ACCURACY'S COMPARISON IN INTRAORAL DIGITAL SCANNING *IN VIVO* AND *IN VITRO*: CLINICAL STUDY

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Aim: this study aims to evaluate the accuracy of two intraoral scanners (Carestream 3600 and Medit i-500) by comparing them both *in vivo* and *in vitro* and assessing their differences. The aim is to highlight the importance of *in vivo* studies and to analyze the impact of oral factors in order to have a clear and complete idea of a device that is changing operative and clinical methods.

Methods: impressions of the arches were taken, using the PVS, to send them to the laboratory and obtain plaster models for the *in vitro* study. Each model was scanned 5 times, using both scanners, obtaining a total of 20 scans, which were converted into STL files. The *in vivo* part started by scanning the arches, 5 times each, using the two scanners, obtaining a total of 20 scans, which were converted into STL files. We exported the files to the Medit Compare program and overlapped the files, to compare the results obtained *in vitro* and *in vivo*. From each overlay we obtained the following statistical variables: Minimum Distance, Maximum Distance, AVG, ABS AVG, RMS, SD, Variance and (90°-10°)/2.

Results: using Student's t-test, we compared the statistical variables between upper vivo, upper vitro, lower *vivo* and lower *vitro* for each scanner. The accuracy of the *in vitro* scanner is significantly better than that of the *in vivo* scanner.

Conclusions: the presence of saliva and tongue cause inaccuracies in the *in vivo* scan. Posterior mandibular areas are more difficult to scan due to space limitation. When scanning from left to right, there are more errors in the right posterior areas.

COMPARATIVE ANALYSIS USING FEM OF STRUCTURES FOR TORONTO BRIDGE ANCHORED ON 3 FIXTURES

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Aim: the aim of this study was to investigate by FEM analysis the behaviour of a 3 implants Toronto framework made by 3 different materials, with 2 abutment systems and 2 loading conditions.

Methods: three implants were inserted in a mandible epoxy resin model in positions 3.6, 4.1, and 4.6. Three frameworks with the same design and dimension but using different materials (fiberglass reinforced resin, Cobalt-Chrome, Titanium allow -TiAl6V4) were designed. For each framework, 2 models using 2 abutment systems (MUA/OT-Bridge) were created. The framework tension and deformation, and the influence of the abutment system were assessed using FEM analysis in 2 different loading conditions: a 500N concentrated load between two implants and a 400N load applied unilaterally on a 7 mm distal cantilever.

Results: in the first condition, the load was distributed over an extended area, especially for OT-Bridge system, and Cr-Co and TiAl6V4 frameworks performed better than resins. In the second condition, Cr-Co and TiAl6V4 frameworks reported higher tension values than reinforced resin framework. The OT-Bridge exhibited better performances than MUA system and framework's deformation is more susceptible to its material than to its abutment system.

Conclusions: from this FEM analysis, Cr-Co and Titanium alloy framework exhibited a better mechanical behavior than resin frameworks. The OT-Bridge system, due to its structural characteristics, allows a better stress distribution on all types of framework than MUA system.

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ROTATIONAL TOLERANCES IN ABUTMENT-IMPLANT CONNECTION FOR ORIGINAL AND COMPATIBLE ABUTMENTS

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Aim: the importance of rotational tolerance on the stability of the screw joint has been proven. Nowadays, several non-original abutments are available, often lacking experimental background. The aim of this study is to investigate the rotational freedom in a conical abutment-implant connection of original and compatible abutments in as-received condition and after several screw tightenings.

Methods: thirty titanium abutments and AnyRidge implants were selected. Ten were original EZ Post abutments (Group 1) and twenty were compatible abutments of two different manufacturers (Group 2 and Group 3). The rotational tolerance of the connection was measured using a tridimensional optics system in as-received condition (Time 0), after tightening the screw at 35 Ncm (Time 1), after tightening 4 times at 35 Ncm (Time 2), after tightening one more time at 45 Ncm (Time 3), and after tightening 4 more times at 45 Ncm (Time 4).

Results: original abutments showed the lowest values of rotational tolerances (min 0.2°, max 1,48°), while the Group 3 showed the highest values, reaching 3° in Time 4 experiment. After screw tightenings, the difference in results between original and non-original abutments become significant ($p < 0.05$) for each experimental condition.

Conclusions: non-original compatible abutments may cause increased rotational tolerance, expecially after multiple screw tightenings, undermining connection stability.

DENTAL 3D DIGITAL WORKFLOW USING AN OPEN-SOURCE 3D SOFTWARE PROGRAM

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Aim: digital field applied to dentistry is characterized by rapid growth. Dental practitioners and technicians intervention in terms of a correct drafting of the operations to achieve the project and then the product is fundamental both from a qualitative and quantitative point of view. There are several ways to obtain good results, but the right sequence in the use of suitable tools and selection of "simple" steps can significantly reduce computational effort. In fact, an incorrect operational sequence often returns incorrect results that fail or otherwise generate altered files. The purpose is to provide a more schematic and practical guide to the use of open-source software.

Methods: the Autodesk Meshmixer open-source software program was used. After examining and comparing several procedures available in literature and/or scientific websites, we outlined the workflows by illustrating the most suitable tools that require less effort from the computer. They permit to create temporary pre-milled crowns, gnathological night guards, rather than an individual tray or a diagnostic wax-up.

Results: after an accurate analysis of methods, time and tools used, we reached a new operational sequence that is certainly more schematic and contains advantages such as simplicity, speed, and less computational effort.

Conclusions: this work outlined a procedural and instrumental work-flow that allows clinicians to start and finish a 3d design using simple steps with time spare and good results.

