

FINITE ELEMENT ANALYSIS ON A NOVEL DENTAL IMPLANT MATERIAL: ZIRCONIA DENTAL IMPLANT

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Aim: the aim of this study is to evaluate in silico mechanical performance of zirconia fixtures with Finite Element Analysis.

Methods: the investigation was performed on a single Patent™ Dental Implant (Zircon Medical®, Altendorf, Switzerland) in two configurations: without offset (Test I) and with offset (Test II, 1.5 mm within the cortical bone). The components of the dental implants were tested using a compression load of 400 N along the implant axis. The Patent Implant system con-

sists of two components: the implant with integrated abutment and the fibreglass post.

Results: the chewing load generates anomalous stress distribution on the bone, therefore, the offset configuration should be avoided.

Conclusions: Test I has better results than Test II to generate lower compressive stress on the cortical bone and higher stress on the cancellous bone.

REPRODUCIBILITY OF THE PATIENT'S REAL OCCLUSAL PLANE: ARTICULATOR VS FACIAL SCANNER

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Aim: the purpose of this study is to evaluate the reproducibility of the patient's real OP in the three planes of space, in anticipation of a prosthetic rehabilitation, by comparing the data obtained from an analog method, with data obtained from the digital Facial Scan (FS) technique.

Methods: analogue procedure sees the recording by the same operator of five facial arches of the patient, with different settings, for each of the two categories analyzed: Artex and Reference and subsequent static assembly in the corresponding articulator. Digital technique has seen as the first step the intraoral scan of the patient and subsequent Facial Scan (FS) through the Zirkonzahn face hunter scanner; from the same scan, five 3D patient reconstruction projects were carried out by the same operator using the associated software. For all the five couples of each category of Facial Arches analyzed and for all the five digital projects, the reproducibility of the OP in the three planes of the space was assessed. OP has been analyzed in different views. The angles formed between the

OP and the corresponding reference plan for each category were quantified. Finally, the average values of the five reference planes of the Artex category were compared with the average values of the five reference planes obtained in the Digital Projects through data analysis; in the same way it was done for the Reference category with digital projects.

Results: data obtained from the data analysis which saw the comparison of the average values of the five reference plans of the Artex category with the mean values of the five reference plans obtained in the Digital Projects, show a p-value equal to 0.0022 ($p \leq 0.05$). Same protocol has been applicated to Reference's category, has been obtained a p-value equal to 0.0034 ($p \leq 0.05$).

Conclusions: digital approach of Facial Scanning presents an effective design of interventions with an accuracy and reproducibility not found in analogue methods, also providing the possibility to plan the work on a 3D "virtual patient" faithful and corresponding to the real situation.

IN VITRO STUDY ON ACCURACY OF THREE FACIAL DETECTION SYSTEMS FOR PROSTHODONTIC PREVIEW

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Aim: the aim of this study was to compare the accuracy of three different devices for facial images acquisition, suitable for prosthodontic esthetic preview.

Methods: bidimensional extraoral photographs (Nikon D300), facial scans (Bellus3D) and 3D digital stereophotogrammetry photos (3dMD Face System) were acquired from 15 patients. The intraoral impressions of all subjects were digitally taken through a scanner (i500; Medit). Files obtained from each acquisition method were transferred on Exocad Software, and the measurements of the frontal teeth were performed and compared with those of the intraoral scans, assumed as reference. The data were statistically analyzed by the Friedman test for matched groups and the Dunn test for multiple comparison ($P < 0.05$).

Results: no significant difference emerged between 2D digital photography and intraoral scans, both in height and width, for central and lateral incisors.

Measures obtained with Bellus3D significantly differed from the reference data in width of all teeth, except for central incisors ($P < 0.05$).

Values referred to canines were those more subjected to significant distortions in width for all devices.

Conclusions: within the limits of this study, measures of frontal teeth acquired by 2D digital photography were similar to those of intraoral scans both in height and width, while those obtained with 3D facial scanners were more subjected to distortions in mesial-distal dimension.

READING DEPTH WITHIN THE SULCUS OF IOSS VARYING RADICULAR EMERGENCE PROFILE AND HUMIDITY

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Aim: the aim of this *in vitro* study was to evaluate the effect of the angle of radicular emergence profile, the gingival sulcus depth and the humidity level on depth of reading within the gingival sulcus of 4 intraoral scanners (IOSs).

Methods: a juxtagingival chamfer preparation was performed on a maxillary premolar of a phantom model. The model was scanned and .stl file was modified varying the angle of radicular emergence profile (0°, 6°, 12°, 20°, 25°) and sulcus depth (1 mm, 2 mm) to manufacture ten different 3D printed models. In addition, 3 different levels of humidity were simulated: dry, wet (1 µl of artificial saliva) and full wet (5 µl of artificial saliva). Each model was scanned 5 times using 4 IOSs: Trios 3, Trios 4, Omnicam and Primescan. Differences in means were compared using Three-way ANOVA with interactions. The level of significance was set at $P = 0.05$.

Results: a deep gingival sulcus, an accentuated angle of radicular emergence profile and a great level of humidity made more difficult the reading within the gingival sulcus. Three-way ANOVA analysis revealed an interaction between these 3 factors.

