositions using Geomagic Control 2014 software. Trueness was determined by the digital superimposition of each composite models' scan against the reference model's scan. Overall deviations, and deviations on tooth, soft tissues, anterior and posterior levels were measured after digital superimposition on Geomagic Control 2014 software. Differences between techniques were analysed by Kruskal-Wallis, ANOVA, and Bonferroni. Statistical significance was inferred when P<0.05.

Results: A+T composite models had the highest repeatability (mean (SD) 0.161(0.155) mm) and trueness (Median 0.172mm) compared to gypsum casts (0.675(0.551)mm, 0.289mm respectively)(P=0.0001). Statistically significant trueness difference amongst the techniques favouring (A+T) on tooth level (mean (SD) 0.308 (0.020) mm) and (P+T) on defect level (0.503(0.009) mm) (P=0.0001). There was no statistically

significant difference in accuracy on anterior and posterior levels between the techniques(P=0.081).

Conclusion: Composite 3D-printed models are accurate and repeatable offering deviations comparable to the gold-standard techniques and within acceptable clinical levels.

Keywords: Palatal-obturators, Printing, Three-Dimensional.

PP03

Withdrawn

PP04

Different build up procedures of endodontically treated posterior teeth.

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Objectives: The aim was to investigate the clinical behavior of endodontically treated (ET) posterior teeth (premolars and molars) restored by various fiber-reinforced post-core composites (FRCs) or fiber posts (FP). Methods. 120 ET posteriors, with 50% or less of coronal residual structure were selected and randomly divided into four groups (n=30). Group 1:FP GC FIBER POST, GC (FP) luted with GRADIA CORE, GC (GC) + Initial LiSi Press, GC partial crown luted with G-CEM LinkForce, GC (LF) (as control); Group 2: everX Flow, GC (EXF) core build up + Initial LiSi Press partial crown luted with LF; Group 3: EXF + G-aenial Universal Injectable, GC (GUI); Group 4: FP + EXF + GUI. Natural teeth were as opposing dentition and patients were free from parafunctions. Patients were recalled at six months and 1 year from baseline. Mechanical and biological parameters were evaluated accordingly with Functional Index of Teeth (Ferrari Cagidiaco *et al.*, 2020). FIT was used for the objective assessment of outcomes

including clinical and radiographic examinations. FIT is made up of 7 variables (Interproximal, Occlusion, Design, Mucosa, Bone, Biology and Margins), each of them to be evaluated using a 0-1-2 score. The Mann-Whitney U test was applied for statistical analysis and the level of significance was set at $p < 0.05$. Results: At one year recall all the restorations were in place without any biological or mechanical complication. FIT scores for each restoration ranged between 13.4 and 14. No statistically significant differences were found among groups.

Conclusions: Under the limitations of this study, posterior ET showed no difference when restored with or without a fiber post, and when occlusal surface was covered by an adhesive partial crown or not. Longer observation time of this study is needed to confirm these findings. Similar studies on patients with different degree of parafunctions are desirable.

PP05

The Inflammatory Effects of Occlusal Splint Materials on Fibroblast Cells

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Objectives of Investigation: Occlusal splint materials can be fabricated with varying production techniques regarding the developments in dental technology. The aim of this *in vitro* study was to investigate whether occlusal splint materials effect Interleukin-6 (IL-6) production which is an inflammatory mediator and associated with tissue damage.

Methods Used: The occlusal splint materials tested in the study are; Photopolymer resin (Dental LT-Clear Resin; Formlabs) produced by additive manufacturing, Polyetheretherketone (PEEK BioSolution; MerzDental) and Organic modified polymer (M-PM Disc; MerzDental) by subtractive manufacturing, polyethylenterephthalat-glycol-C-copolyester (Duran; Scheu

Dental) by thermoforming and polymethyl methacrylate (Akrodent; Koca Kimya&Dental) auto-polymerized by conventional moulding technique according to the manufacturer's instructions. Total of 60 disc-shaped samples were prepared from each test material (h=2 mm, Ø=15 mm). The samples were polished with 600-800-1000-2000-4000 grit silicon carbide sheets. The sterilization process was performed with UV light for 20 minutes. After exposure periods of 1st, 3rd, and 7th days, the IL-6 production was determined by using Mouse IL-6 ELISA Kit (Elabscience). Data were analyzed using one-way ANOVA, Tukey's multiple comparison tests at a significance level of $p < 0.05$.

Results: The IL-6 release of the tested materials showed statistically significant differences on the 3rd and 7th day extracts ($p < 0.05$). On the 3rd day, Duran material showed the highest amounts of IL-6 while on the 7th day Akrodent material showed the highest amounts ($p < 0.05$). PEEK material did not induce IL-6 production for all 1st, 3rd, and 7th day extracts.

Conclusions: Since IL-6 production was associated with inflamed oral tissues, inflammatory effects of occlusal splint materials should be considered.

Keywords: Occlusal Splints, Three-Dimensional Printing, CAD/CAM, Interleukin-6

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PP06

Restoring The Height of Vertical Dimension of Occlusion at Once

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Introduction: Vertical dimension of occlusion (VDO) affects the position and size of the teeth aesthetically and functionally. The decrease in VDO or bite collapse over time due to tooth loss or parafunctional habits causes aesthetic, functional and psychological problems resulting in decreased lower face height, decreased chewing efficiency and aged appearance.

Case Description: Intra oral and extra oral examinations of a 55-year-old male patient revealed tooth loss, decreased chewing efficiency, decreased lower face height and unhygienic restorations. Clinical examination showed that there was an 8mm loss in the vertical dimension of the occlusion. When the literature was reviewed, it was seen that permanent increase of the VDO of up to 5 mm is a common procedure. More than 5 mm increase was done gradually. In this case, the 8mm VDO increase was made by preparing a hard acrylic plaque at one time. The

patient used the plaque for 12 weeks with the controls made every two weeks. During this period, no pain or limitation was observed in the TMJ region. Prosthetic treatment was completed by applying metal-supported fixed prostheses with a face-bow transfer. The occlusal stability was provided bilaterally. No complaints were observed in his monthly controls.

Conclusion: Moderate increases in VDO do not be detrimental, especially if it is provided by bilateral occlusal stability. Restoring VDO improves chewing efficiency and regulates function, contributes to aesthetics by correcting the lower face height. Adjusting and increasing the VDO permanently with fixed restorations is an acceptable procedure for patients.

Keywords: vertical dimension of occlusion, tooth loss, dental prosthesis

PP07

Cemented Single Implant Crowns: Bone Level Changes and Peri-Implant Conditions after 5-Year Mean Follow Up.

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Objectives of Investigation: The aim of the present study was to identify the peri-implant conditions (bleeding on probing (BOP), pocket probing depth (PPD)) and marginal bone loss (MBL, marginal bone level change between follow-up and occlusal loading) around cemented single crowns on bone-level implants (EVEN, Mech & Human, Albignasego, Italy).

Methods Used: The study was a retrospective cohort study with up to 11 years (mean 5.8 years) follow-up. Patients with single cemented crowns were included. Implant survival, BOP, PPD, MBL, and biologic complications (peri-implant mucositis and periimplantitis) were evaluated.

Results: 19 patients who received 20 cement-retained single crowns were included. The implant survival rate was 100%. Peri-implant mucositis rate was moderately low (25.71%). One

patient was diagnosed with peri-implantitis after 6 years of function. Given a score to four areas of the implant restoration, we obtained an average value of 3.73mm for PPD; also, we recorded 26.25% bleeding sites (BOP). Mean MBL was found to be 0.97mm, ranging from 0.18 to 4.67 (median 0.88mm).

Conclusions: High implant survival rate was achieved. Cemented single crowns on bone-level implants showed good peri-implant conditions. Well-designed prospective cohort or randomized controlled clinical trials with larger sample size are needed to confirm these results.

Clinical Evaluation of 52 Bone Platform-Switched Implants After Average 3.5 Years of Function.

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Objectives of Investigation: The aim of the present study was to evaluate the peri-implant conditions (bleeding on probing (BOP), pocket probing depth (PPD)) and marginal bone loss (MBL, marginal bone level change between follow-up and occlusal loading) around cement-retained implant-supported fixed dentures (IFDs) on bone-level implants (EVEN, Mech & Human, Albignasego, Italy).

Methods Used: The study was a retrospective cohort study with up to 8 years (mean 3.5 years) follow-up. Patients with cemented IFDs were included. Implant survival, BOP, PPD, MBL, biologic complications (peri-implant mucositis and peri-implantitis) were evaluated.

Results: 9 patients with 52 implants were included. The implant survival rate was 100%. Peri-implant mucositis rate was moderately low (26.92%). Three implants were diagnosed with peri-implantitis (5.76%). After probing the mesial, buccal, distal and lingual aspects for each implant supporting the restoration, we measured a mean PPD of 3.60mm; also, we recorded 34.61% bleeding sites (BOP). The average MBL was 0.91mm, ranging from 0.22 to 3.37mm.

Conclusions: Despite small population, high implant survival rate was achieved after a maximum 8-year follow-up. Future studies with larger sample size could confirm the favorable outcomes of investigated bone-level implants in terms of MBL.

A Pilot Study of Injection of I-PRF in TMJ in Treatment of Chronic TMD Patients

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Objective of Investigation: Patients with chronic TMD diagnosis and chronic pain usually have impaired oral function due to reduced range of motion (ROM) and can be resistant to conventional therapy.

Methods used: Ten patients with diagnosis of a chronic TMD and a chronic pain were selected after obtaining informed consent. The range of motions (ROM, in mm) were measured during opening and in lateral excursions together with a jaw deviation or deflection. The chronic pain intensity was also measured (VAS 0-10 scale) prior the therapy, after the first injection of I-PRF and at the end of a study after the third injection. The diagnosis was established for each patient using the DC-TMD protocol, MRI and panoramic radiographs. Each patient received 0.3-0.5 ml of I-PRF into the lower TMJ synovial space 3 times under the ultrasound control with a linear probe. The second administration

was 7 days after the first one and the third injection was after 30 days. Pain intensity during injection was also assessed.

Results: Patients reported medium pain intensity (3-7, median 4) during injection. Before injection they also reported medium chronic pain intensity (3-7, median 5). They had limited mouth opening ($3,6 \pm 3,9$ mm) and limited lateral movement, at least towards one side ($4,5 \pm 3,5$ mm). After the first injection on the third day after the first injection they reported less chronic pain, as well as on the third day after another two I-PRF injection sessions. Patients also improved their ROMs 10-30%. No other treatment was provided during the study period of one month.

Conclusion: Treatment with injection of a small amount of I-PRF into the lower TMJ compartment seems to be beneficial to reduce chronic pain and increase ROMs.

Restoring endodontically treated teeth through a digital workflow

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Introduction: The aim of this presentation is to describe the use of digital technology in the prosthetic reconstruction of endodontically treated teeth with mild, moderate and severe loss

of tooth structure. The evolution of Digital Workflow has diminished patient discomfort and decreased treatment time while magnifying restorations' accuracy of fit and high aesthetics. In

addition, the progress of the restorative materials facilitates their CAD/CAM applications through means of partial or full coverage restorations.

Materials and methods: Various clinical cases are demonstrated in order to present all the clinical and laboratory steps of the acquired digital workflow for indirectly restoring endodontically treated teeth.

Criteria for the selection of the most appropriate type of such restorations are presented, taking into consideration factors as the remaining tooth structure, the position of the tooth in the dental arch, the selected treatment plan, parafunctional habits of patient such as bruxism, the available materials for the restoration's fabrication and others.

Furthermore, different types of materials are being used in these clinical cases, highlighting their indications and the variations of the luting process accordingly.

The digital process of designing and fabricating the restoration from the dental technology side of the workflow is also described.

Discussion: A complete digital workflow, when technically available, provides restorations of predictable fit, occlusion and aesthetic properties. Each type of prosthetic appliance in order to restore endodontically treated teeth, from inlays and endocrowns to CAD/CAM post and cores of BioHPP and monolithic ceramic crowns, is applied according to specific indications. The use of intraoral scanners is highly recommended for the aforementioned cases in the latest publications worldwide.

Keywords: Endodontically treated, digital restoration, indirect, intramural scanner

PP11

Effect of Periodontal Stresses in Fixed Prosthodontics : a 3D Finite Element Study

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Objecives of Investigation: A general method for stress analysis, which can be used to determine the stress distribution at the dental bridges, is the finite element method. The aim of the study is to determine by finite element analysis the existence of direct correlations between the abutment periodontal tissues condition and the cantilever bridge in the context of functional occlusion.

Methods Used: In order to reveal the changes occurring in the periodontal ligament, a distal dental cantilever bridge was considered, retained on 34 and 35, subjected to a force of 350N, deemed to be the maximum force developed by the masseter and pterygoid muscles during mastication. A 3D reconstruction of the mandible, of the premolars, canines, incisors was created, and of the dental bridge described, using AutoCAD 2019 and ALGOR 15 FEMPRO software for mesh-area of the structures.

Results: Finite element analysis was employed to determine the stresses, specific deformations and displacements under-

gone by the ligaments under survey. The maximum stress was recorded in the periodontal ligament of the first premolar since this load configuration produces a first degree lever effect with a fulcrum located on the 35 root apex. When the support is on 35, it is noticed that the stress is lower in the bridge area, mainly due to the elimination of the tilting effect, unlike the support at level 34, when the stress distribution is lower than in the first case and the stress on the bridge is higher in the support area, with compression of 34 ligament towards the canine and an elongation from 35.

Conclusions: The overstress of periodontal ligament under occlusal forces leads implicitly to the tearing of the ligament fibers either in their body, or in its insertion into the dentin and bone.

Keywords: dental cantilever bridge, periodontal stress, periodontal tissues, finite element

PP12

A novel modified technique for immediate provisionalisation for implant placement in the aesthetic zone

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Introduction: Nowadays implant placement in the aesthetic zone is predictable and an ideal treatment choice in tooth loss. Different techniques and types of provisionals are demonstrated, the last decades, to provide patients with

immediate functionality and socialization. A new technique combining immediate biological stability, function and aesthetics is demonstrated throughout a clinical case.

Case Description: A 30-year-old male presented to the dental office with an abscess related to the upper right central incisor. After clinical and radiographic examination, the extraction of the tooth and immediate implant placement was decided. The extracted tooth was used as an immediate implant provisional. The difference from the classic protocol, which has been already described in the literature, is the use of the “Cervico system”. Through pre-defined guides of the system, the three-dimensional position of the implant was selected and then the shape of the cervical base of the provisional was constructed from the respective molds. The natural tooth was properly modified and adjusted to the base of Cervico. As long as the implant had initial stability, the modified natural tooth was screwed by hand. The occlusion control at this stage is essential. The provisional natural tooth remained in place for 6 months

without any further modification. Then, the final prosthetic restoration was constructed by copying the three-dimensional biologically peri-implant tissue from the shape of the provisional natural tooth.

Discussion: The Cervico system is an auxiliary system for implant placement and customized prosthetic restorations for both anterior and posterior teeth. Incorporates biological principles for a repetitive and predictable implant prosthesis by imitating the dental nature. Long-term stability of peri-implant tissues is essential for implant survival. With this technique, the customization of the prosthetic zenith is predictable and maintains an ideal relationship between final restoration and peri-implant tissues.