ANALYSIS OF COST FOR REMOVABLE DENTURES FABRICATION PERFORMED WITH CONVENTIONAL AND DIGITAL WORKFLOW

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Aim: the use of removable complete dentures is widely diffused and can be considered an intervention of social utility. The introduction of digital technologies is revolutionizing several fields of dentistry. The purpose of this study is to compare the clinical and laboratory costs of complete removable dentures fabrication performed with Conventional (C), Mixed (M) and totally Digital (D) workflows.

Methods: detailed costs of each investigated approach were collected from 10 private Italian dental practitioners and technicians. The included variables were manufacturing time, costs of materials, labor, packaging, and shipping. For D and M protocols, capital and fixed costs for software and hardware were also considered. Cost-minimization and sensitivity analysis were performed, and break-even points calculated.

Results: from laboratory point of view, workflows M and D permitted a significant reduction of working time, compared to workflow C. The variable costs saving for workflow M was estimated to be between 70,2 and 147 EUR, while Digital workflow saved additional 29,9 EUR. The break-even point related to the capital investment in case of workflows M and D, could be reached with production of a number of dentures between 170 and 933 for workflow M and between 73 and 534 for workflow D, depending on the manufacturing options adopted.

Conclusions: totally and partially Digital workflows resulted to be more cost-effective than conventional method for fabrication of removable complete dentures.

MICRO-CT EVALUATION OF ENAMEL AND DENTIN TISSUE REMOVAL FOR INDIRECT RESTORATIONS

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Aim: to evaluate the effects of different finishing lines on enamel and dentin tissue removal and residual adhesion surface (RAS) areas for indirect partial restorations (IPR).

Methods: a molar was scanned using a micro-CT and the STL file (F_0) obtained was utilized to print 50 replicas. Standardized preparations for IPR were performed by a trained operator. The replicas were randomly assigned to 5 groups (N = 10) according to the tooth finishing line and to the location of the maximum contour line of the dental equator (DE): 1) Rounded shoulder above the DE (SA); 2) Hollow chamfer above the DE (CA); 3) Butt joint above the DE (BJ); 4) Rounded shoulder below the DE (SB); 5) Chamfer below the DE (CB). After scanning the sample, their STL files were superimposed and compared to F_0 to evaluate the volume of enamel and dentin removed with the different preparations (One-way ANOVA). The RAS area for enamel and dentin was also calculated (Kruskal-Wallis test). The level of significance was set at $p < 0.05$ for all the statistical analyses.

Results: no significant differences in both enamel and dentin tissue reduction were found between SA, CA, and BJ ($p > 0.05$). CB was significantly more conservative in enamel than SB ($p < 0.05$) showing the highest RAS among the tested preparation groups ($p < 0.05$).

Conclusions: among the tested finishing lines, CB was the most conservative approach and it provided the higher residual adhesive surface area available for adhesion of IPR. No differences were found between the different margins when located above the dental equator.

NEW BIO-MECHANICAL CHARACTERIZATION OF PMMA FOR CAD/CAM PROSTHESES: BRILLOUIN'S TECHNIQUE

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Aim: the study aims to compare the mechanical and biological characteristics of a polymethylmethacrylate (PMMA) disc for CAD/CAM prostheses (TG) with a traditional resin (CG).

Methods: mechanical analysis was performed using Dynamic Mechanical Analysis (DMA) and Brillouin's micro-spectroscopy. Human keratinocyte morphology and adhesion were analyzed by scanning electronic microscopy (SEM), cytotoxicity by the MTT assay, apoptosis by flow cytometry and p53, p21 and bcl2 gene expression by Real time PCR (3 h and 24 h).

Results: TG exhibited a higher elastic modulus than CG (range 5100–5500 ± 114.3 MPa vs 3000–3300 ± 99.97 MPa). The Brillouin frequency was found at ω_B = (15.50 ± 0.05) GHz for TG and at $\omega_{B_{-1}}$ = (15.50 ± 0.05) GHz and $\omega_{B_{-2}}$ = (15.0 ± 0.1) GHz for CG where two peaks were always present independently of the sample point. SEM analysis revealed that keratinocytes on TG disks appeared to be flattened with lamellipodia. MTT viability data showed TG was significantly less cytotoxic than CG ($p < 0.001$). No significant differences emerged in apoptosis. Real time PCR showed p53 expression increased both after 3 h (9-fold) in cells on TG ($p < 0.001$) and on CG (5-fold) ($p < 0.001$). High p53 expression persisted after 24 h on both disks.

Conclusions: TG were more rigid, leading to major clinical implications. Brillouin micro-spectroscopy provided microscale mechanical properties, showing that CG materials were elastically heterogeneous. TG showed greater biocompatibility than CG. Neither material was associated with a significant increase in apoptosis, despite greater p53 expression.

EFFECTS OF PREPARATION DESIGNS ON THE MARGINAL AND INTERNAL GAPS IN PARTIAL RESTORATIONS

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Aim: the marginal and internal discrepancy (MID) of lithium disilicate (LiSi) CAD/CAM ceramic partial restorations after different finishing margin lines (FML) was evaluated with 3D micro-computed tomography (μCT).

Methods: forty human molars were prepared to receive LiSi overlays (IPS e.Max CAD, Ivoclar) and randomly grouped (n = 8), according to the type of FML and locations to the dental equator (DE): G1: Rounded shoulder above the DE (SA); G2: Chamfer above the DE (CA); G3: Rounded shoulder below the DE (SB); G4: Chamfer below the DE (CB). Restorations were luted with a universal resin cement (RelyX Universal+Scotchbond Universal Plus, 3M). The MIA was evaluated with μCT. The marginal discrepancy (MD), absolute marginal discrepancy (AMD) axial space (AS) and occlusal space (OS) were calculated with 2D analyses. Three-D images were used to calculate the volumetric internal gap. Data were statistically analyzed ($p < 0.05$).