The reading within the gingival sulcus was only partial with all tested IOSs in the presence of 25° of radicular emergence profile, a 2 mm-deep gingival sulcus, and a high humidity level. Trios 3 and Trios 4 showed an adequate depth of reading inside the gingival sulcus up to an angle of 12° of radicular emergence profile.

Conclusions: in the most complex clinical situations simulated in the present study the depth of reading was incomplete, suggesting that deep preparations into the sulcus were difficult to detect with IOSs.

DIGITAL WORKFLOW FOR THE IMPLANT-PROSTHETIC TREATMENT OF TEETH AGENESIS: PROSPECTIVE STUDY

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Aim: the main objectives of the present clinical prospective study were to evaluate the survival and the success of implant-supported zirconia single crowns produced with a digital workflow for the rehabilitation of mono- and bilateral agenesis of maxillary lateral incisors, after 2 years of clinical function. Furthermore, biological and technical parameters affecting the prosthetic restorations were recorded, as well as the patient satisfaction rate.

Methods: twenty-two patients affected by monolateral or bilateral agenesis of the maxillary lateral incisors were included in the study, and a total of 30 narrow diameter implants were inserted. Thirty screw-retained monolithic cubic zirconia crowns (5Y-TZP) with internal connection were fabricated. Objective evaluations were performed by means of the FIPS

(Functional Implant Prosthodontic Score), whereas the degree of patient satisfaction was evaluated by means of VASs (Visual Analog Scales). Descriptive statistics was performed by means of Kaplan-Meier analysis.

Results: after 2 years of clinical function, the overall average FIPS found in the present study was 9.2, whereas the average patient satisfaction score was 8.7. The Kaplan-Meier analysis at 2-year follow up reported a cumulative success rate of 93.3% and a cumulative survival rate of 100%.

Conclusions: implant-prosthetic rehabilitation produced with digital workflow has proven to be a reliable procedure for the esthetic-functional treatment of the agenesis of maxillary lateral incisors in the short-term, although further clinical investigations are required to validate this treatment option in the long-term.

INTRAORAL SCANNER ON VERTICAL DEEP SUBGINGIVAL MARGINS: 3D ANALYSIS AND ACCURACY

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Aim: the aim of this study was to evaluate the accuracy of an intraoral scanner (IOS - Medit i700) on tooth abutments with vertical preparations at different depths below the gingival margin, and to determine if the IOS can detect the surface beyond the finish area of this preparation geometry.

Methods: two abutments of a standard maxillary first molar were designed using a CAD software with vertical preparation geometry 1 and 2 mm deep in the gingival margin. These abutments were printed in resin and placed each on a reference model. Ten scans were made with the tested IOS on each sample to obtain 2 study groups. The experimental scans were named "V-1" (vertical preparation at 1 mm under the gingival margin), "V-2" (same, at 2 mm). The scans were analyzed using a dedicated software to evaluate trueness and precision

in μm . Descriptive statistics (95% C.I.) and independent sample test were performed to analyze differences among groups ($\alpha = .05$).

Results: statistically significant differences were not found both for trueness ($p = .104$) and precision ($p = .409$), between the tested geometries. The mean values for trueness were V-1 = 37.5 [31.4-43.6]; V-2 = 32.6 [30.6-34.6].

About the precision, the mean values were V-1 = 20.5 [8.4-32.5]; V-2 = 18.4 [8.2-28.5]. In both the study groups, it was possible to record the surface beyond the finish area.

Conclusions: vertical preparation design allows to register tooth anatomy beyond the finish area with IOS.

Moreover, the mean accuracy values were clinically acceptable at both 1 and 2 mm below the gingival margin.

ACCURACY OF IOS ON THE EDENTULOUS MAXILLA WITH DIFFERENT PALATAL MORPHOLOGIES: 3D ANALYSIS

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Aim: with the increase in life expectancy, there is a greater demand for prosthetic rehabilitation in edentulous patients. In this regard, an intraoral scanner (IOS) is a useful device for digitalizing the edentulous arches to fabricate prostheses. The present study aimed to evaluate the trueness and precision of scans made with an IOS (TRIOS 4) on a completely edentulous maxilla, in the cases of different palatal morphologies.

Methods: six different typodonts were fabricated for several palatal morphologies with flat, medium, and deep palates, with or without palatal wrinkles. Each morphology was named as follows: WM, WD, and WF in the case of a palate with wrinkles, respectively, at medium, deep, and flat palatal depths; SM, SD, and SF respectively, for medium, deep, and flat palatal depths but without rugae. Ten scans were made with the IOS for each experimental group. The scans, in STL format, were imported into a dedicated software program, then trueness

and precision were evaluated in μm . Descriptive statistics and power analysis were conducted, while the Kruskal-Wallis and Dunn tests were run to analyze differences among groups.

Results: the mean values for trueness were WM = 48.7; WF = 85.9; WD = 161.7; SM = 48.1; SF = 349.1; SD = 349.9. Significant differences were found for SM vs SD ($p < .001$), SM vs SF ($p < .001$), and WF vs SF ($p = .003$). The mean values for precision were WM = 46.7; WF = 48.9; WD = 46.9; SM = 46; SF = 72.6; SD = 105.9. Significant differences were found between WD and SD ($p = .015$).