Keywords: implant provisional, Cervico, customized

PP13

Avoiding an Interim Removable Denture: Staged Approach Protocol for Maxillary Implant Supported Prosthesis

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Introduction: Extensive oral rehabilitation involving multiple extractions of teeth and subsequent implant placement often requires an interim removable denture phase. This denture serves the patient for esthetic and functional purposes during the surgical stage while waiting for implant osseointegration and final prosthesis delivery. Herein, a case where a removable denture was avoided, due to patient's request as well as severe periodontal disease and efforts to prevent use of a tooth supported removable appliance. A Staged Approached Protocol (SAP) enabled using a tooth supported temporary bridge, gradually transitioning to an implant supported temporary bridge.

Case Description: A 58-year-old healthy female presented for treatment. Upon examination, generalized periodontitis stage 4 grade C was diagnosed, as well as caries, periapical pathoses and missing teeth. Treatment plan in the maxilla included extractions of hopeless teeth and restoration with an implant supported prosthesis, from tooth 12 to 27. The patient refused using removable appliances, even temporarily. SAP was therefore applied.

Discussion: In cases where an interim removable denture step is avoided, it is possible to perform extensive surgical steps using SAP. In this case, stage 1 involved extractions of several teeth, and placement of several implants, leaving 4 abutments including the terminal abutments which held the temporary bridge until implant osseointegration. Stage 2 involved exposure of the implants, extractions of the remaining hopeless teeth and immediate implant placement in one of the sockets. During this stage the tooth-supported temporary bridge became an implant-supported temporary bridge. Stage 3 involved exposure of the final implants. Following this stage, impressions were taken and final implant-supported prosthesis was fabricated and delivered. This method enables patients to stay with fixed prosthesis during the whole treatment sequence, prevents using remaining periodontally compromised teeth to support a removable denture, and enhances the comfort and compliance of the patient.

Keywords: Dental Prosthesis, Implant-Supported; Denture, Partial, Temporary.

PP14

Precision of two iOS on single posterior abutments *in vitro*

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Purpose: To compare the accuracy of digital impression of single abutments prepared for esthetic overlay obtained by two contemporary intraoral scanners *in vitro*.

Methods: Twenty extracted intact molars were used for this *in vitro* study. The samples were prepared to receive an overlay.

The abutments were scanned with two intraoral scanners (Trios 3, prototype of Intro Oral Scanner from GC) by one single operator. Twenty scanning shots for each iOS were made. The .stl files generated by the two scanners were elaborated with the Exocad software and were one by one over-imposed in order to detect possible differences. Differences were visibly evaluated

by a color scale ranging from 0 to 100 microns of difference. Statistical analysis across the scanner groups was performed using ANOVA with Bonferroni correction.

Results: All over-imposition of full arch showed a minor discrepancy between the iOS impressions (media around 20 microns). A wider discrepancy was noted mainly at bottom of the inter proximal margins and/or in small areas of axial wall of the

interproximal box (till 100 microns). There was no difference between the two iOS systems.

Conclusions: The two intraoral scanners produced similar precision on teeth. The higher discrepancy was recorded in the margins of interproximal boxes. All discrepancies were within a clinical acceptable range. Both scanners showed to be reliable on taking impressions of single posterior abutments.

PP15

Prosthetic rehabilitation of a young patient with incontinentia pigmenti and partial anodontia: A case report

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Introduction:

Incontinentia pigmenti or Block-Sulzberger Syndrome is a rare X-linked dominant genodermatosis with skin, hair, nails, dental and oral abnormalities. The most frequent oral complications are enamel hypoplasia, reduced asymmetric alveolar ridge height, high arched palate, malocclusion, delayed eruption and partial anodontia.

Case Description:

This report describes a 14-years female patient with incontinentia pigmenti who exhibited multiple missing teeth in both arches and suffered from poor esthetics and impaired chewing function. A medical history was taken, and radiographic examinations (panoramic radiography, cone beam computed tomography) were made. Occlusal analysis involved a critical analysis of the existing dentition through clinical observation

and articulated study casts. Prosthetic rehabilitation in the form of a maxillary acrylic resin removable partial denture and an ultraconservative onlays-fixed partial denture in the mandible was planned. Stable interarch occlusal contacts on all teeth with equal intensity in centric occlusion and appropriate vertical dimension were especially considered. At the end of growth, dental implants can be considered as a definitive implant-prosthetic rehabilitation.

Discussion:

Effective management of partial anodontia of a young patient with incontinentia pigmenti, includes correct timing of interventions, addressing the preservation of the existing tooth tissue with a relatively conservative and reversible prosthetic rehabilitation. Significant improvement in masticatory function, esthetics and psychology of the patient was achieved.

PP16

Retrospective Clinical Study of Fixed Dental Prostheses: Mean Follow-Up of 11 Years

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Objectives of Investigation: To assess the influence of several factors on the survival of tooth-supported fixed dental prostheses retained by vital and non-vital abutments.

Methods Used: The present retrospective cohort study was based on records of patients treated with 3-to-7-unit tooth-supported FDPs with a minimum follow-up time of 6 months after prosthesis delivery. Cumulative survival rate was calculated over the maximum period of follow-up. Cox regression models were used to evaluate the associations between clinical covariates and prosthesis failure.

Results: A total of 331 FDPs in 229 patients were included in the study. The Cumulative survival rate was 90.1% and 77.6% after 5 and 10 years, respectively. Tooth-supported FDP failure

was more prevalent within the first year after prosthesis delivery. Loss of one or more abutment teeth and loss of prosthesis retention were the main reasons for failure. Smoking and type of prosthesis material significantly influenced the survival of FDPs. Abutment vitality, position of non-vital abutment or the length of prosthesis did not show any significant influence on the occurrence of prosthesis failure.

Conclusions: Smoking and type of prosthesis material are suggested to contribute to increased rate of FDP failure.

Keywords: Survival rate, prosthesis failure, smoking, post and core, prosthesis material, bruxism, and multivariate analysis.

The authors deny any conflicts of interest with regard to this study.

Material-mechanical Investigation of Hypoallergenic Denture Base Resins.

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Objectives of Investigation: In western industrialised countries, allergies have been increasing continuously. Type IV-reaction in relation to denture base resins is relevant in prosthodontic treatment. Hypoallergenic denture base resins have been freed from allergenic substances. The objective of this *in vitro*-study was to compare mechanical properties of hypoallergenic denture base resins to polymethyl methacrylate-based (PMMA) denture base resins.

Methods Used: 140 test specimens of hypoallergenic denture base resins (Polyan, Versyo.com, Microbase, Sinomer, Acetal, Erkocryl, Luxene) and 60 test specimens of PMMA-based denture base resins (Paladon 65, PalaXpress, SR-Ivocap) were manufactured. E-Modulus, flexural strength, compressive strength, indentation hardness, average roughness and water absorption were measured.

Results: Microbase performed the largest E-modulus values (3853 ± 123 MPa), Acetal (3311 ± 248 MPa) and Versyo.com (3234 ± 109 MPa) exceeded the comparative level. Microbase (65.3 MPa ± 4.4 MPa), Sinomer (71.4 ± 8.5 MPa) showed lower

flexural strength values compared to PMMA dentures. Data of the remaining hypoallergenic denture base resins were in range of variation. Compressive strength values ranged from 99.8 ± 8.7 MPa (Erkocryl) to 257.8 ± 68.8 MPa (Versyo.com) and were in the comparative level. Indentation hardness ranged from 64 ± 26 N/mm² (Sinomer) to 177.2 ± 1 N/mm² (Versyo.com). Luxene (154.7 ± 6.4 N/mm²) performed values in the comparative level. Average roughness values ranged from 0.03 ± 0.005 µm (Polyan) to 0.38 ± 0.02 µm (Acetal) and were in the comparative level. Water absorption values ranged from 19.36 ± 2.6 µg/mm³ (Polyan) to 25.9 ± 2.6 µg/mm³ (Erkocryl) and were in the comparative level.

Conclusions: None of the hypoallergenic denture base resins fulfilled all demands of the particular comparative group. However, Polyan, Versyo.com and Luxene performed suitable results that the use for removable dentures might be adequate. Further *in vivo* experiments should verify these *in vitro* results.

Keywords: hypoallergenic, denture base resin, PMMA, materials science, *in vitro*

Surgical and prosthetic approach for a malpositioned implant supported crown at lower canine.

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Introduction: Implant therapy is very common in everyday dental practice, as it is considered to be the most conservative way to restore a single missing tooth. For the desired outcome, both surgical and prosthetic steps have to be designed carefully, at the very early steps of the treatment plan, so both implant and implant crown can meet the criteria for health, function and esthetics. When an implant is malpositioned and biological, functional or esthetic problems have appeared, prosthodontist have to decide the best treatment plan for each case, with the removal of the implant being the best choice in many cases.

Case description: A young lady came to our office, complaining about the appearance and a 'bad feeling' for a -6 years- implant restoration at the lower left canine. Clinical and radiographical data showed a malpositioned implant, with almost 5 spirals outside of the buccal bone and a bulky cement retained PFM crown. The final treatment plan was determined after the

removal of the old crown which revealed a destroyed neck of the implant. The plan included, removal of the implant, bone grafting and a new implant with a screw retained crown, following a staged protocol. The new implant placement was performed via a digitally designed and printed guide, in order to achieve the desired place. The final crown was screwed after a period of one year and the two years recall showed a stable outcome, both biologically and esthetically.

Discussion: In contemporary dentistry, digital tools can help clinicians to design implant surgery and follow more predictable ways, in order to avoid mistakes of the past. Implant therapy is a very conservative way to restore missing teeth, but clinicians should be very careful at every clinical step, as replacing malpositioned implants can demand more extensive and invasive clinical steps.

Fully guided implant surgery followed by immediate loading with chairside fabricated implant-supported provisional prosthesis.

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Introduction: Computer-assisted implant planning in combination with template-guided implant placement protocols permit an accurate and predictable implant placement with a less invasive surgical procedure. The purpose of this case report is to present an implant placement workflow combining virtual implant planning, template-guided implant surgery and immediate loading. Emphasis is given on the fabrication procedure of provisional implant supported prosthesis.

Case description: A 72-year-old healthy male patient presented in the Department of Prosthodontics of Athens Dental School with a maxillary complete denture opposing a three-unit implant-supported prosthesis on two implants in the region of teeth #45 and 46. His chief complaint was chewing difficulty due to the loss of lower teeth. Treatment planning included the fabrication of a new maxillary complete denture and a mandibular implant-supported fixed prosthesis on five implants. Implant placement planning and surgical guide design were performed with the use of an implant planning software (coDiagnostiX,

Dentalwings) based on patient's CBCT scan data. Three dental implants were placed in the mandible with a fully guided implant surgery protocol, multi-unit abutments were immediately placed and an abutment-level impression was made after suturing. A full-arch provisional prosthesis was delivered a few hours later supported by five dental implants. Two months later, the patient was rehabilitated with a final hybrid implant-supported prosthesis.

Discussion: Virtual implant planning and template-guided implant surgery allow clinicians to perform implant placement in a precise and safe manner saving chair time during the surgical procedure. The workflow presented demands a high skills level, seamless collaboration and an interdisciplinary approach that ensures a predictable esthetic and functional outcome in simple to advanced surgical cases, with a minimum number of appointments at the practice.

The Use of PEEK for a Full-Arch Four-Implant-Supported Fixed Prosthesis

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Introduction: This clinical report presents a modified polyether-ether-ketone (PEEK) as an alternative material for the fabrication of an implant framework for a full-arch four-implant-supported fixed prosthesis. This modified PEEK material containing 20% ceramic fillers (BioHPP; Bredent GmbH & Co KG), presents high biocompatibility, good mechanical properties and low modulus of elasticity (4 GPa) providing a cushioning effect that may reduce stresses transferred to the restoration and the opposing dentition.

Case description: A 60-year-old man presented for replacement of a failing maxillary fixed prosthesis. All maxillary teeth were extracted and 4 implants were placed (#14,12,22,24). 6 months later a heat-polymerized acrylic fixed interim prosthesis was delivered. After definitive impression and interocclusal centric relation record, prefabricated high-impact PMMA composite veneers (Novo.lign; Bredent) were arranged and clinically evaluated. The tooth position was recorded on the definitive cast with a silicone matrix. A wax framework pattern was fabricated and the BioHPP framework was constructed with the conventional lost wax technique using a vacuum press device

(400°C, 5.5-6 bar). The framework fit was verified intraorally and then the prosthesis was clinically evaluated with the same veneers using the same silicone matrix. The PEEK framework and the veneers were airborne-particle abraded (110µm, 250 to 350 kPa) and coated with a composite resin primer (visio.link; Bredent) and light-polymerized for 90 seconds. A dentin colored dual-polymerizing adhesive composite resin (Combolign; Bredent) was used to attach the PMMA veneers to the framework. A pink shade indirect light-polymerized nanofilled composite resin (Crea.lign; Bredent) was used to imitate soft tissues and the definitive restoration was delivered to the patient.

Discussion: PEEK implant frameworks in combination with prefabricated high-impact PMMA veneers can be a viable treatment solution for all-on-4 implant restorations. However, more clinical studies are needed to evaluate the behavior of this new material.

Keywords: PEEK, Implant-supported, Dental Prosthesis

Stage III Osteonecrosis treatment with prosthetic appliances

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Introduction: Biphosphonates are a class of drugs for the treatment of osteoporosis and similar diseases that prevent the loss of bone density. A very severe complication is osteonecrosis of jaws. Only 30% of patients with complications related with Zoledronic acid (the only one suitable for avoiding metastases in solid tumors) are treated. The treatment in Stage III osteonecrosis (exposed necrotic bone extends beyond the limits of the alveolar process) includes antibiotic, antiseptics and surgical resection of necrotic bone.

Case Description: A 65-year-old male patient with prostate cancer in 2013 was treated surgically and started taking Zometa 4mg/100ml. In 2016 due to severe problems, he visited a stomatologist, a radiologist and an Oral and Maxillofacial surgeon, who recommended the immediate cessation of biphosphonate, and removal of the implant supported prosthetic superstructure in the upper jaw. After repeated failed attempts, the case became Stage III, so an extensive resection of the necrotic bone was

proposed to the patient that would include extensive removal of the upper jaw. The patient's refusal led the patient to our practice. It was decided to manufacture hard protective splints (thermoformed Scheu) with good fit at the borders and space at the places of the lesions in order to store a quantity of medicine (elugel for 15 days and alternatively periocline for another 15). After 3 months there was a significant improvement with coverage of much of the necrotic bone with mucosa. Then a complete denture was manufactured with a soft base. In 2019 there was complete therapy with normal mucosa and the condition remained stable.

Discussion: The hard thermoformed splints assisted the soft tissues to heal over the necrotic bone, protected them from the trauma of opposing teeth and at the same time functioned as reservoirs of the local antibiotics

Keywords: Osteonecrosis, Therapy

All-ceramic Materials for Full Coverage Posterior Restorations

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Objectives of Investigation: To conduct a systematic review to evaluate all-ceramic materials for full coverage posterior restorations. The use of all-ceramic materials for posterior restorations has been increasing as the demand for superior aesthetics and minimally invasive tooth preparations continues to grow. These concerns have introduced all-ceramic restorative materials with better aesthetics, strength, retention and less tooth-wear.