Results: the MID and 3D internal gaps differed between groups ($p < 0.05$). CB showed significantly greater AMD and MD than the other preparations ($P < 0.05$). Preparations below the DE (CB and SB) resulted in significantly greater AS and OS than the groups above DE ($P < 0.05$). CA showed significantly smaller 3D internal gaps than SB and CB ($p < 0.05$).

Conclusions: the marginal adaptations obtained with the tested finishing line preparations achieved clinically accepted values. Preparations located above the DE might results in restorations with smaller internal gaps.

ELDERLY PEOPLE ORAL HEALTH AND COGNITIVE FUNCTIONS

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Aim: to investigate the relationships among the edentulous condition in elderly people, cognitive decline, pathological oral conditions, and neurodegenerative diseases such as Alzheimer's.

Methods: 218 edentulous patients were enrolled. They underwent the administration of GOHAI test, PFEIFFER test, Evaluation of nutritional items according to BRADEN index, TRAIL MAKING TEST, and oral visit.

Results: among 218 patients (95 males, 123 females, mean age 75 ± SD), only 33 had no cognitive impairment. The difference between subjects without cognitive impairment and patients with moderate-severe cognitive impairment was statistically significant ($p < 0.05$). All variables studied affected the diagnosis of cognitive impairment, only sex, and medications taken were not statistically significant. Patients with severe cognitive impairment (n = 185) compared to cognitively intact patients or those with mild cognitive impairment showed a higher mean age and a higher rate of cognitive impairment: a higher mean age and a higher frequency of several parameters of poor oral health (reduction in the vertical dimension, muscle coordination and inversion of fit); a reduction in the integrity of the mucous membranes as well as a greater prevalence of Newton's stomatitis and oral candidiasis; a higher prevalence of diabetes and stroke, moreover a higher use of sedative drugs, anticoagulants, and bisphosphonates and a worse nutritional status; a score lower than 51 in the GOHAI test.

Conclusions: the prevalence of moderate-to-severe cognitive impairment was 84.9%. They presented, compared with cognitively intact or mild cognitive impairment patients, higher mean age, and higher frequency of several parameters of poor oral health and/or a reduction in the integrity of the mucous membranes and/or a higher prevalence of Newton's stomatitis and candidiasis.

METROLOGICAL TEST OF ACCURACY OF THREE METHODS FOR FABRICATING DIGITAL COMPLETE DENTURES

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Aim: to compare different manufacturing techniques of complete dentures, by investigating the accuracy (as trueness and precision) of the intaglio surface.

Methods: starting from the same Standardized Tessellation Language (STL) file of the metal model of an edentulous maxilla, three groups (n = 20) of complete dentures fabricated using three different technologies (milling-monolithic, milling-bonded and injection-molding) were tested to evaluate the trueness and precision of the intaglio surface. Eight areas of interest (AOI) were defined at the intaglio surface of the denture base (right and left edentulous crest, right and left buccal flange; central palate; post-dam; right and left tuberosity) and a new reference geometry approach was used to compare the intaglio surface to the CAD design. This approach was based on reference geometry landmarks and it was compared to the gold standard (best-fit). The minimum number of points for each AOI necessary to describe the error was calculated using sensitivity analysis.

Results: three levels of analysis (inter-groups, intra-group and inter-AOI) evaluated the Δ-mean error value. The inter-groups comparison showed a minimum 12 μm (DS 28 μm) trueness value of milling-monolithic group, with other groups well under the clinically significant limit of tolerance (300 μm). The intra-group analysis confirmed the best Δ-mean error value (4 μm) of the monolithic group at the left flange. The inter-AOI analysis showed the worst results for the injection-molding group at the left (149 μm) and at the right (168 μm) flange. All measures performed with the superimposition demonstrated to be underestimated respect to those determined using the reference geometry approach.

Conclusions: all Δ-mean error values of the trueness were not superior to 168 μm, confirming a level of the accuracy of digitally manufactured complete dentures well under of the clinical tolerance.

TRUENESS AND PRECISION OF DIGITALLY MANUFACTURED FRAMEWORKS FOR REMOVABLE PARTIAL DENTURE

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Aim: to evaluate the accuracy of removable partial denture frameworks manufactured with different production methods and materials.

Methods: starting from the same digital design, 80 frameworks were manufactured (group: n = 20): group 1, Titanium (Direct Metal Laser Sintering); group 2, Co-Cr (Direct Metal Laser Sintering); group 3 calcinable resin (Fused Deposition Modeling); groups 4, Co-Cr casting by lost-wax technique from digitally manufactured calcinable resin. All frameworks were scanned and compared to the Standard Tessellation Language (STL) file of the initial project design. The distance (Δ-error value) between the corresponding points of the frameworks and the digital design was measured in 8 different areas of interest (AOI). To test the repeatability (precision) of the measurement protocol, measurements of ten consecutive scans were performed using the reference geometry approach. Data were collected after the sensitivity analysis, that allowed determining the minimum necessary number of AOI points to analyze. All values were considered as relative values, to better represent the over- or under-contouring determined by the manufacturing.

Results: the inter-group analysis showed a total 6.3 μm Δ-mean error value for Ti, 41.4 μm for Co-Cr, 36.6 μm for calcinable resin, and 24.2 μm for Co-Cr metal casting. Intra-group analysis showed a 6.2 μm minimum Δ-mean error value for the vestibular component of the Bonwill clasp of Titanium frameworks, and a maximum Δ-mean error value (42.4 μm) for occlusal rest of circumferential clasp of Co-Cr frameworks. Inter-group analysis documented the occlusal rest of circumferential clasp as the worst Δ-mean error value for Ti and for Co-Cr, and the lingual component of the Bonwill clasp for metal castings.