Conclusions: the best accuracy was found in the case of medium palatal depth. Moreover, in the case of the deepest palates, the trueness values were better for typodonts with palatal wrinkles than the smooth ones. Finally, the mean values of both trueness and precision were clinically acceptable for each experimental group.

EVALUATION OF PRECISION AND ACCURACY OF 4 DIFFERENT INTRAORAL SCANNERS: AN *IN VIVO* STUDY

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Aim: in dentistry, impression-taking is a fundamental step of the treatment plan. Anyway, with the conventional impression technique there can be many error variables. Intraoral scanning can lead to fabrication of short-span prostheses but also extensive restoration with equal or even improved results. The aim of this study is to evaluate precision and accuracy of 4 different scanners *in vivo*, in order to consider the influence of factors such as saliva, tongue and interaction with the patient.

Methods: the 4 scanners used are: Carestream-3600, Medit-i-700, Marathon-MT-1000 and 3Shape TRIOS 3. The program "Geomagic Control X 3D" was used to match the references (the STL files of the plaster model obtained by scanning two precision

impressions in PVS taken in a young male patient and two virtual models obtained by directly scanning upper and lower arches). From each overlap, descriptive and inferential statistical analysis were obtained.

Results: Marathon-MT1000 and 3Shape TRIOS 3 obtained the best results in terms of trueness. In all the scanners, the results showed a reduction on trueness in the lower arch compared to the upper arch. Similar results were obtained using both the plaster and the virtual model.

Conclusions: despite the transition from upper to lower arch affects the trueness of a scanner, 3Shape TRIOS 3 was found to be the most accurate scanner, in terms of precision and trueness.

INTRAORAL SCANNER PRECISION ANALYSIS AID BY 3D SOFTWARE

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Aim: intraoral three-dimensional scanning techniques could be used to improve dental practice, leading to an improved overall quality of the prosthetic devices and improved comfort for the patient. An accurate and precise intraoral scanner allows proper diagnosis, follow-up evaluation, and prosthesis application. The aim of this research is to evaluate the precision of an intraoral scanners (Medit i500) using open-source software. Precision was compared through repetitions of the scanning process of the upper dental arch, following superimpositions in the whole 3D arch area.

Methods: the present study included 65 intraoral scans of 13 voluntary participants. Decayed, missing, filled teeth index (DMFT) of patient was considered 0 excluding all the third molars. Volunteer's maxilla and mandibular was scanned 5 times

in sequence, after a ten-minute rest period, by same skilled operator, with a conventional intraoral scanner. Operator is defined as skilled as they graduated in dentistry more than 10 years ago and use an IOS on a daily basis. 3D superimposition and Cloud compare are processed and statistical analysis was performed.

Results: it was possible to display colorimetric maps for qualitative comparison, and deviations of the values were classified as clinically acceptable. Within limitation of study, the clinically acceptable in vivo frequency of points' deviation, or the precision, was obtained in $98.8\% \pm 1.4\%$

Conclusions: therefore, the use of open-source software can be a viable option in the digital workflow, improving patient follow ups with the 3D model superimposition.

ONE-YEAR RCT ON CLINICAL DIFFERENCES ABOUT EQUATOR® AND LOCATOR SUPPORTING AN OVERDENTURE

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Aim: it highlights the efficacy of overdenture implantation as a treatment option for complete edentulism and highlights the evolution of attachment systems from traditional ball-and-socket designs to new low-profile options, such as the OT Equator®.

Methods: a multicenter randomized controlled trial was conducted between two different attachment systems: the Locator and the OT Equator. The prosthetic procedure started 8 weeks after the placement of the dental implants, in which a new removable metal-reinforced prosthesis was delivered within 4 weeks, following an early loading protocol. After a few

days, the healing abutments were removed and the attachments connected to the new removable prosthesis.

Results: positive results were found in both groups. This type of abutment (OT) has significant clinical and biomechanical advantages compared to similar abutments.

Conclusions: the results of this study are important as they provide valuable information to dental professionals on the most effective attachment systems to use in the treatment of elderly patients with dental implants. Overall, the study demonstrates the efficacy of implant therapy in elderly patients and underscores the importance of ongoing research in this field.

DETERMINATION OF THE VERTICAL DIMENSION IN A REMOVABLE PROSTHESIS

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The aim of this study is to demonstrate the use and efficacy of cephalometry and analysis of the golden proportions of the face in the planning of prosthetic treatments in totally edentulous patients.

In addition to the classical procedure, the method is performed with latero-lateral and postero-anterior radiographs. Two complications for totally edentulous patients are the establishment of the vertical dimension and the new position of the occlusal plane.

The analysis of the divine proportion was done by the use of a golden divider.

The prosthetic protocol was divided into three phases and, for better understanding, it was selected a case.

Phase 1: allows us to determine the vertical dimension.

Phase 2: Cephalometric skeletal verification of the vertical dimension and determination of the divine occlusal plane.

Phase 3: phonetic test.