Methods Used: Reports of all-ceramic materials for full coverage posterior restorations covering the last five years were systematically searched for in the following databases: PubMed, Web of Science, Medline. A combination of controlled vocabulary, free-text words and well-defined inclusion and exclusion criteria guided the search.

Results: Lithium Disilicate is used for crowns and posterior bridges up to three pieces, due to increased strength and less need of aesthetics, maintaining strength even at a restoration of 0.3mm thickness. Lithium Disilicate crowns in relation to Zirconia, when coated with a weak ceramic, have greater resistance to fatigue over the years. Zirconia which is stronger and with higher opacity, is used for posterior crowns and small or

large extent bridges. The preferred form is the YSTZ (yttrium-stabilised tetragonal zirconia). Monolithic Zirconia restorations properly polished are unlikely to lead to excessive wear of opposing dentition.

Conclusions: Among the available all-ceramic materials for posterior full-coverage restorations, these fabricated by Lithium Disilicate or Zirconia can achieve high longevity, as long as they follow all biological and mechanical principles. Further research for more conclusive evidence is needed.

Keywords: zirconia, lithium disilicate, all-ceramics

New Treatment Concept in Patients with Bruxism

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Objectives of investigation: To present the current trends in the therapeutic approach of bruxist patients using new ceramic materials and techniques that provide an aesthetic and minimally invasive treatment plan. Bruxism is an oral condition of deep interest to both researchers and clinicians in the dental field, as the treatment remains challenging. Bruxism is defined as the repetitive muscle activity of the jaw characterized by clenching or grinding of teeth and/or bracing or thrusting of the mandible. The prevalence is approximately 20% among the adult population. There is a variety of negative consequences related to bruxism such as temporomandibular pain and dysfunction, failures of restorations and repetitive tooth wear.

Methods and Materials: A systematic literature search was conducted to select retrospective and prospective studies that evaluated or compared techniques/materials that aid in the restoration of teeth with severe wear due to bruxism. A search was conducted in PubMed and Google Scholar with a limit of 5 years from publication.

Results: Restorative approaches for patients with bruxism and worn dentition may include direct and indirect composite restorations or different types of ceramic restorations, such as onlays, veneers, and crowns, either alone or in combination with one another. Monolithic zirconia, lithium disilicate and feldspathic ceramics are the most commonly used ceramic materials. The introduction of CAD/CAM and digital dentistry has provided a new way of producing fixed restorations for such patients offering aesthetics and functionality. Following the completion of rehabilitation, a stabilization appliance should be made to control the symptoms of bruxism, and to avoid fracture of the restorations.

Conclusion: The management of worn dentition is a major challenge for dental professionals. Among all available treatment alternatives, there remains a need to identify the modality that combines the best relative cost-effectiveness, highest longevity, greatest benefit to the patient, all while withstanding the course of time.

Keywords: Bruxism; Worn Dentition; CAD/CAM

Analysis of implant treatment using finite element methods

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Objectives of Investigation: The purpose of this study was to try to use finite element methods as a predictive tool for the prosthodontic treatment using dental implant.

Methods Used: Three-dimensional finite element models for the biomechanical analysis were generated based on the patient's CT data. The data from partially edentulous and edentulous patients were used. Finite element models were prepared during the preoperative process of computer-assisted surgical planning for implant placement. The image data in a DICOM format were imported into the mesh-generating software and three-dimensional representation of the oral and maxillofacial structures and prostheses were created. The virtual expression of the implants and prosthesis was performed. Finally, a three-dimensional finite element model was created. When the loads simulating masticatory force were applied on the occlusal surfaces of the prostheses, von Mises stresses and displacements of the components were analyzed.

Results: Stress distribution of the finite element models could be observed. By analyzing stress concentration, weak or cautious structures could be found. Comparing data with reported values, the prognosis of the prostheses, implant and treatment planning could be predicted.

Conclusions: The results of this study suggested that the prediction of the prognosis of the treatment planning using finite element planning might be obtained. Preoperative patient-specific computer modeling could be used as a diagnostic tool and give valuable information in solving problems in clinical fields. In addition, immediate generation of finite element meshes using commercial software might give us valuable information.

Effect of Acidic Oral Cavity Conditions on the Mechanical and Optical Properties of Lithium Disilicate Ceramics

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Objectives of investigation: All ceramic systems were introduced in dentistry to meet increased esthetic expectations. They are recommended for restorations in the esthetic zone and are preferred over ceramometal FPDs in cases of acidic oral environment due to their excellent esthetics and superior durability. Acidic pH with intrinsic (gastric acid) or extrinsic origin (consumption of acidic beverages) could affect ceramics' surface compromising mechanical properties and color stability. Although these parameters are thoroughly investigated in case of Zirconia, there is little evidence concerning lithium disilicate ceramics (LDC).

This review aimed to investigate the effect of acidic pH on mechanical and optical properties of LDC.

Methods used: Literature search in pubmed was conducted. Lithium disilicate, gastric acid, surface roughness, acidic beverages and color stability were used as keywords and search was augmented by using the option of "related articles". 65 studies were selected according to predetermined inclusion/exclusion criteria and 13 were evaluating mechanical and optical properties of LDC.

Results: Comparative evaluation of the studies was difficult due to differences in experimental protocols. None of the tested materials was proved to be chemically inert. Thickness reported as a parameter affecting all ceramics' color stability and mechanical properties. LDC. Although the acidic agents tested (wine, sodas etc.) had the potential to affect color and surface roughness, this effect was not clinically significant. LDC and Zirconia were less affected by the staining acidic solutions, whereas LDC showed the greatest color stability compared to other restorative materials.

Conclusions: Under the limitations of this review, LDC could be used in prosthetic restorations in the esthetic zone in cases of acidic pH in the oral cavity. Patients' beverage consumption habits should be taken into consideration especially when it is combined with erosive conditions in the oral cavity. Randomized clinical trials are necessary to support these in-vitro studies.

Keywords: Dental Porcelain [J01.637.153.377], Gastric Acid [A12.200.307.603], mechanical properties, Beverages G07.203.100, Color G01.590.540.199

Prosthetic rehabilitation of patient with lateral maxillectomy secondary to mucormycosis: A case report

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Introduction: Mucormycosis refers to infection with fungi in the order of Mucorales. Most common risk factors are diabetes, skin injuries and cancer. Once maxilla is infected, surgical resection and debridement are necessary, leading to extensive maxillary defects. The removal of hard palate affects both speech and masticatory function. In addition, there can be fluid leakage through the nose in case of oronasal or oroantral communication. As a result, the clinical challenge is the replacement not only of the teeth but both hard and soft tissue. Prosthetic restoration including implants can improve the life quality of these patients.

Case description: A 34-year-old female patient came to the dental clinic requesting prosthetic rehabilitation. Her medical history included a series of surgical procedures after infection with mucormycosis at the age of 18, diabetes and renal failure. She had a conventional removable restoration at the upper jaw and two implants #11 and #26. Her clinical and radiographic

examination revealed a lateral maxillectomy defect and a fistula of the posterior palate. There was partial absence of the right alveolar ridge and teeth. The patient faced functional and aesthetic problems. Treatment planning included an implant-retained removable partial denture at the upper jaw (obturator) and 5 ceramic veneers of the anterior upper teeth.

Discussion: Prosthodontic restoration of maxillofacial defects is a multidisciplinary task. Osseointegrated implants can contribute to the retention, stability and support of an obturator. Material and method of impression, interocclusal record and the try-in stage are of great importance in the construction of restoration. Further hard and soft tissue surgical corrections can be painful for a patient. However, the custom-made design of the removable denture can restore speech, mastication and facial deformities.

Keywords: mucormycosis, implants, obturator

Physiological, pathological and artefact sounds in the temporomandibular joint auscultation.

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Objectives of Investigation: During mandibular movements no sounds from temporomandibular joints (TMJ) are expected. However, if they do appear, the cause should be found. The aim of this study was to identify the specific characteristics of sound signals of the healthy TMJ, these with dysfunction, and to analyze the examination artifacts and their possible causes.

Methods Used: Sixty nine people participated in the study. The first step was a clinical interview. Subsequently, the patients were examined with the axis I and axis II of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to receive the diagnosis. The final step was the auscultation of TMJ with two independent but synchronized stethoscopes 3M™ Littmann® Electronic Stethoscope 3200 Model performed simultaneously during opening and closing mouth. The signals were sent via Bluetooth from the memory of the stethoscopes to the computer and analyzed using dedicated software. The research

was approved by the Bioethics Committee (1072.6120.71.2019), and all of the participants voluntarily agreed to take part in the examination.

Results: Each patient received a diagnosis according to the evaluation criteria of the RDC/TMD questionnaire. Then, the recorded signals were compared with the diagnosed dysfunction. The recorded sounds without a diagnosis were classified as artefacts and their origins were analyzed. The characteristics of sound signals in each group of patients were presented in a graphic form.

Conclusions: There are specific differences between signals from temporomandibular joints. The graph visualization is an appropriate tool to present the signals in an interpretable form.

Keywords: Auscultation, TMJ

Immediate loading of six implants in a maxilla using guided surgery and intraoral scanning.

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Introduction: Immediate loading of six implants on the upper jaw has been thoroughly documented, especially when the initial stability is measured through means of Magnetic resonance and ISQ values above 70. The use of Intraoral scanning to deliver the accurate situation of the oral cavity, CBCT files transferring the information of the 3D bone volume and Specific designing software, facilitate the entire procedure, providing surgical templates of high precision and immediate PMMA restorations just in a few hours. The aim of the presentation is to describe all the clinical and laboratory steps followed on a clinical case delivered in our clinic.

Materials and Methods: A healthy sixty year old, female patient seeking functional and aesthetic rehabilitation of her collapsing dentition proceeded to our clinic. On the upper jaw the only teeth standing were the six anterior teeth, which were suffering from extreme periodontal loss and in combination with the loss of posterior occlusion, presented third grade mobility. The patient's desire was to be restored with fixed prosthetics

throughout the duration of the treatment. An intraoral scan of the remaining dentition was conducted using Carestream CS3600 intraoral scanner. A CBCT was obtained, and it was decided that the remaining teeth would be extracted and six implants would be placed in the maxilla and immediately loaded using an interim PMMA prosthesis. All data collected were processed through Dental Wings Software of CoDiagnostix™, and two surgical splints were ED printed. The tooth supported splint was used to drill the exact position for the bone pins, and implants were placed through the bone supported splint. The software provided the desired type of Fast and Fixed abutment (Blue Sky Implants, Bredent Group GmbH&Co. KG), and a digital impression was established, placing scanning posts on abutment level.

The PMMA interim prosthesis was delivered a few hours later, its fit and aesthetics were excellent and a few adjustments were made to the occlusion. The patient was satisfied with the result in all desired aspects.

Conclusion: The evolution of digital technology in dentistry provides us with great benefits in the field of implantology both in the surgical and the prosthetic part of the treatment plan. Immediate loading of an edentulous jaw has been a great challenge for the clinicians involved. However, the use of

guided surgery in combination with intraoral scanning, and all CAD/CAM laboratory procedures involved, diminishes patient discomfort, maximises the accuracy of surgical procedure and facilitates the fabrication of ideal prosthesis.

PP29

Maxillary Rehabilitation with Crown Lengthening, Veneers and Dental Implant after Orthodontic Treatment.

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Introduction: Restoring the anterior region is perhaps the most challenging case a restorative dentist will have to deal with. The following clinical case report presents step by step the rehabilitation of the anterior area of an esthetically demanding patient.

Case Description: A 23-year-old female patient visited our clinic with the chief complaint of the left central incisor discoloration. After clinical and radiological examination, a periapical radiolucent defect was observed at teeth #21, 22. The root canal treatment of tooth #21 was not acceptable regarding technical and biological standards and there was root resorption at tooth #22. In addition, the canine #13 was impacted. A CBCT radiograph was performed in order to evaluate the size of the periapical defect and the exact position of the impacted tooth. The treatment plan included orthodontic treatment with guided canine eruption, root canal retreatment of tooth #21, extrac-

tion of tooth #22 and the removal of the periapical lesion. One year after the root canal retreatment, a vertical root fracture was diagnosed and tooth #21 was extracted. A new CBCT was performed to evaluate the dimensions of the alveolar ridge and a dental implant was placed at site #22. After the orthodontic treatment, a mock-up was placed and was used as a surgical guide for esthetic crown lengthening. Six months after the surgery, we proceeded with preparation of veneers at the anterior region and the placement of the final implant restoration.

Discussion: A multidisciplinary approach of the treatment planning in demanding cases may predictably lead to a biologically, esthetically and functionally acceptable result. We have to examine carefully every clinical case and select the best treating option.

Keywords: Dental Prostheses, Crown Lengthening, Dental Implant

PP30

Case Report: A Fully Digital Approach of Complete Dentures

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Introduction: Digital workflow has significantly impacted dentistry, minimizing patient's discomfort and providing time-effective treatment plans. The objective of this clinical case report is to highlight the opportunities offered by digital dentistry in cases of complete dentures.

Case Description: 18 years ago, the edentulous maxilla of a female patient was treated with 7 implants that were loaded immediately with heat cured acrylic provisional restorations. The patient did not proceed to definite restoration and actually never returned for her scheduled appointments, until 6 months ago. The clinical and radiographic examination revealed generalized severe chronic peri-implantitis and significant bone loss. In the maxilla the implants were still supporting the 18 years old provisional restoration. Intraoral scanning was performed and virtual casts were mounted at the desired OVD. The remaining teeth images were, then, deleted in the virtual 3D-image of the maxilla and the obtained data were imported into denture planning software to design the complete denture. The resulting data were exported

to a milling machine for denture fabrication. Upon completion, all the remaining implants were extracted and excess bone and gingival tissues were removed. The maxillary digitally fabricated immediate denture was inserted after suturing. Minimal chairside adjustments were made. A week later, sutures were removed and the denture was relined chair-side. The retention of the denture base was excellent. The patient had no difficulty with mastication and was pleased with the esthetic outcome.

Discussion: During the whole digital workflow of this case, the existing implant prosthesis wasn't necessary to be removed, except from the delivery day. Additionally, in the digital workflow only two sessions are necessary for denture delivery, whereas the conventional workflow requires five. Given the additional time needed for laboratory steps, the digital workflow is a time-saving procedure. Finally, the possibility of archiving the acquired digital impressions and fabrication data at any time, is a major clinical advantage concerning replacement or copy dentures.

Keywords: Computer-Aided Design, Dentures

Digitally-driven Protocol: Combining Crown Lengthening With Optimal Restorative Workflow

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Introduction: Esthetic reconstruction of the anterior maxillary region challenges even the most skillful clinicians. Nevertheless, up-to-date digital technology ensures satisfactory and predictable results. State-of-the-art dental restorations, pristine periodontal health and symmetrical soft tissues are the pillars of an attractive smile. Redesigning smile using digital smile design (DSD) software and visualizing the potential result using mock-up, facilitate the approval of the treatment plan by the patient.