Conclusions: all digital workflows produced clinically acceptable values of accuracy, although the Titanium DMLS manufacturing showed the highest level of trueness.

CARTILAGE REGENERATION: INNOVATIVE MOLECULES AND SYSTEMS TO IMPROVE HEALING AND COUNTERACT ARTHRITIS

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Temporo-mandibular joint (TMJ) is a crucial part of the stomatognathic system. Excessive or prolonged overload and some mechanical factors leads to matrix components degradation with the destruction of the joint's articular cartilage. Recently, the use of Gellan Gum (GG) as scaffold for cartilage regeneration is increased exponentially thanks to its easy preparation, low price and editable biological properties. The goal of this study is to biologically characterize different GG-based hydrogels filled with several molecules to assess GG versatility in cartilage regeneration. Materials' cytocompatibility has been evaluated, after the establishment of a 3D model, by means of metabolic activity by using the alamar blue assay whilst chondrogenesis has been evaluated by histological analysis and Real time PCR; The protective effects of molecules on cells against bacteria has been done by using the innovative cells/bacteria co-culture in which the number of cells and bacteria is estimated by using the trypan blue and the CFU respectively. Results demonstrated how the incorporation of different molecules didn't interfere with materials' cytocompatibility and at the same time how it can significantly increase materials' mechanical properties. This last parameter has been demonstrated to be crucial during chondrogenesis. Moreover, the incorporation of some molecules has been demonstrated to have a protective role on cells against pathogenic bacteria often present in septic arthritis. According to these results, we can assume its ability to efficiently sustain cartilage regeneration.

CLINICAL PERFORMANCE OF IMPLANT-SUPPORTED FIXED PROSTHESES WITH ANGULATED SCREW CHANNELS

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Aim: the aim of this prospective cohort clinical study was to assess the mechanical complication and crestal bone loss in posterior monolithic zirconia implant-supported fixed dental prostheses with angulated screw channels.

Methods: participants with good general health, sufficient residual bone height and thickness were choosing. All implants were placed according to the same protocol. After 4 months of healing, a conventional impression was taken and the monolithic zirconia FDPs with ASC were designed by CAD software program and mechanically attached to a titanium base. During the follow up at 6, 12, 24, 36 months CBL and mechanical complication were checked. CBL was measured from radiographs, considering the mesial and the distal sides of the implant. The mechanical complication recorded included fracture or chipping of the fixed dental prostheses, fracture of the implant and loosening or fracture of the screw. Also implant diameter, screw channel angle (angle ≤ 15 degrees versus > 16 degrees), prosthetic type (single or multiple crowns) and antagonist type (natural dentition or prosthesis) were noted as implant and prosthetics characteristics.

Results: the analysis included 49 implants and screw loosening was recorded in two participants. The effect of the angle of ASC, implant diameter, implant length, prosthetic type, and antagonist on the CBL was not statically relevant.

Conclusions: posterior monolithic zirconia implant-supported FDPs with ASC did not increase neither CBL nor mechanical complication during the first 3 years of placement.

CONOMETRIC CONNECTION BETWEEN ABUTMENTS AND PROSTHESES: REVIEW OF THE LITERATURE

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Aim: the conometric design was proposed as a possible connection between the abutment and the prosthetic coping. This study aimed to review the characteristics and possible clinical uses of this connection in implant-supported prosthesis.

Methods: a search was done on electronic databases for the keywords: dental implant and (conometric connection or conometric prosthesis); articles published in English after 2010 were considered and the research gave 17 results. 6 parameters were analyzed: advantages due to the absence of cement or screw, retention force, bacterial seal, digital approach, follow-up and types of prostheses.

Results: this connection eliminates the possibility of cement residues in the sub-gingival region, reducing the risk of inflammation of peri-implant support tissues; having not to remove the cement residues, it is possible to place the margins in more apical portions, improving the aesthetics. It is also known that the retention by means of a screw causes a weakening of the restoration. The retentive force is adequate for fixed rehabilitation even after a high number of insertion-disengagement cycles; *in vitro* studies have also shown a high bacterial seal. Implant rehabilitation using preformed components, such as conometric hoods, is helpful for CAD/CAM design. Single rehabilitation, fixed partial dentures, complete prostheses were presented: they all demonstrated adequate clinical performance in the follow-up.

Conclusions: this type of connection seems to be suitable to support fixed implant rehabilitations, but long-term clinical studies are needed.

MASTICATORY FUNCTION AND NUTRIENTS INTAKE IN THE INDEPENDENT ELDERLY: A SYSTEMATIC REVIEW

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Aim: impaired masticatory performance of ageing patients has been considered associated with nutrients deficiency. The aim of the study was to investigate the association between masticatory function and nutrients intake in independent elderly.
Methods: PubMed, Web of Science, Cochrane Library e Tripdatabase were searched for eligible studies published between 1991 and 2020. The search comprised articles written in English, selected using the key words "denture" OR "mastication" AND "nutrition" OR "elderly". Samples of patients with age not inferior to 65 years and independent life conditions were considered.
Results: among 1362 studies, 10 articles referred to 4 randomized controlled trials and 8 observational studies fulfilled the inclusion criteria. Three RCT comparing different prosthetic treatments found no difference in the nutrients intake between the two study groups. One RCT suggested some improvement of the nutritional intake only when the prosthetic treatment was associated with proper dietary advice. The overall results of the observational studies suggested that a better masticatory performance provides the elderly with a higher nutrients intake.
Conclusions: improved masticatory performance alone can't assure adequate nutrients intake in the elderly, but the influence of other factors is suggested, including socio-economical, psychological and pharmacological factors: nutritional counseling seems an important factor to improve nutrients intake and it's recommended to be associated with the prosthetic rehabilitation.