A prosthesis made according to cephalometric parameters and divine facial proportions helps to improve the patients aesthetics, skeletal and tissue relationships, which also improves the function of chewing and swallowing, avoiding muscle fatigue and protecting the TMJ.

EVALUATION OF INTRAORAL DIGITAL IMPRESSION FOR FULL DENTAL ARCHES

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Aim: the purpose of the study was to assess the accuracy of an intraoral scanner (Medit i-500) in the full dentate arch, with and without gum.

Methods: the trueness is analyzed by overlapping the scans dataset made with Medit I-500 with the scans dataset made with the lab scan and the values of ABS AVG, RMS and $(90^\circ-10^\circ)/2$ method are reported. Precision is evaluated by using the same values of trueness coming from the intra-group overlapping.

The first set describes impression of both gums and crowns, the second one only crowns.

Results: the trueness values are $24 \mu\text{m}$ (SD:3.6) for ABS AVG, $70 \mu\text{m}$ (SD:28) for RMS and 28 (SD:4.5) μm for $(90^\circ-10^\circ)/2$

method for the group with gum and $33 \mu\text{m}$ (SD:4) for ABS AVG, $103 \mu\text{m}$ (SD:18) for RMS and $30 \mu\text{m}$ (SD: 5) for $(90^\circ-10^\circ)/2$ method for the group without gum. The precision values for the group with gum are $17 \mu\text{m}$ (SD:4.6) for ABS AVG, $52 \mu\text{m}$ (SD:15.8) for RMS and $23 \mu\text{m}$ (SD:6.3) for $(90^\circ-10^\circ)/2$ method and for the group without gum are $15 \mu\text{m}$ (SD:6) for ABS AVG, $26 \mu\text{m}$ (SD:37) for RMS and $25 \mu\text{m}$ (SD:6.5) for $(90^\circ-10^\circ)/2$ method.

Conclusions: the large dispersion of the ABS AVG and RMS values and the statistically significant difference between the group with gum and the one without gum, suggests that the $(90^\circ-10^\circ)/2$ method should be considered the recommended procedure for the accuracy evaluation of an IOS.

SUPERLATTICE VS MACHINED ABUTMENT ON PERI-IMPLANT TISSUES: A 1-YEAR FOLLOW-UP

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Aim: the aim of the present multi-center split-mouth randomized controlled trial was to compare traditional machined abutments and chromium nitride/niobium nitride (CrN/NbN) coating (superlattice) abutments in terms of implant survival, marginal bone loss and periodontal indexes.

Methods: two adjacent implants were inserted in posterior mandible or maxilla in 20 patients. Ten patients were treated in Turin and 10 patients were treated in Genova. A machined abutment was randomly screwed on either the mesial or distal implant, while the superlattice abutment was screwed on the other one. Implant survival rate, peri-implant probing depth (PPD), plaque index (PI), and bleeding index (BI) were collected 6 months and 1 year after surgery. Marginal bone loss (MBL) was evaluated immediately after surgery, at 6 months and 1 year later.

Results: at 3 months from surgery, one implant with superlattice abutment failed. The reason of the failure was attributed to

a non-osseointegration of the implant. Overall implant survival rate was 97.7%.

At 1-year follow-up a mean MBL of 0.83 ± 0.55 mm was recorded for superlattice abutments, while a mean MBL of 0.85 ± 0.45 mm was recorded for the abutment with machined surface.

A mean PPD of 1.3 ± 0.23 mm was recorded for the superlattice group, and a mean PPD of 1.3 ± 0.31 mm was recorded for the machined surface group. PI was of 0.59 ± 0.52 for superlattice group and 0.6 ± 0.50 for machined group, while BI was of 0.48 ± 0.46 for superlattice group and of 0.47 ± 0.41 for the machined one.

No statistically significant differences were observed between the two groups ($p > 0.05$).

Conclusions: within the limits of this study, our results indicate that both machined abutments and superlattice abutments achieved similar clinical performance.

IMPLANT-PROSTHETIC BIOMECHANICAL COMPLICATIONS IN ORAL SURGERY: STATE OF THE ART

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Aim: an FDA document states that “computational, nonclinical *in vivo* and clinical modelling and simulation studies can be used to evaluate the safety and efficacy of medical devices”. However, there remains, of exclusive clinical concern, the issues related to the choices of type, number and location of implants chosen during the implant-prosthetic planning phase.

Methods: the bioengineering methods that can be used in dentistry are different. Thanks to finite element simulation it is possible to simulate the distribution of forces with the Von Mises method and evaluate the fracture resistance of materials.

Results: inclined implants function perfectly when placed in geometries of number and position that enhance their position.

Creating an unfavorable angle between the prosthetic restoration, occlusal load, and implant device, on the other hand, poses an extremely high biomechanical risk to both the recipient tissue and the integrity of the device.

Conclusions: the purpose of our study is to go and evaluate, in light of the state of the art in oral surgery, the biomechanical complications of implant prosthetics.