Case description: A 65-year-old female patient was referred to our clinic for prosthetic rehabilitation. The treatment plan was focused on improving the esthetics of the anterior maxillary area via employing CAD/CAM technology. Violation of biologic width, followed by gingival inflammation and recession of the interdental papilla of upper central incisors was detected, due to defective prosthetic restorations. By utilizing DSD software, new gingival margins and teeth shapes were visualized. Intraoral scanning was obtained and by incorporating DSD information, a digital wax-up was designed. Provisional restorations for central incisors and a surgical index were 3d-printed, prior to surgery. Teeth #11, #21 were fully reshaped digitally and

gingival margins of teeth #14 to #24 were relocated apically. Previous fixed prosthesis at central incisors was removed and endodontic retreatment was performed. Reconstruction of abutments was executed with high-performance polymer posts and prefabricated provisional crowns were temporarily cemented. Clinical crown lengthening was executed, in order to surgically correct the biologic width impingement and enhance esthetics. Gingivectomy was guided by the surgical template, to determine the altered gingival zeniths. PMMA-prefabricated transitional restorations were relined intraorally and cemented. Final restorations were cemented upon soft-tissue maturation.

Discussion: Digital technology improves the dentist-patient communication, enabling the latter to preview the final potential outcome of prosthetic and periodontal interventions. Additionally, it contributes to the fabrication of surgical guide, an asset in clinical cases that demand a multistage surgical and restorative approach.

Keywords: Three-Dimensional printing, dental prosthesis design, oral surgery, esthetics, digital technology

Influence of Different Polishing Systems on the Surface Roughness of Resin Composites

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Objectives of Investigation: Surface properties of restorative materials are clinically important in terms of the durability and survival of restorations. The aim of this study was to evaluate the surface roughness of three resin composites after polishing with eight different polishing systems.

Methods Used: A total of 405 disc-shaped specimens (5x2 mm) were prepared with a micro-hybrid composite (Filtek Z250, 3M ESPE), a nano-hybrid composite (Herculite XRV Ultra-Enamel, Kerr) and a nano-ceramic composite (Zenit, President Dental). The specimens were cured under mylar strips for 20 sec with a LED light curing unit (VALO, Ultradent). For each composite, specimens were divided into 9 groups according to the following polishing systems: Mylar strip (MS) (control), EcoComp (EC) (Eve), Diacomp Ultra (DU) (Eve), Flexi-Dia HP (FD) (Eve), OptiDisc (OD) (Kerr), Super-Snap Disks (SS) (Shofu), Poli-Pro Disks (PP) (Premier Dental), Kit Polidont (KP) (Microdont) and Sof-Lex XT (SL) (3M ESPE) (n=15). The surface roughness was measured with a surface profilometer. The normality of data was analyzed with Kolmogorov-Smirnov test. Kruskal-Wallis test was used for

analyzing the differences between groups and post-hoc analyses was performed with Mann-Whitney U test (p<0.05).

Results: There were no statistically differences among all types of composites in MS, EC, FD, KP and SL groups (p>0.05). The surface roughness values of micro-hybrid composite polished with EC and FD groups were significantly higher than control group. The surface roughness values of nano-hybrid composite polished with EC, DU, FD and OD groups were significantly higher than control group. The surface roughness values of nano-ceramic composite polished with EC and DU groups were significantly higher than control group (p<0.05).

Conclusion: Polishing procedures affect the surface characteristics of the composite restorative materials. The polishability of restorative materials can be influenced by abrasive of polishing systems and filler types of composites.

Keywords: Resin Composite, Polishing Systems, Surface Roughness

Multidisciplinary Treatment Management in Ectodermal Dysplasias: 15-Year Follow-up of Two Cases

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Introduction: Ectodermal dysplasia (ED) is a rare hereditary disease with X-linked recessive inheritance characterized by congenital dysplasia of structures of ectodermal origin. This large group of hereditary disorders is characterized by the triad of signs comprised of sparse hair (atrachosis or hypotrichosis), abnormal or missing teeth (anodontia or hypodontia), and inability to sweat due to lack of sweat glands (anhidrosis or hypohidrosis). Hypodontia affects the primary and permanent dentition and is characterized by congenital loss of multiple teeth. Dental treatment depends on the severity of disorder. Treatment should be planned considering the patient's age, growth and development.

Case Description: This case report describes the 15-year follow-up and multidisciplinary treatment of two sisters, 11 and 8 years old, with ectodermal dysplasia, who had a history of consanguineous marriage between the parents. Two sisters

diagnosed with hypohidrosis ED are presented, as it is a rare clinical picture. Within the scope of multidisciplinary treatment after orthodontic treatments, removable partial dentures were applied to the cases before fixed prosthetic treatments. Upper-lower fixed prosthetic restorations which were applied at age 19 are followed up with regular controls.

Discussion: ED cases require a professional and multidisciplinary approach in terms of chewing function, orthognathic growth, oral and dental health. Fixed prosthetic restorations applied to the cases are important in solving problems related to functional, aesthetic, and psychological issues and improves a patient's quality of life. In terms of sustainability, it is important to find solutions to the problems as soon as possible by monitoring the patient with regular controls.

Keywords: Ectodermal dysplasia, hypodontia, prosthetic rehabilitation

Posterior Monolithic Zirconia Single Crowns - A Two-year Critical Clinical Evaluation

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Objectives: Monolithic zirconia has become a common material for manufacturing single crowns. By combining a minimal tooth reduction with good esthetic results, this material offers an alternative to classic metal ceramic crowns. However, there is a limited number of clinical studies investigating the clinical performance of these restorations. Therefore, aim of this prospective cohort study was to evaluate the clinical performance of posterior monolithic zirconia single crowns (MZSC) two years after insertion.

Methods: A total of 30 posterior MZSC were inserted. The crowns were evaluated and inspected at baseline and 1, 3, 6, 12 and 24 months after insertion. The clinical and occlusal situation, any biological or technical complications and occlusal changes on the crowns and opposite jaw were documented using documentation forms, intraoral photographs and impression casts. A descriptive data analysis took place and a significance level of $\alpha=0.05$ was set, while a p-value <0.001 represented high significance.

Results: Thirty patients received a MZSC (14 premolars, 16 molars). At the two-year follow-up 26 crowns were examined representing a drop-out of 13.3%. One biological complication

(vertical root fracture) was recorded. No other biological or technical complications were detected. Signs of abrasion in the opposite jaw and MZSC as well have been noticed in some cases.

Conclusions: Posterior MZSC seem to have a good middle-term clinical performance offering a promising alternative to conventional metal ceramic crowns. However, the positive long-term performance of these restorations will still have to be evaluated. Signs of abrasion in the opposite jaw and crowns will have to be observed and evaluated further.

Keywords: crowns, monolithic, zirconium oxide, clinical study, ceramic

3D Printed Complete Removable Dental Prostheses: A Review

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Objectives of Investigation: The purpose of this paper is to review available literature on digital, and particularly 3D printed, dentures in terms of novel biomaterials, fabrication techniques and workflow, clinical performance and patient satisfaction.

Methods Used: The methodology included constructing a search strategy, defining inclusion and exclusion criteria, and retrieving studies; selecting studies; extracting relevant data; and forming tables to summarize the results. Searches of PubMed, Scopus, and Embase databases were performed independently by two reviewers to gather literature published from 2010 to 2020.

Results: A total of 56 selected articles were reviewed, 37 *in vitro* studies, and 19 clinical studies. In terms of material strength, adaptation of milled denture base was shown to be a superior to the printed base. Regarding denture tooth bonding, milled monolithic teeth and base (one unit) produces a stronger result than a printed

tooth bonded to a printed base. The benefits of printing include the ability to print multiple denture bases at once, printers are more affordable than milling machines, and less material waste. On the other hand, the current limitations of printing include monochromatic teeth, the need for specific photopolymer materials, and necessity for human time for finishing the prosthesis. Most common current applications for 3D printed dentures are immediate and/or interim complete removable dental prosthesis.

Conclusions: 3D printing has the potential to modernize and streamline the denture fabrication techniques, materials and workflows. Initial studies have shown promising short-term clinical performance, positive patient-related results and cost-effectiveness. Further research, however, is required on the existing and novel materials and printers, to allow for expansion of this technology's applications in restorative dentistry.

Effects of tooth bleaching protocols using Er,Cr:YSGG and diode lasers on color change of resin-based restoratives

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Objectives of Investigation: To evaluate color change of a BPA-free composite resin and a resin-matrix infiltrated with ceramic CAD/CAM material after two in-office tooth bleaching protocols using Er,Cr:YSGG (2780 nm) and diode (980 nm) lasers.

Methods used: A nanohybrid composite resin (EP), a Bis-GMA free composite resin (EPBio) and a resin-matrix infiltrated with ceramic filler particles CAD/CAM material (HC) were tested. Ninety specimens were prepared and stored in artificial saliva. Group 1 received an in-office bleaching treatment using 40% H₂O₂. The same bleaching procedure was assisted by Er,Cr:YSGG laser in Group 2 and by a diode laser in Group 3. Color measurements were performed using a double-beam UV-Vis spectrophotometer at four-time intervals.

Results: Color change did not exceed the established 50:50% acceptability threshold ($\Delta E < 2.7$). EP presented the highest color change after the bleaching followed by EPBio and HC ($p < 0.05$). Three-way ANOVA revealed that type of material and time of measurements significantly affected color change ($p < 0.001$). After 24 h, HC presented the lowest ΔE value following all bleaching treatments ($p < 0.05$). After 15 days, EP exhibited the highest ΔE after all bleaching treatments ($p < 0.05$). After

30 days, EP presented higher ΔE values than the other two materials ($p < 0.05$), following the conventional bleaching treatment. Nevertheless, after diode laser (980 nm) treatment, the materials did not show significant differences in ΔE ($p > 0.05$), while after Er,Cr:YSGG laser treatment, HC presented significant lower ΔE ($p < 0.05$). Both laser-assisted bleaching treatments presented lower ΔE values than the conventional treatment for EP ($p < 0.05$).

Conclusions: The tested treatments assisted by Er,Cr:YSGG and diode lasers did not induce unacceptable color changes in the resin-based restorative materials. These findings support that the esthetic appearance of the specific materials is not compromised in case they are accidentally exposed on the bleaching gel and laser irradiation.

Keywords: Tooth bleaching, Er,Cr:YSGG laser, Diode laser, BPA-free composite resin, resin-matrix infiltrated with ceramic CAD/CAM material

Correlation between intercanine distance and number of bony segments in anterior jaw reconstruction.

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Introduction: Surgical design and simulation (SDS) has allowed head and neck reconstructive surgery following tumour resection to become increasingly efficient and precise. However, technological advances notwithstanding, the digital workflow still offers challenges in the timescale it takes to plan the SDS. While it is not possible to use a fully templated workflow for all patients, there is still an opportunity to partially template the SDS workflow.

Case description: This is a retrospective study of patients who underwent surgical planning. The aim was to template part of the SDS workflow, by determining if there was a correlation between the number of fibula bone segments used in reconstruction (V-shaped(two-segment) vs. U-shaped(three-segment)) of the anterior jaw and the maxillary and mandibular intercanine distance. Following standardisation, models of patients' anterior jaws were used to measure intercanine distance based on four distinct groups: maxillary anterior two-segment reconstructive design (1)

or a three-segment reconstructive design (2), or mandibular anterior two-segment reconstructive design (3) or a three-segment reconstructive design (4).

Discussion: The average intercanine distance of maxillary reconstruction patients who required a two-segment design was 34.33mm (n=8) and who required a three-segment design was 36.01 mm (n=6). The average intercanine distance of mandibular reconstruction patients who required a two-segment design was 26.34mm (n=9) and who required a three-segment design was 26.94mm (n=8). A weak correlation was observed between the intercanine distance and the different maxillary reconstruction designs; however, no such correlation was observed in the mandibular reconstructions. This study was one of the first of its kind to attempt to partially template the SDS workflow to create an algorithm to predict whether the anterior jaw reconstruction(maxilla or mandible) should be carried out with a three-segment plan (U-shaped) or a two-segment plan (V-shaped).

Clinical survival of metal vs nonmetallic posts for restoring endodontically treated teeth: Critical literature review

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Objectives of Investigation: Numerous post materials and techniques have been proposed for the restoration of endodontically treated teeth (ETT). Metallic cast and prefabricated posts in combination with metal ceramic crowns have been utilized for decades. Recently, several non-metallic, tooth-coloured posts have been alternatively applied in response to the request for enhanced esthetic result with all ceramic crowns, reduced financial cost and less stress concentration. Given the lack of clinical evidence regarding the best post to use for the restoration of ETT, the aim of this review was to compare the clinical survival rate of metal and nonmetallic posts. Additionally, two restorative options are being presented in two case reports, regarding different material post systems for the prosthetic rehabilitation of anterior ETT.

Methods Used: Research in three online Libraries (Medline, Scopus, CENTRAL) was performed for clinical (prospective, retrospective and randomized controlled clinical trial) studies with

follow-up at least 3 years. Search terms applied were: clinical survival rate of ETT with posts, cast post and core and clinical study, nonmetallic post and clinical study, fiber post and carbon-reinforced resin post and clinical study. Included articles were selected from January 2000 up to February 2021.

Regarding the case reports, the selection of an adequate restoration of the patients was guided by the functional and esthetic requirements of the clinical cases.

Results: Twenty studies were selected for final analysis over an initial yield of 109 titles. Non metallic (fiber glass) posts have demonstrated good clinical survival (ranged from 86.6%-95.2%) with similar to cast post (ranged from 88.8%-95.5%) but in shorter (3 to 5 years) follow-up period.

Conclusion: Cast posts and cores present good clinical survival for period twice as long as the fiber glass posts, but the associated failures are mostly irreversible. Longer term clinical studies are required to further strengthen this evidence.

Margina Bone Loss Around Cemented IFPDs: A Cohort Study.

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Objectives of Investigation: The aim of the present study was to assess the peri-implant conditions (bleeding on probing (BOP), pocket probing depth (PPD)) and marginal bone loss (MBL, marginal bone level change between follow-up and occlusal loading) around cement-retained Implant-supported Fixed Partial Dentures (IFPDs) on bone-level implants (EVEN, Mech & Human, Albignasego, Italy).

Methods Used: The study was a retrospective cohort study with up to 12 years (mean 6.6 years) follow-up. Patients with cemented IFPDs were included. Implant survival, BOP, PPD, MBL, biologic complications (peri-implant mucositis and peri-implantitis) were evaluated.

Results: 16 patients with 43 implants were included. The implant survival rate was 97.67% because one distal implant was lost due to peri-implantitis in a patient with poor oral hygiene conditions. Peri-implant mucositis was a relatively common finding, affecting 16/43 of implants (37.20%). After probing the mesial, buccal, distal and lingual aspects for each implant supporting the restoration, we obtained an average value of 3.82mm for PPD; also, we recorded 37.79% bleeding sites (BOP). Mean MBL was 1.26mm, ranging from 0.48 to 5.35mm.

Conclusions: High implant survival rate was achieved after a mean observation period of 6.6 years, but mucositis seemed to show up frequently around cemented IFPDs. Further investigations with larger sample size are needed to confirm the low rate of long-term MBL displayed by the present study.