DENTAL IMPRESSION THERMO ACCELERATOR; COMFORT, EFFICIENCY AND SAVINGS

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Aim: one of the most troublesome procedures reported by dental patients is the taking of a conventional impression. Dental scanners currently represent an innovation that can greatly reduce this discomfort. However, some limitations related to procedure and accuracy remain. The reduction of the discomfort of a conventional impression must go through the reduction of the setting times of the impression material during which the patient must remain immobile enduring a discomfort given by the size of the impression tray. The ideal solution is a device that reduces setting times without changing the precision, workability and impression instruments used in daily clinical practice. A device called "Impression Heater" (EU application No. 3.769.716) consisting of a disposable self-heating adhesive plaster with an exothermic chemical reaction to be placed on the tray with activation decided by the dentist. The aim of the study was to evaluate the effectiveness of a thermal impression accelerator in reducing the setting time of different elastomers.
Methods: for 3 samples of 5 different elastomeric materials (width 6 mm x length 50 mm x depth 3 mm) the hardening of the material was evaluated at intervals of 15 seconds using an ASTM 2240 Shore-A durometer. The same procedure was replicated 3 times and reproduced, after positioning on a Impression Heater at temperatures of 35 °C, 50 °C and 65 °C, for each type of each material.
Results: the increase in temperature during impression taking at 50 °C reduces the setting time between 38.1% and 45.8%. At 65 °C the reduction in setting time is between 52.4% and 66.9%.
Conclusions: Impression Heater is a quick, economical and easy-to-use device that can reduce the discomfort caused by long times for taking dental impressions without shortening the working time for the operator.

A NOVEL CONICAL DENTAL IMPLANT CONNECTION: FEM AND VON MISES INVESTIGATION

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The finite element technique (FEM) allows to study the structural phenomena related to the rigidity, resistance and elastic stability of the bodies. The FEM analysis in the design method allows us to study complex physical phenomena and identify any problems even before the prototype is built, then to review the project. In addition to identifying malfunctions, the structure can be optimized by removing excess material and improving weight distribution. These investigations are of great help in the prosthetic and dental field to evaluate the stress of dental implants on the different biomechanical forces present in the oral cavity. The methods used are FEM and Von Mises to study how forces of different magnitudes (430N-800N) are discharged on the prosthetic abutment with different angles at 0 ° and 30 °.
In the results it was noted that at 0 ° the stresses in the bone are localized around the implant with maximum tension in the cortical bone, at 30 ° the stress is concentrated on the side of the implant. To date, therefore, the prostheses are examined by the FEM before production to verify the correspondence with biomechanical criteria that they must face once implanted.

TRAD. *VS* INNOVATIVE IMPRESSION METHOD TO RESTORE A MAXILLOFACIAL DEFECT: A CLINICAL CASE

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Aim: processing a facial prosthesis is a complex procedure. Conventional extra oral impressions can be used to record the characteristics of defects. In recent years, advanced digital processing methods have been used, in an attempt to remedy some of the clinician's difficulties in the rehabilitation of facial defects. In this case report we want to investigate traditional techniques limits and advantages that can be obtained through the introduction of a CAD/CAM method in extra oral maxillofacial prosthetics. To do this we will describe the construction of nasal epithesis of an oncological patient, which has been rehabilitated using a traditional method of impression and an impression obtained with ConeBeamCT method.
Methods: a stone model was obtained from traditional impression; from virtual processing of CBCT data with Materialise Mimics® Medical software was obtained a ABS plastic model, printed with a 3d printer. Two noses prostheses were modeled, tested on patient, printed in silicone and delivered to the patient.
Results:
- reduction of work sessions and more comfort for the patient;
- absence of significant differences in the fitting of the two epitheses;
- radiation dose supplied to carry out the CBCT must always be taken into consideration before prescribing the examination.

Conclusions: there are no methods in literature to quantify the greater efficacy of one impression over another. The different characteristics with which defects occur require a specific approach, both in materials choice and in impression techniques.

CLINICAL ADVANTAGES OF SECTORAL ALIGNERS IN AESTHETIC REHABILITATIONS: INVISALIGN GO

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Aim: improving the aesthetic of teeth and smile has become the main request of all patients who are approaching dental treatments today. The introduction of sectoral aligners, such as Invisalign Go, allowed the clinicians to propose multidisciplinary treatment plans that are based on faster, cheaper, and less invasive pre-restorative phases.

Methods: a 54-year-old woman asked for consultation because she was unsatisfied with her smile. Clinical evaluation revealed discolored and worn upper incisors in presence of unpleasing pre-existing composite restorations, a cross-bite on the upper right canine and a head-to-head interocclusal relationship on the upper right lateral incisor. No signs of temporomandibular disorders were detected. The treatment plan aimed at correcting, by means of clear aligner therapy, the cross-bite and misalignment from 1.3 to 2.3, in order to optimize the subsequent prosthetic re-shaping with adhesive veneers. The clear aligner therapy was performed with Invisalign Go (Align Technology, San Jose, Calif) a system specifically designed for general practitioner involved in restorative dentistry, which allows tooth movements from second premolar to second premolar in both arches.

Results: the patient was highly satisfied for the aesthetic result achieved. Thanks to the preliminary correction of the anterior sector misalignments and to the subsequent optimization of the interocclusal relationship on frontal teeth, which was successfully achieved while maintaining a pre-operatively verified occlusal balance on posterior sectors, the delivered esthetic treatment was extremely conservative ant its long-term prognosis may be considered definitely predictable.

Conclusions: the newly introduced Invisalign Go could be extremely useful for clinicians involved in multidisciplinary treatment plans, especially in a pre-restorative phase, as it may definitely simplify a minimally invasive approach based on adhesive restorations.