10-YEAR CLINICAL AND RADIOGRAPHIC OUTCOMES IN A MANDIBULAR OVD RETAINED BY SINGLE IMPLANT

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Aim: overdenture retained by a single mandibular implant (SIROD) is considered a less invasive approach in the rehabilitation of edentulous patients. The study tests if a single implant in support of a complete mandibular denture improves the threshold of thickness discrimination and chewing capacity over 10 years. Implant survival, radiographic and prosthetic maintenance data were also recorded.

Methods: 13 edentulous patients were selected from the group of patients applied for complete dentures at the Prosthodontics department of the Dental School in Turin. After the realization of complete dentures, one implant was placed with a delayed loading protocol. Thus, a Locator attachment was

placed, and the connection blocked. Thickness discrimination and registration of masticatory capacity were performed five times and radiographs were taken at different times over 10 years.

Results: thickness perception and chewing capacity improved up to the first year and remained stable over 10 years. No implants were lost, and radiographs after 10 years showed a bone loss of 1.34 mm. The data on prosthesis maintenance confirmed the results of the literature.

Conclusions: a mandibular overdenture retained by a single implant may be considered a trustable treatment option, for patients that need a low surgical impact.

TEMPORARY PROSTHETIC BRIDGE MANUFACTURED WITH ADDITIVE VS SUBTRACTIVE CAD/CAM TECHNIQUE

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Aim: the aim of this study is to evaluate the fracture toughness of three-element provisional bridges on stump produced by subtractive (PMMA and composite) VS additive CAD/CAM techniques.

Methods: provisional bridges were placed on a metal master model, simulating a single edentulous situation of element 1.6 (stumps on elements 1.5 and 1.7). Static load tests of the three-element prostheses were performed by Instron 5884 universal testing machine which records the load force, in relation to a constant speed displacement of 2.5 mm/min, until the break of the specimens, detected as a sudden decrease in the applied force.

Results: maximum values in breaking force were observed in the CAD/CAM subtractive PMMA group, while the minimum

values were recorded by the CAD/CAM subtractive composite group (Mean+SD analysis).

The one way ANOVA test showed a statistically significant difference between the groups (p Value <0.05). In contrast, *post hoc* t-test according to Bonferroni (significance level for alpha of 0.05 corrected to 0.0166) found significant differences between the subtractive group with PMMA and the additive group (p Value <0.01).

Conclusions: considering the analysis of our data both the use of additive CAD/CAM and subtractive CAD/CAM techniques for the manufacturing of three-unit provisional fixed prostheses appear to be viable and feasible solutions.

MULTIDISCIPLINARY PLANNING OF PROSTHETIC PATIENT IN ORTHOGNATHIC SURGERY

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Aim: the correction of severe skeletal malocclusions generally requires surgery combined with orthodontic or prosthodontic treatment. An orthodontic camouflage or a pure prosthetic treatment may result in an unsatisfactory and unstable outcome. Patients partially or totally edentulous and patients with prosthetic fixed crowns represent a limit and, therefore, a challenging treatment. The aim of this work is to show a complete multidisciplinary approach and planning for patients with II or III dental-skeletal malocclusion, who present a total or partial edentulism or a fixed-type rehabilitation and require a combined orthognathic surgical treatment with prosthetic rehabilitation.

Methods: this study is a retrospective review and it is conducted on 15 patients with II or III malocclusion with total or partial edentulism or with fixed-type prosthetic rehabilitations,

rehabilitated in Implantoprosthesis Department of Policlinico “Umberto I”, Rome.

Results: the crucial element for successful orthognathic surgery in partially or completely edentulous patients is occlusal stability. All patients underwent a first prosthetic and orthodontic phase; based on the occlusal stability, orthognathic surgery was performed. Six months after surgery, fixed prosthetic rehabilitation was finalized in all patients.

Conclusions: different approaches have been proposed, the key to success in such treatments lies in the multidisciplinary of the entire diagnostic and therapeutic path, which necessarily provides for close collaboration between the different specialist figures, such as the surgeon maxillofacial, the orthodontist, and the prosthetist.

LISI CERAMIC RESTORATIONS PRE-TREATED WITH A SELF-ETCH CERAMIC PRIMER: A CLINICAL CASE

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Aim: different ceramic surface treatments have been proposed as alternative to hydrofluoric acid (HF) to enhance bonding procedures. This clinical case presents a full mouth rehabilitation with lithium disilicate (LiSi) ceramic pre-treated with a self-etch ceramic primer.

Methods: a 55-yr old male patient complaining esthetic dissatisfaction came to our attention. After medical, dental, radiographic and photographic examinations a diagnosis of caries and severe tooth wear with reduction in the vertical dimension occlusion (VDO) was made.

The treatment plan consisted in a combined periodontal/restorative approach with the preparation of adhesively-bonded indirect LiSi ceramic restorations and implant-supported zirconia crowns. Prior to definitive bonding procedures, LiSi restoration

surfaces were pre-treated with a self-etch ceramic primer (Monobond Etch&Prime, Ivoclar Vivadent; MEP) according to manufacturer’s instructions.

Results: no pain, dental sensitivity or discomfort were reported and the patient was satisfied with the esthetic results. At the 1 yr follow-up, periodontal parameters were normal with no signs of retention loss and discoloration of the restoration nor material’s fractures.