CAD/CAM provisional restorations: an overview of recent developments

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Objectives of investigation: Recent advances in computer-aided design/computer-aided manufacturing (CAD/CAM) technologies and their ease of application created the modality of innovative treatment concepts for contemporary prosthodontics. With such fast expansion, new manufacturing methods and novel materials continue to appear abruptly and, therefore, this influences provisional restorations as well.

Methods used: An electronic data research was held via the international scientific databases PubMed, Medline and Google Scholar using keywords such as: "provisional / interim / temporary restoration / prosthesis / prosthetic restoration" and "CAD/CAM / 3D printing / additive manufacturing / digital technology method". The language chosen was in english and the results were limited to the last 5 years.

Results: Fabricating provisional prostheses in CAD/CAM technology is divided into two methods: subtractive and additive manufacturing. In subtractive manufacturing, also known as milling, there are some limitations concerning the geometry of the desired structure and, most of all, the scepticism about the waste produced and the consequent financial and ecological cost. Concerning the additive methods, which are usually recognized as 3d printing, they do not present the difficulties met in milling and, moreover, studies have proven them to have sufficient mechanical properties for intraoral use compared

to conventionally cured provisional materials. Another clinical advantage is the possibility to easily repair or relin them chairside. Factors that seem to be conclusive for the printing accuracy and need to be considered are printing orientation, resin color setting and printing layer thickness.

Conclusions: Computer-assisted methods for interim prostheses present satisfying clinical performance and sufficient mechanical properties compared to the conventionally used materials. They hold great promises for further evolution but still more clinical research is needed for more long-term conclusions.

Endocrowns: Incorporating Reverse Preparation and Adhesive Approach for the Restoration of Endodontically Treated Teeth

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Objectives of investigation: Restoration of endodontically treated teeth with severe coronal destruction has always been a challenge for the dental clinician. Fabrication of full-coverage crowns along with post and core has been the preferred restoration for many decades. Recently, CAD/CAM technology and evolution of dental materials have introduced new minimally invasive techniques. The aim of this literature review is to examine whether endocrowns are a viable alternative for endodontically treated teeth with extensive structural loss, the indications/contraindications of this restorative approach, the preparation principles and the most appropriate materials for their fabrication.

Methods used: We searched for evidence-based research articles on endocrowns published from January 1995 until May 2021 using the MEDLINE (PubMed) database. After initial screening of the literature, the terms “endocrown”, “endocrowns”, “endo-crown”, “endo crown”, were used as key words. Supplementary manual research was also conducted.

Peer-reviewed articles, articles written in English, and articles regarding endocrown fabrication aspects were the inclusion criteria. Articles not written in English, duplicates, and articles not focusing exclusively on endocrowns were excluded from further evaluation.

Results: After exclusion of irrelevant or duplicated articles, 89 articles were included in the final evaluation process. Endocrowns are associated with a decay-oriented preparation design, taking advantage of both the micromechanical adhesion and the macromechanical retention from the pulp-chamber walls. They are indicated in endodontically treated molars with curved or narrow root canals and limited interocclusal space and they should be manufactured from materials that can be bonded to the tooth structure, such as ceramics, composite resin or hybrid materials.

Conclusions: Endocrowns are a reliable alternative to traditional post and core restorative choices, given that the clinicians respect the requirements and indications mentioned in the literature. Avoidance of root canal reintervention is one of the main advantages of this approach.

Digital smile design: Guided Crown lengthening in the esthetic zone

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Introduction: In the era of digital dentistry, aesthetics constitutes a major factor that determines a successful outcome. An optimal rehabilitation relies not only on certain dental characteristics, but also the soft tissue architecture. Thus, contemporary software for digital smile design offer the opportunity for cervical anatomy to be predictably altered.

Case description: The aim of this presentation is to analyze the digital workflow of a patient with excessive gingival display and smile asymmetry in the esthetic zone. Ideally, the esthetic smile line reveals minimum amount of gingival tissue. Crown lengthening surgery needed to be performed on all anterior teeth, so that both the asymmetry and length-to-width tooth ratio could be corrected. The procedure includes digital impressions and intercuspal position recording with the intraoral scanner (TRIOS; 3shape), initial smile analysis, designing of the teeth shape and gingival contour and manufacturing of a surgical guide for the procedure. The initial incisions are made according to this guide and, in this case, there was no need for bone resection and flap reflection.

The gingival contouring was achieved using diode laser, since the ablation of tissues can be done very precisely, and the wound healing is more favourable. Precise adherence of the guide to the underlying structures is necessary for errors attributed to parallax to be avoided.

Discussion: Esthetic dentistry has emerged as one of the most popular fields and, patient expectation has become a major factor to be taken into consideration. Digital smile design not only analyzes the patient dentofacial features, but also helps in visualizing the desired outcome. Long-term esthetic results in patients with excessive gingival display can be achieved through proper diagnosis and treatment planning. A digitally designed and manufactured surgical guide facilitates the surgical procedure and increases treatment predictability, both crucial aspects that affect patient satisfaction.

Cervico: A new era in emergence profile definition

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Introduction: Implants constitute one of the most popular dental procedures, whose placement significantly increases in number each year. Demands in aesthetics are tremendously high, which calls for extreme clinical skills both at the surgical part and at that of the superficial restoration. Avoidance of complex clinical steps, along with the concomitant ability to achieve optimal esthetics, compose the philosophy behind the invention of the Cervico system.

Case presentation: The patient presented external resorption on the root of the central incisor #21. As a result, its prognosis was defined as poor and the extraction was necessary. A digital impression was received before any intervention in the area, so that the implant placement and final restoration were designed digitally. The provisional restoration was a combination of a modified, individualized healing abutment manufactured with Cervico Mold and a crown identical to the natural tooth. The implant placement was performed without flap reflection and

the provisional crown was immediately placed. Six weeks later, the implant has been loaded with the final restoration and an ideal emergence profile had been shaped.

Discussion: This system serves as a guide for the ideal position and tilt of the osteotomy, as far as the surgical procedure is concerned. The most important advantage is the immediate fabrication of a customized healing abutment, whose morphology at the cervical part mimics that of the natural tooth to be restored. The achievement of such results allows the long-term preservation of the therapeutic outcome both by the clinician and the patient with the daily application of oral hygiene. This event is of vital importance for the avoidance of any peri-implant pathology. Cervico serves the appropriate placement of the implant, as well as the shaping of soft tissues in such a way, that facilitates future plaque removal and gives optimal esthetics in a simpler way.

Instrumented Indentation Testing of CAD/CAM Composite Materials

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Objectives of Investigation: The purpose of this study was the characterization of mechanical properties of different CAD/CAM composite materials employing instrumented indentation testing.

Methods Used: 6 CAD/CAM composite materials [Brilliant CRIOS (BC), Cerasmart (CS), Lava Ultimate (LU), Tetric CAD (TC), Shofu Blocs HC (SB), Grandio Blocs (GB)] and a lithium disilicate CAD/CAM control material [IPS e.max CAD, (EC)] were tested. 15 CAD/CAM fabricated rectangular specimens for each material, after metallographic grinding and polishing, were subjected to Instrumented Indentation Testing (IT). Martens Hardness (HM), Vickers indentation Hardness (HV), Indentation Elastic Modulus (EIT) and Elastic to Total Work Ratio - Elastic Index (η_{IT}) were determined employing a maximum force of 49.03 N and 2 sec dwell time. All properties were determined according to formulas provided by ISO 14577. Three force indentation curves were acquired for each sample and mean value was used to characterize the specimen itself. The results of HM, HV, EIT, and η_{IT} were statistically analyzed by one-way ANOVA employing the material as a discriminating variable ($\alpha=0.05$).

Results: Statistical significant differences were identified among materials for all properties tested ($p<0.05$). The results of the materials tested were classified in the following descending order: (a) [HM(N/mm²)]; EC:4302±135 > GB:953±7 > LU:674±25 > BC:550±5 > TC:530±37 ≥ CS:496±8 ≥ SB:449±7, (b) [HV]; EC:586±12 > GB:136±1 > LU:105±2 > SB:74±1 ≥ TC:74±1 ≥ BC:73±1 ≥ CS:67±2, (c) [EIT/(GPa)]; EC:101±5 > GB:23±1 > LU:15±1 ≥ BC:14 ≥ TC:14±1 ≥ CS:12 ≥ SB:10, (d) [η_{IT} (%)]; SB:51.6±0.9 > LU:47.6±0.8 ≥ EC:46.4±1.1 ≥ CS:45.9±0.2 > GB:42.8±0.3 ≥ TC:41.6±1.6 ≥ BC:41.2±0.1.

Conclusions: The results of this study showed that the CAD/CAM materials tested have significant differences in their mechanical properties and thus differences in their clinical performance are anticipated.

Keywords: Composite resins, Computer-Aided Design, Hardness, Elastic Modulus

Different build up procedures of endodontically treated anterior teeth

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Objectives: The aim was to investigate the clinical behavior of endodontically treated (ET) upper anterior teeth (incisors and canines) restored by various fiber-reinforced post-core composites (FRCs) or fiber posts (FP).

Methods: 80 ET posteriors, with 50% or less of coronal residual structure, were selected and randomly divided into four groups (n=20). Group 1:FP GC FIBER POST, GC (FP) luted with GRADIA CORE, GC(GC) + Initial LiSi Press, GC crown luted with G-CEM LinkForce, GC (LF) (as control); Group 2: everX Flow, GC (EXF) core build up + Initial LiSi Press crown luted with LF; Group 3: EXF + G-ænial Universal Injectable, GC (GUI); Group 4: FP + EXF + GUI. Natural teeth were as opposing dentition and patients were free from parafunctions. Patients were recalled at six months and 1 year from baseline. Mechanical and biological parameters were evaluated accordingly with Functional Index of Teeth (Ferrari Cagidiaco *et al.*, 2020). FIT was used for the objective assessment of outcomes including clinical

and radiographic examinations. FIT is made up of 7 variables (Interproximal, Occlusion, Design, Mucosa, Bone, Biology and Margins), each of them to be evaluated using a 0-1-2 score. The Mann-Whitney U test was applied for statistical analysis and the level of significance was set at $p < 0.05$.

Results: At one year recall all the restorations were in place without any biological or mechanical complication. FIT scores for each restoration ranged between 13.5 and 14. No statistically significant differences were found among groups.

Conclusions: Under the limitations of this study, anterior ET showed no difference when restored with or without a fiber post, and when occlusal surface was covered by a crown or not. Longer observation time of this study is needed to confirm these findings. Also, similar studies on patients with different degree of parafunctions are desirable.

Case report: Oral Manifestations and Prosthodontic Management of a Patient with Multiple Autoimmune Disorders.

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Introduction: Autoimmune disorders refer to a category of diseases in which the immune system attacks healthy cells in the body. They are caused by a dysfunction of the acquired immune system. These diseases can affect any system in the body and are initiated when the immune system becomes overactive and, rather than destroying invader cells, targets the body's own healthy cells and tissues.

Evidence suggests that exposure to antigens from bacteria, viruses, toxins, and blood and tissue from external sources trigger an immune response in which the body mistakenly attacks healthy cells in an attempt to rid itself of harmful substances. As a result, the following adverse events may occur: tissue damage, malfunctions in organ growth, and organ dysfunction.

Case description: 47-year-old female patient presents to the Graduate Prosthodontics clinic at Penn Dental Medicine. Patient's health history is significant for Osteoporosis, Hashimoto's Thyroiditis, Sjogren's syndrome, Gastritis, Gastroparesis, Sjogren's syndrome, Depression, Anxiety, Systemic Lupus Erythematosus, Gastroesophageal reflux disorder and Esophageal strictures.

Multiple autoimmune disorders have significant oral manifestations including xerostomia, dental erosion, caries, recurrent caries, extreme caries risk.

Patient's comprehensive treatment plan included caries risk management with fluoride treatment, full mouth reconstruction including full coverage restorations for natural teeth as well as implant supported restorations for missing/hopeless teeth and maintenance therapy.

Discussion: Patients with multiple autoimmune disorders can have significant oral manifestations and treatment modifiers for dental treatment. Interactions of multiple medications also affect treatment outcomes and prognosis. Interprofessional communication and management of the patient's overall health is crucial for the success and favorable long-term prognosis of the patient's dental treatment.

Keywords: Autoimmunity, Xerostomia, Sjogren's Syndrome, Oral Manifestations

Are Three Mini-Implants sufficient for long-term clinical success of mandibular overdentures? A Longitudinal Randomized Study

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Objective of Investigation: Four mini-implants (MDIs) inserted in the mandible interforaminally represent a standard procedure confirmed as successful in the dental literature. Sometimes, when one mini-implant fails, patients continue to wear mandibular overdenture retained by only 3 MDIs. Therefore a prospective randomized clinical study was designed to test the hypothesis whether three MDIs were sufficient for a long-term clinical success.

Methods used: Patients with atrophied ridges in the mandible who would benefit from MDIs were randomly assigned into one of the two groups: the 4-MDI or the 3-MDI group, respectively. Each group comprised 35 patients at baseline. In the 4-MDI group mini-implants were inserted in previous sites of 34, 24, 42, and 44, while in the 3-MDI group mini-implants were inserted into midline and between the previous sites of 34 and 34 and between the 43 and 44. Marginal bone level (MBL) was

measured on successive radiographs immediately after insertion (baseline), and after one, three and five years of function. Prosthodontic complications were also recorded, as well as "O"-ring replacements. Patients filled-in the OHIP-edent and the chewing function (CF) Questionnaires at each clinical follow-up examination.

Results: Twenty eight patients in the 4-MDI and 29 patients in the 3-MDI group were available after 5 years. There was no significant difference in MBL between the groups after 5 years ($P > .05$). The results of the both questionnaires were similar at the 5-year examination ($P > .05$). More O-ring replacements were recorded in the 3-MDI group ($P < 0.5$). Slightly better self-reported CF was recorded in the 4-MDI group after 5 years, but it was not statistically significant ($p > .05$).

Conclusion: Treatment with only 3-MDIs seems to be a feasible clinical option, at least for a 5-year period of function.

A Pilot Study of Mandibular Overdentures Supported by Roxolid-Alloy Mini Implants with Optiloc Retention

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Objective of Investigation: Mandibular complete dentures in edentulous patients with atrophied ridges usually lack stability and retention, leading to inability to chew all kinds of food. Four mini-implants made from Ti90Va4Al6 alloy inserted interforaminally, with rubber O-ring in metal housings for denture retention have proven to be beneficial in such patients. Recently, new MDI system made from Roxolid alloy (Ti85, Zr15) with a new Optiloc system for retention (PEEK material in metal housings) was released on the dental market. The new system should allow better mechanical properties of MDIs and better and more durable retention.

The aim was to compare treatment effects and one-year results between patients with new MDI system (N-MDI) and patients with conventional MDI system (C-MDI) considering self-perceived chewing function (CF) and oral health-related quality of life (OHRQoL).

Methods used: Ten patients received four Roxolid MDIs interforaminally with Optiloc system, representing a study group (N-MDI), and another ten patients received conventional MDIs

with rubber O-ring in a metal housing, representing a control group (C-MDI). The OHRQoL was assessed using the OHIP-EDENT questionnaire; the CF using the CF questionnaire in both groups: before treatment, one month after treatment and after one year in function.

Results: All patients reported significantly better OHRQoL better CF, high effect size of the treatment and there was no significant differences between groups. However, at the one year stage, the MDI group with Optiloc system had slightly better CF than the O-ring MDI group. Only one MDI was lost in the O-ring group.