DIGITAL APPROACH TO IMPLANT SUPPORTED REHABILITATION: A CASE REPORT

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Aim: challenging rehabilitations presents multiple difficulties on both surgical and prosthetic sides: a digital approach can support the workflow in these situations. This case report illustrates how a digital approach can help in the management of these clinical cases.

Methods: surgical guides were used for the placement of the implants on both arches. In the jaw an immediate load was possible while, in the upper maxilla, extensive bone ridge augmentation was required and therefore loading was delayed. After four months second surgery and contextual soft tissue augmentation were carried out and a 3D printed interim restoration was placed. After two months, new dental and facial scans, smile design and bite registrations were obtained. Both metal bars were passivated and cemented to the coping in one session; in the following session aesthetics and occlusal checks took place and, on the third appointment, both prothesis were screwed in.

Results: careful planning of the case and the production of a screwed 3D printed temporary prosthesis were conducted through the application of digital techniques. Smile design and facial scans paired with traditional bite registration methods provided means to create acceptable aesthetics and function in few sittings with minimal discomfort for the patient.

Conclusions: the presented digital protocol can bring advantages in the surgical and prosthetic phases of the rehabilitation. Further studies are needed to validate this protocol.

TISSUE CONDITIONING AND IMPRESSION ON POST-EXTRACTION IMPLANTS WITH IMMEDIATE LOAD

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Aim: to draw attention to the importance of the provisional prosthesis and of the impression to obtain a definitive product that replicates accurately the morphology of the conditioned tissues.

Methods: two case reports of post-extraction implant with immediate loading and screw technique. In specific a male patient of 42 y with post-extraction implant in position 21 and a female patient of 38 y with post-extraction implant in position 14. After the achievement of the tissutal conditioning we can proceed to the registration of the precision impression with the customization of the transfer with flow composite to guarantee the accuracy of the registration of the trans-mucosal path and of the gingival margin adequately conditioned by the provisional prosthesis.

Results: the provisional prosthesis conditioned adequately the gingival tissues and the customization of the transfer with flow composite permits to reply accurately the morphology of the provisional restoration. This technique permits the realization of a definitive prosthesis that guarantees a long-term success.

Conclusions: with these reports it's highlighted the importance of the correct morphology of the provisional restoration to guarantee a long term success and an optimal esthetic result of the definitive prosthesis with a precise analogic impression and the customization of the transfer with flow composite.

FIXED FULL-ARCH REHABILITATION OF A 7 YRS CHILD WITH ECTODERMAL DYSPLASIA

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Aim: Ectodermal Dysplasia syndromes (EDs) are a heterogeneous group of inherited diseases characterized by abnormal development of tissues of ectodermal origin. Oligo-Anodontia is one of the most severe impairment affecting chewing, speech, aesthetics and social relation so early prosthetic rehabilitation is essential. Insufficient retention and stability of conventional dentures are an indication for implant-supported prostheses in these patients. The present article describes a case of an edentulous 7 yrs old patient rehabilitated with a fixed lower full-arch implant prosthesis.

Methods: three implants were placed in the interforaminal area, an OT Equator low-profile attachment was placed on each of them, and a digital impression was performed. In order to follow and avoid any alteration of the mandibular growth, a sliding bar was applied as framework. Then, an acrylic resin fixed full-arch implant prosthesis was delivered. A 12-months follow-up period was reported.

Results: following the protocol "OT Bridge", the OT Equator was used as a multi-unit abutment allowing the anchorage of the prosthesis, achieving a functional monoblock and guaranteeing its passivation. This function is performed by two elastic rings called Elastic Seeger placed into the abutment. This specific sliding framework allows transversal and sagittal growth but, at the same time, guarantees the stability and the support of the prosthesis.

Conclusions: after 12 months of follow-up no implant failure nor prosthetic fracture were documented. The diet and the quality of life of the patient are improved.

PERI-IMPLANT MUCOSITIS POTENTIALLY LINKED TO BIMETALLISM: A CASE REPORT

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Aim: peri-implant diseases are defined as inflammatory lesions of the surrounding peri-implant tissues and include peri-implant mucositis and peri-implantitis. The aim of this case report is to describe the excision and the treatment of a peri-implant mucosal hypertrophic lesion.

Methods: 72-year-old male patient came to our attention referring bleeding and swelling in the left upper palatine area. Radiographic examination showed six osseointegrated implants in the upper arch and a mild peri-implant osteolysis.
Clinically, there was an incongruous fixed implant prosthesis with the presence of horizontal and vertical over-contour and closure of the interproximal spaces with compression of the interdental papillae. The presence of an exophytic, slightly ulcerated, epulis-like lesion associated with the implants in the left 4-5-6th region, with detectable extensive perimucositis at probing, requires as treatment the surgical excision of the lesion and subsequent realization of a new and well designed prosthesis metal-free based on the same implants.

Results: histological analysis showed mucosal fragments with fibro-inflammatory epulide-like features with a high content of plasma cells and microcalcifications; and, a fragment of plurifocally eroded-ulcerated mucosa with reparative giant cell granuloma-type alterations.

Conclusions: patient's medical history excluded medical conditions or drug regimens that might account for the mucosal reaction observed. The anatomical-pathological picture provided appears to be compatible to electrogalvanic current lesions linked to the bi-metallic nature of the implant-prosthesis.

REPLACE AN EXISTING MAXILLARY OBTURATOR WITH NO IMPRESSIONS. POWER OF DIGITAL PROSTHODONTICS

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Aim: maxillary defects resulting from tumours, trauma, congenital deformities may require prosthodontic obturators (PO) to seal oroantral communications and restore function and aesthetics. PO are often made with same methods of conventional removable prosthodontics. CAD-CAM techniques have been recently employed to simplify in office procedures and reduce patient discomfort.