Conclusions: the single bottle self-etch ceramic primer seemed a faster and safer alternative to the gold standard HF for the conditioning of LiSi ceramic surface restorations. Indeed, thanks to its formulation (i.e. trimethoxypropyl methacrylate and polifluoride), MEP would provide etching, silaning and decontamination of the restoration in one single application.

IMPLANT-SUPPORTED PROSTHESIS FOR EDENTULOUS PATIENT REHABILITATION: A SINGLE CASE REPORT

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Aim: this study stems for the idealization of a new protocol to simplify the supported oral rehabilitation representing the first of a whole series of cases that demonstrate its utility.

This case report is about an edentulous patient who went to the dentist looking for a rehabilitation with total prosthesis in order to overcome psycho-physical trauma, functional and social problems related to being a prosthesis wearer.

Methods: in this manuscript, a patient was considered and shown according to a complete photographic documenta-

tion all the phases. Rehabilitation included the use of Oss-tem (Seoul, Korea) and equator type abutments (Rhein83, Bologna, Italy).

Results: the rehabilitation of oral functions allows the patient to speak, chew, smile and feel confident in his own aesthetics and therefore improve his well-being in social relations.

Conclusions: in conclusion, an important step in oral rehabilitations is to evaluate their type and therapeutic timing.

PROSTHETIC AND ORTHODONTIC MANAGEMENT OF A PATIENT WITH ECTODERMAL DYSPLASIA

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Aim: ectodermal dysplasia is a rare congenital disease affecting ectodermal structures, requiring orthodontic and prosthetic solutions to improve speech, masticatory function, and facial esthetics.

Methods: this case report describes a 12-year-old Italian girl with ectodermal dysplasia-induced oligodontia. An intraoral examination revealed that the patient had only ten teeth (upper primary second right molar, upper permanent first molars, upper permanent canines, upper permanent central incisors, lower primary right canine, and lower permanent canines). Her upper permanent incisors had a history of dental treatment, including two major restorations. The patient had a deep overbite and thin atrophic knife-edge alveolar ridges, as well as vestibular height loss. A panoramic radiograph revealed the

absence of other dental elements during radiographic investigations.

The treatment began with an orthodontic phase to close the gap between elements 11 and 21, using a sectional appliance with aesthetic brackets and a 0.016 NiTi archwire. The two elements were splinted with a fix retainer and conventional dentures were constructed for the patient.

Results: the multidisciplinary orthodontic prosthetic treatment made it possible to effectively rehabilitate the young patient's stomatognathic apparatus both functionally and aesthetically.

Conclusions: orthodontic and prosthetic rehabilitation in children with ectodermal dysplasia can improve their overall quality of life by improving speech, masticatory function, and facial esthetics.

BIOLOGICALLY ORIENTED DIGITAL IMPRESSION TECHNIQUE

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Aim: the purpose of this prospective case series study is to evaluate clinical and aesthetic results of single, metal-free restorations, fabricated according to a new digital impression protocol that doesn't require the use of retractor cords for final impression on a natural tooth previously prepared according to the principles of the B.O.P.T. technique.

Methods: patients of 18 years of age or older, with at least one single tooth prepared according to the principles of the B.O.P.T. technique in the aesthetic area (between maxillary premolar), were considered eligible for this research. At the time of definitive impression, a first impression of the temporary restoration was taken. After that, the temporary restoration was removed and the dental abutment cleaned. No retraction cord was used. A second impression of the dental abutment was taken. Then, an impression of the whole temporary

restoration, including the finish line and the emergence profile was taken and automatically matched with the previous impressions. Using the same software (Medit Link) the impression of the temporary was used to define the finish line and the emergence profile of the dental abutment impression, by means of a Boolean subtraction. Finally, the definitive crowns were fabricated.

Results: four patients with five teeth to be rehabilitate were treated. All the patients were satisfied with their prosthesis. Pink esthetic score was 13.60 ± 0.55 .

Conclusions: the results from this prospective case series study encourage the proposed technique. The main benefits are the respect of the periodontium and easier prosthetic procedure in the dental lab. Further study with larger sample and control are needed to confirm this preliminary results.

PRECISION OF THREE-DIMENSIONAL PHOTOGRAPHIC ANALYSIS WITH FACIAL SCANNER

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Aim: measuring facial proportions can provide useful information for designing proportionate and aesthetically pleasing prostheses. The currently accepted gold-standard tool for these measurements is the caliper. However, these measurements can be time-consuming and difficult in uncooperative patients. The market offers various systems for scanning the face with digital technologies, which facilitate measurements and represent a useful tool for studying patient morphology and clinical evaluations. However, the precision of these new tools is not yet known. The aim of this study is to evaluate the accuracy of facial scanning with digital technique for small (less than or equal to 6.5 cm) and large (greater than 6.5 cm) measurements, comparing them to measurements obtained with analog methods.

Methods: fourteen points were traced on the face of a 29-year-old woman. A scan was then performed with the Planmeca Pro-Max 3d using the ProFace program. The measurements were divided into 2 groups:

Group A: small distances (less than or equal to 6.5 cm): AB, AC, AF, AI, CG, CL, EH, EM, IL, LM, IG, NP.