Conclusion: Both groups of patients showed high effect size of a treatment, with consistent results over the one-year period of observation. The N-MDI group had slightly better self-reported chewing function after one year.

Retention Force of Polyoxymethylene Telescopic Overdenture - a Pilot Study

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Objectives of Investigation: Overdentures retained with telescopic double crowns have many good properties such as axial loading of the teeth, good retention and longevity. However, double crowns have been repressed from use mainly due to high prices of the gold alloy. Recently, new materials have been introduced as alternative for gold, especially metal-free and tooth-coloured ones. Polyoxymethylene (POM) is material suitable for fabrication of denture frameworks, with favourable characteristics such as high strength, low coefficient of friction, high wear resistance, dimensional stability, low water absorption and high biocompatibility. However, it hasn't been investigated whether the retention force of double crowns made of POM is in the optimal range of 5-10Newtons (N). The aim of study was to measure the retention force of telescopic overdenture made of POM.

Methods Used: Six overdentures, each retained with four telescopic double crowns were made, 2 on incisors and 2 on premolars. Internal crowns were made of CoCr alloy and external

crowns together with denture framework were made of POM, the material with a lower modulus of elasticity. The measurements were conducted with dynamometer manually, as complete separation of the telescopic crowns with artificial saliva substitute interposed. The individual retention force of each telescope assembly was measured as well as the total retention force of the overdentures.

Results: Individual retention force was greater in the premolars than in the incisors (4.1N compared to 2.2N). The highest individual retention force was 5.0N and the lowest 1.2N. The average total retention force was 12.8N. All dentures had total retention force value slightly above the optimal range.

Conclusions: POM telescopic crowns showed retentive force values in the optimal range. Further research is necessary in order to determine whether the retention force decreases with function, that is, whether the wear resistance is stable.

Keywords: retention force; double crowns; polyoxymethylene.

Comparison of Accuracy of Original vs. Non-Original Abutments using Various Connection Geometries

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Objectives of Investigation: In the context of dental implant components, the term 'non-original' refers to abutments which are manufactured by a company independent of the implant system. The purpose of this systematic review was to investigate whether the compatibility of non-original abutments (NOAs) is influenced by the type of implant connection (internal or external) and whether certain combinations of componentry may be as compatible as the original components (OAs).

Methods Used: A structured literature search was conducted using 3 electronic databases (MEDLINE®, 'The Cochrane Library' and 'Web of Science Core Collection') for studies reporting on the use of non-original abutments published between 1995 and 2020. This was supplemented with hand searching in relevant journals and references, as well as searching grey literature. Relevant studies were selected according to specific inclusion criteria.

Results: The electronic searching and hand searches yielded titles and abstracts of 5617 studies following de-duplication; 40 studies were finally selected. Overall, OAs showed better

precision of fit, ability to resist microleakage, prevention of rotational misfit, micromotion, and fatigue strength compared with NOAs. Some NOAs on external connections were comparable with OAs in terms of precision of fit and resistance to screw loosening and may be associated with less catastrophic failures than those on internal connections.

Conclusions: OAs present more predictable outcomes than NOAs with regards to the parameters investigated. However, it seems that external connections can provide some level of compatibility, thereby reducing the risk of some complications. There is a lack of information regarding the influence of connection geometry on many aspects of compatibility and therefore the current clinical recommendation should be to use OAs. More laboratory studies comparing NOAs on different implant connections are required. In addition, there is a need for long-term *in vivo* studies providing data on the clinical performance of NOAs.

Keywords: dental implants, dental implant-abutment design

Management of Severe Tooth Surface Loss

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Introduction: A 44-year-old with Autism Spectrum Disorder (ASD) was referred to the Prosthodontic Department at University College London Hospital by his general dental practitioner for treatment of moderate to severe generalised tooth surface loss (TSL). His main concern was that his teeth were getting shorter. Clinical examination showed TSL on the upper anterior palatal and incisal and lower anterior and posterior occlusal surfaces. Cupping and coinciding wear facets indicated erosive and attritive aetiology. Objectives of treatment were to protect the remaining dentition and restore aesthetics.

Case Description: A methodical treatment plan was formulated in collaboration with the patient to address his concerns. Following stabilisation, diagnostic wax-up, mock try-in and provisional prosthodontic treatment phases, the patient underwent a full mouth reconstruction utilising a reorganised approach in centric relation. The teeth were restored with a combination of lithium disilicate crowns and composite restorations anteriorly,

and ceramic and gold onlays posteriorly. An indirect-direct technique was employed for provisionalisation. A post-operative Michigan splint was provided to help protect restorations and maintenance was arranged.

Discussion: Upon completion of treatment, the patient reported the rehabilitation of his dentition has had a positive impact on his self-esteem and confidence. The patients' wishes directed the treatment plan, and the objectives have been fulfilled. Consideration was given to the evidence base to support restoration and material selection. The case highlighted the importance of controlling the occlusion and maintaining accuracy and verification at every step, in order to facilitate a predictable outcome. Patient management is very important for patients with ASD, particularly aspects such as appointment timing and clear communication.

Keywords: tooth wear, dental occlusion

Push-out bond strength of a new two steps adhesive

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The adhesion of fiber posts luted with simplified adhesive systems has been a matter of great interest over the past years. The aim of this study was to assess the post retentive potential of new two steps self-etching system (GB2) when used alone and in modality etch and rinse. As luting material Gradia Core (GC) and everyXFlow (EXF) were used. Fiber posts (GC) were placed in endodontically treated teeth and divided into four groups (n = 6) according the adhesive-luting material, as follows: group 1 (GB2+GC in self-etch modality); group 2 (GB2+GC used in etch and rinse); group 3 (GB2+EXF used in self-etch modality); and group 4 (GB2+EXF used in etch and rinse modality). The push-out test was used to assess the retentive strength of fiber posts (expressed in MPa), and specimens were analyzed under a stereomicroscope to determine failure mode. The adhesive interface between the cement and root canal dentin for each group was evaluated using scanning electron microscopy. As push-out strength data were not normally distributed (Normality test failed, $P < 0.05$), the Kruskal-Wallis analysis of variance was applied. Dunn's multiple range test was used for *post hoc* comparison among the groups. The chi-square test was used to investigate whether the failure mode distribution differed significantly among the groups. The level of significance was set at $P < 0.05$. In *post hoc* comparisons of failure modes the Bon-

ferroni correction was applied. Calculations were performed using the Sig- maPlot 11.0 software (Systat Software, San Jose, CA, USA). The post retentive potential of group 3 (14.71 ± 4.25 MPa) was higher than the other three groups, but not statistically significant difference from Group 1 (13.52 ± 3.68 MPa) and Group 4 (13.84 ± 2.91 MPa). Group 2 showed the lowest push-out bond-strength values compared with the other groups and was statistically significant different to the other three groups. The new GB2 bonding system showed high values of push-out bond-strength when used with Gradia Core and everyXFlow. Two steps procedure showed better results than three steps etch and rinse.

Intraoral Scan Bodies in Digital Dentistry

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Objectives of Investigation: Digital workflows provide improved efficiency and accuracy for clinicians. Intraoral scan body (ISB) design is highly alterable and that may influence the accuracy of digital scans in digital dentistry. The purpose of this literature review was to examine the factors that may influence the precision and accuracy of digital impressions in implant dentistry.

Methods Used: A MEDLINE/PubMed search was performed to identify relevant reports concerning the ISB usage in digital implant dentistry. The search included accuracy of digital impressions in implant dentistry, the design and the materials of the ISB, the depth of placement of implants. The related titles and abstracts were screened and the remaining articles that fulfilled the above inclusion criteria were selected for full-text readings.

Results: The studies were evaluated according to the following subjects: the variability of commercially available scan bodies, the features/design, the materials, the depth of placement of the implants and the accuracy, their re-usability and the efficacy of the digital intraoral impressions in implant dentistry.

Conclusions: ISBs are complex transfer devices that have a crucial role in the digital workflow in implant dentistry and have a major impact on the precision and trueness of digital intraoral impressions. The features and design, the material, the connection, the re-usability and their depth of placement may influence in many different ways the accuracy of the impressions. With digital technology developing and evolving in a rapid rhythm, more future studies are needed to examine the basic components of ISBs, how they relate to CAD-CAM technology in order to ensure precise and accurate transfer of implant position to the digital definitive cast.

Immediate Dentin Sealing: An Integral Step of Indirect Bonded Restorations

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Objectives of investigation: Nowadays, more conservative restorations like inlays, onlays and laminate veneers are preferred given their less need for tooth substance removal. However, the exposure of dentin tubules remains an issue and due to their inadequate sealing by interim cementation materials, they are confronted with bacterial infiltration and the several chemical and mechanical stimuli transmitted during impression taking, the provisional phase and the removal of provisional materials. For this reason, the application of a dentin bonding agent after tooth preparation and prior to impression taking has been suggested. The aim of the present study is to review available literature and clarify clinical concerns related to immediate dentin sealing application (IDS).

Methods used: A MEDLINE (PubMed) electronic research was conducted including articles published from January 1990 until May 2021 using the following keywords: "immediate dentin sealing", "resin coating technique", "dual bonding technique", "prehybridization". 67 articles relevant to the topic emerged and were included in the review after exclusion of irrelevant or duplicate ones.

Results: Immediate dentin sealing has been suggested to provide advantages concerning bacterial microleakage, hypersensitivity and bond strength, whereas issues regarding the interaction with impression materials, the provisional phase and the conditioning protocols applied at the cementation appointment need further investigation.

Conclusions: Although more research is required on the field, immediate dentin sealing is a well-established technique that should be incorporated into the clinical practice.

Comparison between two ios about .stl files, nanoleakage and cement thickness of lithium disilicate single crowns *in vitro*.

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Objectives: The aim of this *in vitro* study is to compare the marginal and internal fit discrepancy of lithium disilicate single crowns fabricated with computer-aided design and computer-aided manufacturing (CAD/CAM) technology by using 2 digital intraoral scanners.

Methods: 20 molars were prepared for lithium disilicate single crowns with vertical margins. The teeth were scanned in a model scanner, creating master scans. Then two intraoral scanners (IOS) were used to perform impressions on the 20 prepared teeth: Trios 3 Basic (3 Shape) and Experimental Aadvia IOS (GC). The 20 abutments were scanned with both IOS and the 40 .stl files of the impressions were exported and overlapped with the master scan with software Aadvia GC 2.1.2 Dental DB so that the discrepancy between them was evaluated. After digital wax-up, 40 lithium disilicate crowns were fabricated with CAD/CAM technology: each abutment had two crowns made with the two tested ios devices. Then, 20 crowns (10 from each device) were randomly selected and luted to the 20 prepared teeth. After lut-

ing with LinkForce following manufacturer's instructions, the crowns were tested for marginal infiltration with an aluminum nitrate solution. Then, the teeth have been embedded into self-curing transparent resin and cut into slices of 1 mm in thickness each with low precision diamond blade cutting machine (Buehler Isomet). The slices of each tooth have been looked under optical microscope and scanning electron microscope (SEM) to evaluate the thickness of the cement along the preparation and the presence of infiltration at the margins.

Results: No statistically significant difference has been found between the two different intraoral scanners about the sovraimposition of .stl files. Also, no statistically significance difference were found between the two groups about neither nanoleakage at the margins nor cement thickness.

Conclusions: The two tested ios devices showed similar performances when tested about precision of generated .stl files, nanoleakage at the margins and cement thickness.

Effectiveness of conservative treatment modalities for Temporomandibular Disorders-related pain: a systematic review

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Objectives of Investigation: Temporomandibular Disorders (TMD) are a major cause of non-odontogenic pain in the orofacial region. The aim of this systematic review was to gather and evaluate the available literature on the effectiveness of conservative treatment modalities for TMD-related pain.

Methods Used: A systemic electronic and manual literature search of randomized controlled clinical trials was performed using the PUBMED (MEDLINE) and Scopus databases, for articles published from 2001 to 2021. The review protocol is registered with the PROSPERO International Prospective Register of Systematic Reviews. The 27-item Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement is used in the summary and description of the search process results. The following search keywords were selected using MeSH terms of the National Library of Medicine in combination: pain management OR conservative treatment AND TMD pain and

management OR treatment modalities OR therapies AND TMD. Studies included must have patients older than 18 years, with painful TMD, which diagnosis was done by Research Diagnostic Criteria for TMD or Diagnostic Criteria for TMD.

Results: Initial search concluded in 1560 articles while an additional of 39 articles was added through manual search. Data were independently extracted by two reviewers after title and abstract evaluation, exclusion of the duplicated files and full – text assessment. Finally, thirty-six studies met the inclusion criteria and were included in the study. Despite the promising short-term effectiveness of different conservative treatment approaches (biofeedback, physiotherapy, medications, low-level laser therapy, photobiomodulation, counselling), hard occlusal splint had superior effect in post-treatment pain intensity and relaxation, especially in patients with myofascial TMD diagnosis.

Digital workflow for manufacturing implant-supported restorations: a case series.

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Introduction: The application of digital technology in dentistry offers the possibility of simplifying several procedures and minimizing necessary steps while manufacturing implant-supported prostheses. The digital approach can nowadays be applied from implant placement to the final delivery of the restoration. The present case series underlines the advantages of digitization when treating patients with dental implants to provide modern, time-saving alternatives for clinicians.

Cases description: Three clinical cases, including a case of partially edentulous patient receiving implants with various inclinations and restored by a hybrid (screw and cement-retained, i.e., "screwmentable") restoration, and two cases of single-implant restorations in the posterior- (replacing the posterior right first molar) and aesthetic (replacing the left upper canine) zone respectively, the latter requiring digital design to provide a customized abutment, will be presented, highlighting the assets of digital technology in various steps.

Discussion: Nowadays, the fabrication workflow for implant-supported prostheses can be performed entirely digitally, through scanning the implant position and obtaining a digital impression, designing a virtual working model, CAD design of the construction (abutment and suprastructure), and subsequent milling (CAM). Digital fabrication of dental restorations on implants offers essential advantages, such as avoiding conventional impression making, avoiding changing abutments during prosthetic treatment, individualized emergence profile, quick communication between dental technicians and clinicians, and financial and biological benefits. CAD/CAM abutments and suprastructures provide accurate fit and ideally designed geometry that conventional techniques would not easily achieve. Innovative abutment designs and novel retention types, including titanium inserts, have evolved through CAD/CAM technology. However, such restorations need to be further evaluated through long-term clinical trials.

Keywords: digital technology, implant-supported prostheses, CAD/CAM, treatment planning, clinical and laboratory workflow

Combining Conventional and Digital Workflow for the Implant-Prosthetic Rehabilitation in a Partially Edentulous Patient

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Introduction: The lack of traceable structures and the smooth surfaces of long free end saddles in partially edentulous patients, may introduce errors in the stitching of images during intraoral scanning. These errors may in turn affect the accuracy of centric relation or maximum intercuspation registration. The aim of this study is to present a method of reducing the errors in the registration of maxillomandibular relationships in partially edentulous patients when intraoral scanning is used.