Case report: a 64 y.o. woman with an acquired class IId following maxillectomy for Pindborg tumour in 2003 received several PO at DDOS during time. In autumn 2021 because of discomfort and unsatisfactory aesthetics the patient requested a new PO. Since the existing one was still functional with no apparent fluid or solid leakage, it was scanned with a dental CAD-software and duplicated to obtain a master stone cast without necessity of impression of defect. Then a new acrylic resin PO was manufactured and delivered. Patient was satisfied for functionality and aesthetics at 4 months follow-up with no necessity to reline the bulb portion of PO.

Conclusions: PO are customized devices effective in restore maxillary defects. However, their construction requires complex and uncomfortable in office procedures for both patient and clinician. This may represent an important issue considering improved survival of patients and frequent necessity for modifications or replacing of PO. In this case the combination of dental CAD techniques and conventional manufacturing resulted in an easy two-appointment procedure for delivering a new PO with optimal functionality and aesthetics and very little discomfort for the patient.

LIP BUMPING EFFECT: LIP VOLUME AUGMENTATION USING INCREMENTING THICKNESS VENEER MOCK-UPS

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Aim: this study was conducted to evaluate if the volume of upper and lower lips tissue changes after the application of incremental thickness veneer mock-ups.

Methods: the study was conducted on 7 patients, 1 male and 6 females. Profile photographs were taken using a repeatable method for each patient in a natural position and after the application of each mock-up, with a standard increasing thickness of 0.5mm each, starting from 0.5mm, up to 2mm. As a cephalometric reference for photographs, a Natural Head Position (NHP) plane was used. KeyNote software was used in order to measure horizontal distances between an arbitrary reference point, which goes from the glabella to the tip of the chin, and the tangential line to the upper lip (A0-A) and the one to the lower lip (B0-B). Also the vertical distance between tangential lines to the upper and lower lip (A-B) was calculated. Data were collected in an Excel table and were analyzed with a IBM SPSS statistics software.

Results: the mean value of A0-A (upper lip) increased from 4.93mm in a natural condition up to 6,68mm with a veneer increment of 2.0mm ($p = 0,781$), while the mean value of B0-B (lower lip) increased from 2.50mm in a natural condition up to 3.71mm ($p = 0,777$). The main value of A-B augmented from 9.96mm in a natural condition up to 10.68mm with a veneer thickness of 2.0mm. However, it was noticed that A-B mean value only increased when mock-up thickness is > 1,5mm. In fact, it even decreased immediately after the application of the first 0,5mm mock-up and then it stabilizes between 0,5mm and 1,5mm of mock-up thickness.

Conclusions: a directly proportional ratio between the progressive veneer mock-up thickness augmentation and a lip volume increase emerged, even though the significance levels were not entirely satisfied.

ACCURACY AND PRECISION OF NEW MEDIT I700 INTRA-ORAL SCANNER: *IN VITRO* EVALUATION

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Aim: the objective of this *in vitro* study is to evaluate the precision and accuracy of the new Medit i700 Intra-oral Scanner, comparing it to an industrial Alicona scanner model Inspect Professional.

Methods: an implant abutment, custom-made, simulating a mandibular right first molar, was taken as a reference model for the study. The same operator executed a single scan with Alicona industrial scanner model Inspect Professional, which was used as a control group, and a total of 9 scans were performed with Medit i700 intra-oral scanner, which were used as a test group. At each of these 9 scans, a pairing with the control scan was performed to perform the comparison. Comparisons were performed, and 10 measurements were taken in the vestibular-lingual and mesial-distal directions, on the axial walls, at the margin and on top of the abutment. Descriptive analysis was performed using the mean, standard deviation, and median to determine the discrepancy values between the 2 scanners.

Results: the Medit i700 demonstrated excellent results in terms of precision and accuracy, but in agreement with the literature, angle reproduction remains critical.

Conclusions: with this study we can understand how it is of primary importance the accuracy and precision of an intraoral scanner to obtain prosthetic manufactures that are as precise as possible.

INFLUENCE OF DIFFERENT ADHESIVE CEMENTS IN CERAMIC CEMENTATION: EVALUATION OF AGING EFFECTS AFTER TH

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Aim: the aim of this study is to compare *in vitro* tensile bond strength values of the cement-ceramic interface following thermocycles, by comparing lithium disilicate with zirconia, using four different resinous cements

Methods: this study compares the adhesive cement-ceramic interfaces which were obtained by adhesion of two ceramics, among the most used in the prosthetic field (lithium and zirconia disilicate), with four different resinous cements. Starting from a single CAD project 48 samples were made, 24 in zirconia and 24 in lithium disilicate to obtain 12 pairs for both category of ceramic. These were equipped with a 3 mm cylindrical connector. The cements used in the study are: Variolink Esthetic DC, SpeedCem Plus, Panavia V5, Relyx Ultimate. Cementation: Zirconia group provides: sandblasting of the surfaces with 50 µm aluminum dioxide, decontamination in an ultrasound tank, drying the surface with air. Lithium disilicate group does not require any mechanical surface treatment. Thermocycling: In this study the dynamic climatic chamber used is the BINDER model MKT 115.The samples were stored for 150 days in distilled water at 37 ° C interrupted by 37,500 thermocycles between 5 ° C and 55 ° C with a dwell time of 30 seconds. Tensile test: Using the vertical dynamometer to carry out the tensile tests, an increasing force was applied at a feed speed of 1 mm/min until detachment of the two samples was determined to verify the adhesion force between the two interfaces.

Results: from the traction performed on the samples we obtained 24 values of tensile bond strength, of which 12 were for lithium disilicate and 12 for zirconia. For each ceramic pair, the same cement was used and three tensile tests were carried out to obtain statistically comparable results in Mega pascal (MPa), and the mean of the values was calculated. Afterwards, all the ceramic surfaces were analyzed by evaluating the type of fracture (adhesive, cohesive or mixed) using ambient scanning electron microscopy (ESEM) at a magnification from 50x to 2000x. A careful evaluation of the images showed adhesive fractures in all samples. The different spectra of chemical composition, at the level of the ceramic interfaces, have been analyzed by EDX spectroscopy for a more correct interpretation of the images.