Group B: large distances (greater than 6.5 cm): AD, AE, AN, AP, EO, EP, GM, IP, MP, LP, AL, EL.

Among the traced points, 24 distances were measured *in vivo* with a caliper and the Romexis Viewer software. The paired T test was used to evaluate whether there was a significant difference between digital and analog measurements for groups A and B.

Results: the paired T test used to measure data in group A did not show statistically significant results ($p = 0.8194$). The paired T test applied to group B ($p < 0.05$) showed statistically significant results.

Conclusions: facial scanning with digital technique shows measurements overlapping with analog technique for measurements less than or equal to 6.5 cm, with significant deviation for points with a distance greater than 6.5 cm.

HARMONIC PALATAL OBTURATOR: A NEW TECHNIQUE FOR LIGHTER PROSTHESIS. A CASE REPORT

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Aim: the aim of this case report is to apply an innovative technique to a post-maxillectomy total upper obturator prosthesis, in order to ensure an easier insertion and removal of the same as well as minimization of its weight.

Methods: a female patient is examined after hemi-maxillectomy surgery for a squamous cell carcinoma. Her pre-existing full denture is relined and provisionally modified with a tissue conditioner (Hydrocast). After 6 months the definitive obturator prosthesis was planned. Once the prosthesis with obturator was built, before delivering it, a cut was made on the protruding part of the obturator to eliminate all the inside resin, reduc-

ing the majority weight of the final prosthesis. The same portion was re-assembled and delivered to the patient.

Results: the patient immediately perceived a sense of lightness and comfort of the prosthesis, immediately showing an improvement in the nasal voice.

Conclusions: the follow-up after 1 and 3 months confirmed a high degree of patient satisfaction both in terms of aesthetics and in the restoration of normal masticatory, swallowing, phonatory and breathing functions. An important fact was also the retention of the prosthesis in the oral cavity, being very lightened. The use of adhesive pastes improved the tensile strength.

INDIRECT ANTERIOR RESTORATIONS WITH NO PREP TECHNIQUE AESTHETIC AND BIOLOGICAL EFFICACY

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Aesthetic outcome in the ceramic restoration of anterior teeth has always been a challenge in clinical practice, and in such cases, success depends on the skills of the clinician and the dental technician. In current dentistry, the main goal is to pursue esthetic results while preserving biological structures. This technique was developed to meet the needs of patients who desire an aesthetic and functional solution for their teeth but do not wish to undergo invasive and painful procedures. Minimal tooth preparation is at the heart of the noprep technique. Such preparation results in minimal wear of the tooth tissue and minimizes the need for local anesthesia, making this methodology less invasive and more comfortable for the patient. The technique is particularly suitable for creating dental veneers, as these require less material than dental crowns. Dental veneers are used to improve the appearance of the front teeth to correct the shape, position and color of the teeth. The noprep technique can also be used to treat patients with

special aesthetic needs, such as changing tooth shape, closing diastemas, or improving tooth color. The noprep technique has proven to have a high success rate due to the use of high-quality adhesive materials and minimal tooth preparation. In addition, the noprep technique is less invasive than traditional tooth preparation techniques, which means that the healing time is shorter and the risk of postoperative complications is lower. In conclusion, the noprep technique is an innovative methodology that offers patients an aesthetic and functional solution for their teeth without the need for invasive and painful procedures. Due to minimal tooth preparation and the use of high-quality adhesive materials, the noprep technique has proven to have a high success rate and can be used for a wide range of dental restorations. The noprep technique is therefore an excellent option for patients who want a more beautiful and healthy smile without having to undergo painful and invasive procedures.

A NOVEL CHEWING-GUM FOR THE OBJECTIVE ASSESSMENT OF MASTICATORY PERFORMANCE

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Aim: the present study aims at assessing the reliability of a novel chewing-gum for the measurement of masticatory performance (MP). Moreover, the impact of a full-digital individualized workflow on the restoration of MP was also evaluated.

Methods: eligible participants were adults, in need of complex rehabilitation due to masticatory dysfunction. Participants underwent a comprehensive diagnostic examination. Participants performed the two-color mixing ability test. Hue-Check Gums (University of Bern, Switzerland), Control Group (CG), and m-Gums (Innovative Medical Applications & Research, Italy), Test Group (TG), were chewed for 20 chewing cycles. Boluses were flattened to a standard thickness of 1 mm and digitalized using a flatbed scanner. The images were analyzed optoelectronically to obtain the variance of hue.

Results: the study involved 12 participants, consecutively treated, and rehabilitated with fixed prosthesis using a full-digital individualized workflow. The chewing-gums in TG were comparable to the ones in CG, $p > 0.05$. A MP of 0.480 ± 0.207 and 0.576 ± 0.084 was recorded at baseline, respectively in GC and TG. A significant improvement in MP was observed at prosthetic prototype application ($p < 0.05$), 0.358 ± 0.166 and 0.328 ± 0.053 , and after the delivery of the final prosthesis ($p 0.01$), 0.088 ± 0.043 and 0.102 ± 0.061 , respectively in CG and TG.