Case description: A 65-year-old woman with a Kennedy class I maxillary edentulism was restored by placing four implants in the upper posterior area. After osseointegration, a digital impression of the four implants was made in order to manufacture two screw-retained implant bridges. A screw-retained baseplate was conventionally fabricated for the registration of centric relation. The digital impression was taken with an intraoral digital scanner (3Shape Trios3, Copenhagen, Denmark). The baseplate with occlusal rims was scanned and used to transfer the interocclusal registration digitally. Digitally designed 3D printed prototypes contributed to the intraoral

check of occlusion, contact points with the adjacent teeth, emergence profile, esthetic and phonetic outcome. Then, they were scanned and used to digitally design the final restoration. The final milled monolithic zirconia restorations were cemented on prefabricated Titanium base abutments and screwed in the implants at 20 Nt /mm.

Discussion: The presented conventional-digital workflow constitutes an alternative to the conventional implant-prosthetic protocol providing a time effective outcome without complications.

The prototypes allow the clinician to simultaneously verify the accuracy of the digital impressions and check the prosthetic parameters in a single visit, reducing clinical and laboratory time. The delivery of the final prostheses was carried without difficulties and with minimal adjustments. Moreover, this workflow facilitates the communication of the dental team both with the dental technician and with the patient.

Keywords: Centric Relation; Workflow; Zirconium Oxide; Printing

Combined Skeletal Class III and Oligodontia Prosthetic Rehabilitation

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Introduction: Hypodontia is the most prevalent craniofacial malformation in humans. Oligodontia is a more severe form of tooth agenesis, and defined as the absence of more than six teeth. This case presents the use of a multidisciplinary approach in order to treat a patient with two severe presentations including oligodontia and skeletal class III relations.

Case Description: An 18-year-old female, diagnosed with oligodontia of 11 permanent teeth (excluding 3rd molars), severe skeletal class III jaw relations (OJ=-10mm), mixed and spaced dentition, and undeveloped alveolar ridges in these areas. A multidisciplinary prosthodontic-surgical-orthodontic treatment plan was used to regain function and esthetics. The first step included Inferior alveolar nerve lateralization simultaneously with the placement of dental implants. This was done in order to get sufficient anchoring to start the orthodontic treatment. Once the implants had been osseointegrated, the patient received temporary crowns, followed by the commencement of the orthodontic phase. Next, the patient underwent orthognathic

surgery in order to fix the skeletal relations. After healing from surgery, the orthodontic treatment was completed and the final prosthodontic treatment was executed by restoration of the missing teeth with dental implants and adhesive restorations.

Discussion: The multidisciplinary approach included two-step planning. First, occlusal scheme for each jaw was planned resolving the missing teeth. Second, the inter-occlusal scheme was planned resolving the CL III malocclusion. Execution included multidisciplinary orthodontic, surgical and prosthodontic intervention: bone regeneration, nerve repositioning, dental implants, fixed partial dentures and orthodontic treatment, followed by the orthognathic surgery. The described case was a complicated challenge. To give the ideal treatment, a multidisciplinary team was assembled, taking into consideration the two major cranio-facial problems described.

Visualizing the Final Outcome of Extensive Rehabilitations Using Rapid Prototyping or Conventional Mock-ups

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Introduction: Planning and evaluating the final outcomes and limitations in extensive prosthetic rehabilitations through the mock-up technique, prior to any tooth preparation, represents a strategic approach. The mock-up is a diagnostic tool that allows not only the intraoral previsualization of the esthetic and functional result, but also a better understanding of patients' expectations. Conventionally, the wax-up is molded intraorally by means of a silicone template with resin material. In a digital way, resin mock-ups are milled or 3D-printed from the digitally designed 3D wax-up, allowing easier and more accurate results.

Case Description: Three different cases which required extensive prosthetic rehabilitation, were managed preoperatively by mock-up planning. After the initial photographs were obtained, conventional or digital wax-up was created. In the first case, full mouth evaluation of the increased occlusal vertical dimension (OVD) was made by transferring the conventional wax-up intraorally with silicone templates. In the second case of worn dentition, for the upper and lower jaw rehabilitation, the conventional wax-up was scanned and the mock-up was 3D printed and used to test the new jaw relationship. In the last

case, 3D printed mock-up from digitally designed wax-up for maxillary rehabilitation was performed. In all cases, the mock up was modified, if needed, and contributed to the esthetic and functional evaluation of the final restoration.

Discussion: The mock-up represents a powerful diagnostic tool in many aspects of prosthetic therapies. It constitutes a reliable prototype, testing the final prosthetic outcomes both functionally and esthetically with a completely reversible approach.

Keywords: Vertical Dimension; Mouth Rehabilitation; Tooth Wear; Esthetics

The Evolution of Interim Prosthesis

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The objectives of the investigation: Interim restorations are critical in fixed prosthodontic treatment both biologically and biomechanically.

Interim restoration serves an important diagnostic role as a functional and esthetic try-in and as a blueprint for the design of the definitive prosthesis. The Computer-aided design and computer-assisted manufacturing (CAD/CAM) technology provides the opportunity to simplify the current technique and thus reduce the chairside fabrication time of provisional restorations. The most recent wave of technological development in digital dentistry also offers the solution of 3D printing which has a significant impact in the field of restorative dentistry in recent years.

The purpose of this literature review is the comparison among provisional prosthesis fabricated conventionally, CAD/CAM technology and 3D printing methods.

Methods used: An electronic search was conducted through PubMed. The literature search aimed to retrieve comparative studies regarding the mechanical properties, marginal and internal fit of interim prosthesis.

Results: Studies comparing the marginal and internal adaptation as well as the fracture strength concluded that the CAD/CAM prostheses demonstrated superior fit and better strength than direct provisional crowns. Additionally, after thermal cycling the CAD/CAM provisionals show superior marginal accuracy and flexural strength. Another study shows that 3D-printed interims demonstrated sufficient mechanical properties.

When comparing radiopacity, both conventional and CAD/CAM interims show lack of it. In terms of surface properties, plaque accumulation and vertical marginal fit CAD/CAM systems offer better results. Lastly, provisionals restorations fabricated conventionally with digital light processing (DLP) and stereolithography (SLA) provide adequate flexural strength for dental use.

Conclusion: We can conclude that the use of CAD/CAM interim prostheses as well as 3D printing are both reliable and even better alternative to conventional fabricated provisionals.

Effect of Chemical Aging on Veneered Lithium Disilicate Ceramics

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Objective of the investigation: To evaluate the effect of chemical fatigue on biaxial flexural strength and micro-hardness of bilayered ceramic discs with two different surface finishing and two different core fabrication techniques.

Methods: Eighty bilayered veneer/lithium disilicate ceramics divided into two main groups according to the core fabrication technique (E.max Ceram+E.max Cad and E.max Ceram+E.max Press) which were then divided into 2 groups of different surface finishing techniques applied (glaze/polishing). Each group was further divided into 2 subgroups on the condition of chemical aging application. All samples were tested for biaxial flexural strength. In addition, the samples in the chemically aged group were examined with ultrasonic testing before and after chemical aging, and then tested for biaxial flexural strength. Stresses generated at the core and the veneer, at the top and the bottom surfaces, and the interface of bilayered discs were calculated using Huesh's solutions. The fractured samples were also examined for vickers microhardness. The data of flexural strength and vickers

microhardness were statistically analyzed with ANOVA and Tukey's *post hoc* multiple comparison tests ($p \leq 0.05$).

Results: For each tested group, there were no significant differences between the corroded and non-corroded samples' biaxial flexural strengths ($p > 0.05$). IPS e.max Press and IPS e-max CAD recorded similar flexural strengths ($p > 0.05$). Glazed surfaces recorded higher flexural strength than polished surfaces ($p < 0.05$). Vickers microhardness strengths increased in glazed groups after chemical corrosion, but it is not statically significant ($p > 0.05$). According to ultrasonic test results, after chemical corrosion no delamination was seen between core and veneer interfaces but ultrasonic velocities were decreased from 6165 m/sec to 5920 m/sec in all groups.

Conclusion: Even though there were increase in microcracks, support of lithium disilicate substructure protected bilayered ceramics from negative effect of chemical aging.

Keywords: Lithium disilicate, corrosion, fatigue, ultrasonic waves

Fixed implant restoration protocols in edentulous mandible: a systematic review

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Introduction: Dental implants are used for the restoration of edentulous mandible, with high degree of patient satisfaction compared to conventional removable dentures. Although prosthetic rehabilitation on six implants (all-on-6) is a well-established protocol, the use of four, inclined implants in distal positions (all-on-4), in anterior region was proposed. The purpose of this systematic review was to evaluate survival rates of all-on-4vs all-on-6mandibular implant-supported full arch fixed prosthetic restorations after a mean observation period of at least 3 years.

Methods/materials: An electronic search in Medline (PubMed) and the Cochrane Library was conducted by two independent researchers in order to collect articles, published until June 2020, reporting treatment of edentulous arches by the two protocols. Inclusion criteria were: a mean follow-up time of at least 3 years, the presentation of data concerning the type/ dimensions of implant, of restoration (screw or cement), prostheses including fixed reconstructions, English language. Exclusion criteria were studies using telephone interviews or patient records, animal or *in vitro* studies, case reports, abstracts, letters,

a mean follow-up of < 3 years, studies not reporting restoration or implant type, not written in English, examining removable prostheses. In case of repeated publications Data from most recent version used. Following the electronic search and titles collection, abstracts were screened to assess their suitability for inclusion. Consensus was reached regarding disputed articles after discussion. The full-texts were collected and implant survival rate was recorded.

Results: 34 articles were included for analysis. Data analysis concerning fixed implant prostheses on 6 implant or on all 4 protocol revealed high implant survival rate (84-100%), comparable for both treatments.

Conclusion: Survival rate of implants on 6 or 4 implants full-arch, fixed, implant-supported restorations was high and comparable. However, differences in protocols at current literature make difficult the comparison of success between the two investigated treatment protocols.

Keywords: Prosthodontics [E06.780], Dental Prosthesis, Implant-Supported, Mandible [A02.835.232.781.324.502.632]

Full Mouth Rehabilitation of a Bruxism Patient: A Case Report

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Introduction: Bruxism is a parafunctional activity related to clenching or grinding the teeth. The effects of bruxism to the stomatognathic system are temporomandibular pain and dysfunction, masticatory muscle hypertrophy, tooth surface loss, fracture of restorations or teeth, hypersensitive or painful teeth and pseudo class III relationship. Management of severe worn dentition in patients with bruxism is really challenging due to the numerous impacts on the stomatognathic system.

Case description: A 58-years old male was referred for evaluation of a severely worn dentition due to bruxism. The patient did not complain about any pain symptoms or temporomandibular disorder and his main concern was the retention of food in the masticatory cavities. Our purpose was the functional and esthetic restoration of the patient but we had to consider the treatment position, the kind of restorations that will be used due to the crown lengthening and the choice of restoring material. The prosthetic treatment was planned with a digital smile

and a mock-up technique after we established the musculo-skeletal stable position and determined the vertical dimension of occlusion. We proceeded to a full mouth rehabilitation with onlays on posterior teeth, resin veneers on the palatal surfaces of anterior teeth and ceramic veneers on the labial surfaces. Finally, an occlusal splint device was given to the patient.

Discussion: Management of severe tooth wear due to bruxism is a challenging situation because of the common reduced amount of remaining dental structure and loss of vertical dimension of occlusion. Several treatment planning methods and restorative materials are used to treat tooth wear in modern dentistry. Clinicians should be able to select the most suitable treatment planning methods and materials for individual patients. Onlays on posterior teeth and veneers on anterior teeth may represent a suitable clinical solution for indirect functional and esthetic restorations.

Management of Biological and Technical Complications of a Fixed Full-Mouth Implant Rehabilitation: A case report

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Introduction: Management of a clinical case which presented with an implant supported prosthetic rehabilitation and severe associated complications, is a prosthodontic challenge. In a contemporary approach, the desired prosthetic solution is planned, and optimal implant position is selected to facilitate the prosthesis. All elements of treatment plan, such as number and position of implants and prosthetic solutions must be re-considered for decision making.

Case Description: A 61-year-old Caucasian female presented in the Postgraduate Prosthodontic Clinic of AUTH with pain and inflammation of gingiva and mucosa. Her chief complaint was pain and inability to clean her new fixed implant supported restorations. Clinical examination revealed 19 implants (8 in maxilla, 11 in mandible) and 3 natural teeth supporting the restorations. The restorations, connecting teeth and implants, were cemented with marginal misfit on most of the abutments. The width of attached keratinized tissues was below 2mm in most places with complete lack in the mandible where peri-implant mucositis was predominant. A treatment plan based on the collection of clinical and radiographic data was decided.

The workflow included diagnostic wax up and provisional restoration placement. Periodontal surgical augmentation of the tissues in the mandible was done and after 3 months of healing, final impressions at implant level were made. The appropriate angulation of the multi-unit abutments was selected with the aid of the mounted casts and the wax up. Eventually, abutment level impressions on were made, followed by jaw registrations, metal framework and biscuit bake try-in and delivery.

Discussion: The prosthetic rehabilitation of a complex clinical case with pre-existing implants is multifactorial. Key points of treatment include peri-implant tissues' health, abutment proximity and inclinations, distribution and number of abutments supporting each restoration. Additionally, prosthodontic considerations include type of restorations (screw or cement retained) splinted or segmented, and ease of maintenance for teeth and implants.

Keywords: dental implants, full-mouth rehabilitation, prosthetic complication

Full-mouth rehabilitation of a patient with bruxism-associated dental attrition: A case report

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Introduction: Dental attrition from bruxism has been demonstrated to be associated with various dental problems such as tooth sensitivity, excessive reduction of clinical crown height and loss of occlusal vertical dimension (OVD). The management of the worn dentition is becoming an increasingly common problem in the practice of dentistry from both restorative and esthetic points of view. The aim of this report was to describe the stages of full mouth rehabilitation of a severe dental attrition in a 58-year old female patient with a history of bruxism.

Case description: Bruxism assessment has been made on the basis of a self-reporting questionnaire, RDC-TMD questionnaire and clinical examination of the patient. Treatment planning was markedly demanding; in the first stage, a full-arch centric relation stabilization splint, mounted study casts, diagnostic waxing-up, direct mock-up and provisional restorations were made. In the

second stage, preparation of all mandibular and maxillary teeth and placement of long-term provisional restorations in the increased OVD were performed, based on the dictating esthetics and phonetics. In the last stage, after the occlusal adjustment, metal-ceramic restorations on the anterior teeth and with metal occlusal surfaces on the posterior teeth were cemented and a new stabilization splint was used to protect the restorations. Stable interarch occlusal contacts on all teeth with equal intensity in centric occlusion and smooth anterior guidance in harmony with functional movements were especially taken into account.

Discussion: Providing sufficient space for restorative materials, establish a centric occlusion in an appropriate OVD and the placement of stabilization splint are often required for the functional and esthetic restoration of a patient with bruxism-associated severe dental attrition.

Microleakage study of three different adhesive-resin composite combinations.