Conclusions: from the high bond strength results obtained on zirconia and the relative fracture of the 4 cements, with the exception of Panavia V5, it is possible to see that the cementation on polycrystalline ceramic is not only micromechanical but also adhesive. The intrinsic strength of resin cements is the key factor in achieving maximum adhesive cementation potential.

BIOMECHANICS OF PASSANT SCREWS IN IMPLANT-PROSTHETIC REHABILITATIONS: AN *IN VITRO* STUDY

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Aim: dental implants are alloplastic devices, so they are not free from biomechanical complications, especially in the case in which the connections are complex and involve several components. In this study, the passing screws of the abutments of the dental implants were evaluated with a scanning electron microscope, in order to highlight what could be surface alterations using different screwing torques, or simply by repeating the screwing process several times.

Methods: the samples were examined under a Zeiss EVO LS 10 scanning electron microscope, operating with an accelerating voltage of 20 kV. Tested screws are Osstem®, South Korea Dental Implant Ebony Gold® passant screws. The analysis of the samples was performed by comparing the surface alterations of the screw after regular screwing with 30 N torque, screwing with maximum torque, double screwing with 30 N torque and unscrewed control screw.

Results: the results showed that the screw undergoes structural alterations when it is subjected to a higher torque than indicated by the manufacturer or when it is unscrewed and screwed back a second time.

Conclusions: inadequate adaptation can lead to a microgap, thus increasing the risk of biological complications, i.e. microbial colonization, bone loss and loss of osseointegration of the implant, but also mechanical complications, such as loosening or fracture of the screw, the prosthesis or the abutment.

A DIGITAL WORKFLOW TO MAXIMISE COST EFFECTIVENESS IN IMPLANT-FIXED COMPLETE DENTURES

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Aim: this work aims to present a protocol for the realization of a full-arch, implant-fixed complete dentures in monolithic zirconia and titanium using digital tools in order to obtain a satisfactory result at a more affordable cost.

Methods: implant-fixed complete dentures can be expensive. To reduce costs, monolithic zirconia and titanium can be milled using CAD-CAM methods, reducing labor and therefore costs. Moreover, zirconia, compared to other materials such as metal-resin prostheses, undergoes less wear and despite an higher costs, it undergoes fewer complications making it preferable and less expensive in the long-term. Lastly in case of complications, it enables the monolithic zirconia to be milled again, and to be re-cemented onto the titanium bar. Whether it was necessary to modify the titanium bar, due to the loss of an implant, it would be enough to re-mill it, this time preserving the zirconia part, since, once cemented, the two components can be separated using heat.

Results: the presented protocol represents an effective, low-cost solution, easily and quickly repairable, which leads to complete restoration of the masticatory function and an excellent aesthetics compromise.

Conclusions: the presented protocol offers different advantages, in terms of cost sustainability, minimal wear risk for the prosthesis and its antagonists and ease of re-intervening. However, the lack of pink orthopedic component and the absence of stratification, mean that this technique finds its main indication in patients with limited economic possibilities and without great aesthetics demands.

A METHOD FOR RECORDING AND TRANSFERRING CLINICAL DATA TO COMPLETE DENTURE DIGITAL DESIGN

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Aim: to propose the combination of a simplified method for complete denture with the digital laboratory workflow. With the uptodate S.E.T. method (Simplified Edentulous Treatment) and the scanning of the obtained information it is possible to proceed with all CAD-CAM procedures.

Methods: the S.E.T. clinical procedure allows to obtain, through a single clinical session, a block containing all clinical data necessary for the realization of the complete denture, in respecting basic traditional principles: final impressions, intermaxillary relationships, definition of neutral zone and lip support and esthetics. This clinical procedure is followed by laboratory scanning, digital design, and digital manufacturing (CAD-CAM milled or printed).

Results: the method allows to give the laboratory all and reliable clinical data after just one clinical session. The clinician can ask for a try in prototype or go through the process until the delivery, but no other records or clinical procedures are needed.

Conclusions: the efficacy of the method has been already documented in the literature with a traditional laboratory workflow. The possibility to use it with a digital laboratory process allows to further reduce not only the clinical but also the laboratory timings. Furthermore, the digital design allows to have a simulation of the final prosthesis and to store all the information on a digital database.

INFLUENCE OF VEP TECHNIQUE AND CHAIR-SIDE TEMPORARY RESTORATION ON THE GINGIVAL MARGIN

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Aim: the purpose of this retrospective study was to quantify the influence of Vertical Edgeless Preparation on the stability of the gingival margin.

Methods: the evaluation was carried out by comparing intraoral scans acquired before the patient was treated, after the preparation of the tooth and one month after the placement of the provisional restoration. The data collected were obtained thanks to the use of overlap and distance calculation algorithms, able to estimate the displacement of the gingival margin in space, even broken down into its three dimensions (bucco-lingual, mesio-distal and apico-coronal). In particular, the possible alterations occurred between the first and second scans, and between the second and third scans, were observed in three points of the gingival margin: one on the mesial side, one central and one on the distal side.

Results: from the descriptive statistical analysis of the measurements carried out in the different comparison groups, it appears that on average the variation following the dental preparation is 0,19mm – 0,24mm vertically in apical direction and after the healing of the tissues one month after the placement of the temporary restoration is 0,15mm – 0,18mm vertically in coronal direction.

Conclusions: the small variation observed can be considered clinically negligible, which is why it can be concluded that the techniques used are suitable for maintaining the stability of the gingival margin.