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The aim was to evaluate the influence of several adhesive systems on the microleakage of direct composite restorations with one proximal margin located below the cemento-enamel junction (CEJ) and the other above in the enamel. Standardized MOD cavities with proximal margins located 1mm below CEJ were prepared in 30 human molars and randomly divided into 3 groups. Three adhesive systems were combined with an injectable resin composite (G-aenial Universal Injectable). An incremental technique was followed to restore the cavities. In Group 1 G2-BOND (GC), in Group 2 Clearfil SE Bond 2 (Kuraray) and in Group 3 OptiBond FL(Kerr) were used. Sample teeth were tested for microleakage scoring the amount of tracer (Silver

nitrate) along the marginal interfaces in 5 degrees. At the dentin interfaces Group 1 scored 1,3, Group 2 2,3 and Group 3 1,3. At the enamel site Group 1 scored 0, Group 2 0,2 and Group 3 0,1. Differences in leakage at dentin and enamel adhesive interfaces were also evaluated for statistical significance ($P < 0.05$). At the dentin interface statistically significant differences emerged in microleakage scores between Group 2 and the other two groups whilst no difference was found at the enamel interface. The G2-Bond showed the best margins' quality, similarly to Optibond FL in both dentin and enamel interfaces. The enamel interfaces showed an extremely good seal whilst the dentin interfaces always showed leakage.

Elution of monomers from CAD-CAM materials and conventional-resin composite after storage in artificial saliva.

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Objectives of Investigation: To evaluate the leaching pattern of different types of polymer computer-aided design and computer-aided manufacturing (CAD-CAM) materials with a conventional resin composite.

Methods Used: The materials that were examined were three representatives by type polymer CAD-CAM blocks and one conventional-resin composite. The materials were suspended using a silk thread in distilled water and artificial saliva. After 1 day, 7 days, 14 days, 30 days, and 60 days, the eluates bisphenol A (BPA), urethane dimethacrylate (UDMA), triethylene glycol dimethacrylate (TEGDMA), bisphenol A-glycidyl dimethacrylate (Bis-GMA) were analysed utilising high-performance liquid chromatography. Additional specimens of each material, before and after immersion in the solutions, were examined by scanning electron microscopy, and elemental analysis was performed by energy-dispersive X-ray spectrometry. For those specimens that did not follow a normal distribution, mean values were analysed with the use of non-parametric test Kruskal-Wallis and one-way

ANOVA with multiple comparisons using Dunn's test. The statistical significance for all the tests was set at a $p < 0.05$.

Results: TEGDMA was the main eluted monomer for the polymer CAD-CAM materials for both solutions. However, there was a decreasing pattern throughout the tested period. On the contrary, there was a constant release of monomers from the conventional-resin composite. Bisphenol-A was released only by the conventional-resin composite.

Conclusions: Different type of polymer CAD-CAM materials release significantly fewer monomers than the conventional-resin composite material. Each of the methods of fabrication of polymer CAD-CAM materials produces inferior properties than the conventional-resin composite with a dramatical decrease of monomer elution.

Keywords: CAD-CAM, high-performance liquid chromatography, monomer release.

Implant-Supported Prosthetic Restorations: Analysis Of Design, Construction and Clinical Parameters

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Introduction: Tooth replacement with implants is considered a well-documented therapeutic solution. Occlusal overloading and non-axial forces are responsible for the appearance of mechanical complications in implant-supported restorations. Implants should be placed ideally at or near the center of the tooth it replaces. However, final clinical position is often different, resulting in the development of intra-coronal cantilevers.

Aim: The aim of the present study is to investigate the correlation between the three-dimensional structure of the implant-restoration and the positioning of the supporting implant.

Material and methods: Dimensions of 49 posterior implant-supported cemented restorations and their components were recorded. The restorations were inserted in 18 patients at the postgraduate clinic of Prosthetic Dentistry of Dental School of National and Kapodistrian University of Athens. The following parameters were recorded: 1. implant diameter and length, 2. abutment diameter, 3. abutment height, 4. crown length, 5. crown width, 6. crown height, 7. occlusal table area, 8. intra-coronal cantilevers, 9. opposite side crown length, width and table area and 10. distance between implant center and

restoration center. Subsequently, an interocclusal bite record was made utilizing T-scan III Pressure Management System (Tekscan Inc) in order to specify the magnitude and exact point where maximum occlusal force was applied.

Results: 1. Moderate positive correlation between implant diameter and crown width.

2. Intra-coronal cantilever's maximum level was 6,35mm.

3. Maximum level of the distance between implant center and restoration center was 3,65mm. The center of the implant was placed at the same section (5th section) with the center of the restoration in 68% of the included restorations.

4. Intra-coronal cantilever was developed in 71% of the pre-molar's and in 82% of the molar's restorations.

Conclusions: Survival and success of implant-supported restorations are affected by all the clinical parameters which were examined. Optimum design of implant prostheses and control of force's magnitude and orientation during the restoration's insertion and the follow-up appointments are fundamental for its successful clinical performance.

Intraoral Scanning Accuracy of the Denture Bearing Completely Edentulous Maxilla

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Objectives of investigation: Recently, there has been an increased interest in the digital fabrication of complete dentures. The digital workflow requires a virtual jaw model of the patient, which is currently obtained indirectly by digitizing the conventional impression or the stone cast, using a laboratory scanner. Lately, the integration of direct digital impression, via an intraoral scanner (IOS), enables the full digitization of denture fabrication procedure. Although intraoral scanning may be time-efficient and improves patient comfort and clinic ergonomics, there are some challenges in recording completely edentulous areas, such as the smooth oral mucosa, without reference points and covered by saliva, that could produce errors in the stitching process of the current available intraoral systems and decrease the accuracy.

The aim of this review is to investigate the accuracy of IOS in capturing the completely edentulous maxilla denture bearing areas.

Methods used: A literature research was conducted in PubMed database, resulting in eight *in vitro* and five *in vivo* studies,

that were investigating the accuracy of intraoral scanning under laboratory or clinical conditions, in comparison with an industrial-reference scanner and model or a conventional impression technique digitized by a laboratory scanner.

Results: The purpose of these studies was to create virtual models using IOS and a reference scanner, in order to evaluate the accuracy, which is determined by trueness and precision. The virtual models were superimposed by a software, displaying mean 3D deviations in a micrometric level, and creating corresponding color maps. Different results arise from a variety of IOS that were included in the studies, while other factors, such as the scanning strategy and the use of artificial reference points appear to affect the accuracy as well.

Conclusions: Intraoral scanning of the completely edentulous maxilla may be a promising tool, while for the time being it appears to require, further IOS innovations and clinical evaluation.

Effectiveness of *Candida albicans* biofilm removing methods from the dental acrylic surface

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Objectives of Investigation: Approximately half of the adult population in the Europe have had some type of dental prosthetic. A lot of effort has been put to develop cleaning methods. The aim of this study was comparison of different methods of *Candida* biofilm removing from acrylic surface *in vitro*.

Methods used: 2 × 2.5 cm non polished acrylic plates made of denture material were used in this experiment. The effectiveness of cleaning method was evaluated in *Candida albicans* biofilm model. Acrylic plates were inoculated with *C. albicans* and incubated for 72 hours. Plates with formed biofilm were divided to the six equal groups (30 pieces each): one for (1) control, and five for different cleaning procedure: (2) dental cleaner with liquid (3) dental cleaner with PBS (4) air drying (5) antiseptic liquid (6) ultrasonic cleaner. After cleaning, *Candida* cells were collected with a swab and suspended in distilled water.

Results: Dental cleaner effectiveness in the biofilm removing was comparable to a sonic washer. The best results in both the biofilm cells killing and removing from acrylic plates were achieved for sonication. Dental cleaner with the antiseptic liquid also caused its killing and removing from the surface of plates. The liquid alone was significantly reducing the biofilm viability, although – like air drying – caused the biofilm fixation.

Conclusions: Sonic dental cleaner is efficient tool for cleaning acrylic surfaces from *Candida albicans* biofilm, comparable to ultrasonic washer. The combination of cleaning with a dental cleaner and subsequent soaking of acrylic tiles in an antiseptic liquid gives better results than using these methods separately or using them simultaneously.

Thermographic and Microscopic Examinations of Lymph Vessels' Presence in Teeth Designated for Fixed Prosthesis

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The objectives of the investigation: The aim of the study was to identify lymphatic vessels in the dental pulp using microscopic techniques; immunohistochemical evaluation of lymphatic vessels within the dental pulp under physiological conditions and in inflammation induced by the carious process; and evaluation of the usefulness of the thermography method in detecting the presence of blood and lymphatic vessels in the dental pulp under physiological and pathological conditions.

Experimental methods used: Healthy and curiously changed teeth used as models of abutments were examined under fluorescent microscopy, immunohistochemical examination and thermography.

Results: In the examination of healthy teeth using fluorescent microscope, spaces were found in which no erythrocytes were found, they were lined only with single-layer flat epithelial cells.

Specific lymphatic endothelial antibodies (Anti-VEGFR-3, Anti-PDPN) and Anti-Collagen IV antibodies were used in the immunohistochemical examination as control sample. In this study, there was no clear conclusion to the association of the presence of lymphangiogenesis indicators with the type and degree of dental inflammation.

Thermographic examination confirmed the presence of different amounts of spaces associated with fluid drainage and, consequently, heat.

Conclusions: Understanding angiogenesis and lymphangiogenesis mechanisms during inflammation processes may be beneficial for more effective disease treatment. Although the existence of pulpal lymphatics is controversial. Despite many indications of the presence of lymphatic vessels in the tooth pulp, this problem is still open and requires further research and development of new methods to identify the presence of lymphatic vessels in the tooth.

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Keywords: Histology, Dental Pulp, Lymphatic Vessels, Thermography, Morphological and Microscopic Findings

Guided surgery as a tool for maximizing 'All-on-4' protocol in extreme atrophic mandible

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Introduction: Edentulism has been shown to have a negative impact on quality of life. The main difficulty of rehabilitation is significant resorption of the alveolar ridge. Solutions might include the use of short implants, vertical ridge augmentation procedures, nerve reposition or cantilever prostheses. 'All-on-4' protocol is a possible solution. The utilization of 4 tilted implants allows us to give the patient a fixed full arch restoration in an immediate loading protocol.

Case Description: A 57-year-old woman, complains of difficulty eating due to an unstable lower implant-supported-overdenture. The patient has a fixed tooth supported maxillary restoration and requests a fixed restoration in the lower jaw as well. Cone-Beam-CT(CBCT) revealed extremely atrophic posterior ridges and two previously placed, failed, anterior implants, due to peri-implantitis. The CBCT was made in a double-scan protocol in order to plan implant placement according to the prostheses. After careful examination of the CBCT, a protocol of 'all-on-4' could be implemented in this case. Due to minimal

bone volume it was mandatory to precisely plan implant placing with SIMPLANT™ software and a bone-supported surgical guide was manufactured. The existing full denture was planned to be adjusted as immediate screwed prosthesis on the day of surgery and also was the prosthetic base for the computerized implant planning. Four implants were placed through the surgical guide. Multiunit abutments were installed, and the denture was connected by titanium sleeves to the multiunit abutments. Three months' post-surgery, impressions were made with a customized tray on multiunit level after transfers splinting. Wax rim with teeth arrangement was measured in the existing VDO. A screwed implant-supported PFM bridge was fabricated and delivered to the satisfaction of the patient.

Discussion: The 'All-on-4' protocol is a viable option for rehabilitating edentulous jaws. In cases of low bone volume, this protocol should be refined with the use of computerized-prosthetically-based implant planning.

Axiographic Evaluation of Mandibular Guidance Parameters in Patients with Dental and Periodontal Diseases

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Objectives of Investigation: To determine and compare axiographic findings on sagittal condylar and sagittal incisal inclinations (SCI, SII) in individuals with dental and periodontal diseases.

Methods Used: 142 people were examined and divided into such groups: patients with periodontitis (P, n=40), patients with tooth wear (TW, n=38), patients with caries (C) and control group (CG) comprised individuals with almost «ideal» occlusion (n=28). Each research group was divided into 2 subgroups including patients with complete dental rows (CDR) and patients with minor defects of dental rows (MD): P+CDR, n=20; P+MD, n=20; TW+CDR, n=19; TW+MD, n=19; C+CDR, n=17; C+MD, n=19. Axiography was conducted by means of AXIOQUICK Recorder (SAM, Germany), results were statistically analyzed (ANOVA, p <0.05).

Results: The obtained values of Sagittal Condylar Inclination (SCI, degrees) in examined groups were as follows: 48.7±2.3 (P+CDR); 43.9±1.0 (P+MD); 46.6±1.9 (TW+CDR); 41.7±1.7

(TW+MD); 42.5±1.3 (C+CDR); 45.7±1.6 (C+MD); 49.3±1.5 (CG). The following values of Sagittal Incisal Inclination (SII, degrees) in examined groups were 44.7±2.4 (P+CDR); 42.5±2.8 (P+MD); 42.1±2.9 (TW+CDR); 31.3±4.9 (TW+MD); 53.3±4.1 (C+CDR); 52.6±2.9 (C+MD); 53.6±1.9 (CG). Our study revealed statistically significant (p <0.05) difference of mean values of SII and SCI between TW+MD and control group.

Conclusions: Statistically significant decrease of SII and SCI in individuals with tooth wear and minor defects of dental rows was found. It can lead to overloading of frontal teeth in functional occlusion and produce pathological effects on temporomandibular joints. Certain occlusal corrections are necessary during therapeutic procedures to achieve balanced occlusion in such patients.

Keywords: axiography, temporomandibular joint, periodontitis, tooth wear, dental occlusion.

The author declares the absence of any conflict of interest.

Dental Status of Young Patients with Juvenile Idiopathic Arthritis

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Objectives of Investigation: To study the peculiarities of the oral cavity in young patients with juvenile idiopathic arthritis and analyze the impact of the disease on the condition of teeth, periodontal tissues, occlusal relations and temporomandibular joint.

Methods Used: 19 young patients with diagnosis of juvenile idiopathic arthritis (according to ILAR criteria) aged from 18 to 36 years old (mean age 21.3 ± 8.3 years) who included 12 females and 7 males were examined at Dental Medical Center of O.O. Bogomolets National Medical University. DMFT index was used for dental caries prevalence estimation. Tooth mobility and periodontal pocket depth measurement were used for periodontal lesion estimation. Bite class according to Angle's classification and presence of teeth crowding was checked.

Results: Overall caries prevalence for the sample was 100%, mean DMFT index was 8.75 ± 4.94 . Overall periodontitis prevalence was 100%, while only 4 (21%) had severe periodontitis.

Mean pocket depth was $3,48 \pm 0,71$ mm. All patients shown certain signs of traumatic occlusion such as gingival recessions, abfractions or pathological mobility of teeth of I-II degree. 9 patients (47%) had I class bite, 6 patients (32%) - II class bite, 4 patients (21%) - III class bite. 9 patients (47%) had teeth crowding. 14 patients (73%) had signs of TMJ disorders such as clicking or decreased mouth open.

Conclusions: Significant levels of caries, periodontal lesions were revealed in young patients with juvenile idiopathic arthritis. Almost all examined patients had certain signs of occlusal disorder and TMJ dysfunctions. That's why such patients may need a comprehensive complex of dental prophylaxis and rehabilitation measures in order to keep their oral health and prevent the development or progressing of occlusal and TMJ disorders.

Keywords: juvenile arthritis, caries, periodontitis, oral health.

The authors declare the absence of any conflict of interest.