Conclusions: the tested chewing-gums can be used interchangeably for the assessment of MP. The rehabilitation process obtained by the full-digital individualized workflow allowed to achieve a significant improvement in MP.

DIFFERENCES BETWEEN SCREW AND CEMENT-RETAINED SINGLE IMPLANT CROWNS: A SPLIT MOUTH STUDY

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Aim: to compare clinical, radiographic and biochemical conditions: proinflammatory cytokines in peri-implant crevicular fluid (PICF) at screw or cement-retained Cr-Co metal-ceramic single crowns.

Methods: in total, the study examined 25 single screw-retained crowns and 25 contralateral cement-retained crowns, in 25 systemically and periodontally healthy subjects. Levels of IL-1 β , IL-1RA, IL-6, IL-8, IL-17, b-FGF, G-CSF, GM-CSF, IFN, MIP-1 β , TNF- α , and VEGF were assessed in PICF using the Bio-Plex 200 Suspension Array System. Plaque index (PI), probing depth (PD), bleeding on probing (BOP), and gingival recession (REC) were recorded. Radiographic marginal bone levels (MBL) were assessed at the mesial and distal aspects of the implant sites with an individualized acrylic resin device that was fixed to the

residual dentition. Measurements were performed at 1, 3, 6, 12, 24 months from the delivery of the final restoration.

Results: PI, PD, BOP, and REC values had no significant differences in either group. The levels of IL-1 β , IL-6, IL-8, GM-CSF, and MIP-1 β and TNF- α were higher at screw-retained metal-ceramic crowns than in cement-retained crowns. However, only IL-1 β , IL-6, and TNF- α values presented significant differences between these groups.

Conclusions: after two years, the results obtained show a difference in the level of inflammation in a screw-retained crown, attributable perhaps to the greater amplitude of the micro-movements or to the different interface material at the level of the implant connection (Cr-Co/Ti for screw-retained and Ti/Ti for cement-retained).

CLINICAL STUDY ON FRACTURE RESISTANCE OF CERAMICS INVOLVED IN RETENTION OF PARTIAL DENTURE

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Aim: stability of the removable prosthesis is an important issue and is required and desirable in all cases. The effectiveness of the dental implant procedure can be impacted by the patient's age. Older people recover quicker because there is less bone formation around an implant. Cingulum rests on healthy abutment teeth, occlusal clasps, and clasps can all be used to create support. However, the detachable partial denture installed on unhealthy abutment teeth can be supported by implants or crowns. This research looked into two different all-ceramic restoration types that were used as abutments for the framework of removable partial dentures.

Methods: zirconia and IPS e.max Press ceramics, two different kinds of ceramic materials, were used to make the crowns. Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) was used to mill the final restoration, such as zirconia samples or wax with IPS e.max Press and RPD samples, to standardize the sample fabrication and dimension. The removable partial denture framework was made from the metal alloy cobalt-chrome. Twenty samples were made, with two all-ceramic crowns on each linked by a removable partial denture saddle framework, and two occlusal rest seats on abutment

crowns merged distally in the first premolar and mesially in the second molar.

Results: a universal testing device was used to compare the mean fracture strengths of ten samples from each set (IPS e.max Press and zirconia). After performing a single cycle of the fracture strength test at a speed of 1 mm/min, the results revealed that neither group's ceramic crowns fractured, so these results were disregarded. Both ceramic crown materials had their breaking strength tested using a universal testing apparatus. The RPD framework's highest load for the zirconia group was 400 N, and its maximum deflection was 1.9409 mm. The lowest load, however, was 206 N, and the maximum deflection was 1.9014 mm. The maximum load and maximum deflection for the RPD framework with the IPS e.max Press group were 374 N and 2.3335 mm, respectively. The lowest load and minimum deflection were 174 N and 1.1745 mm, respectively.

Conclusions: the findings showed that all-ceramic crowns did not fracture, but partial denture frames did deform. With the study's limitations, it can be said that zirconia and IPS e.max Press ceramic can be used as abutments to give the detachable partial denture enough support.

THE CLINICAL EVIDENCE OF PROSTHETIC REHABILITATION WITH OT EQUATOR®

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Aim: the OT equator is the smallest and most innovative overdenture attachment. In fact, the average size of the total vertical, male and female connection and the housing is only 2.1 mm. The width is 4.4 mm. The purpose of this paper is to mechanically analyze the characteristics of two different prosthetic retention devices. Through the use of engineering tools such as the finite element method (FEM) and Von Mises analysis, we studied how the implants resist force during chewing cycles.

Methods: the review sees the comparison of publications and related papers on the topic published and available on scientific search engines, with observation also of the characteristics of products offered in the market.

Results: from the reading inherent to this topic, it can be deduced that in narrow diameter implants (NDI) connected to the locking cone, Equator attachments showed stable clinical behavior as retention of mandibular overdentures (MO) for edentulous patients with clinical mandibular atrophy this, especially when compared with other attachment systems where the result may vary depending on them. The literature suggests that the Equator attachment also offers fewer biomechanical complications and failures than the Locator attachment.

Conclusions: this system has greater flexibility and multipurpose capability ranging from single-attached overdentures to multi-bar technologies to fixed rehabilitations with the OT equator.

NEW DIRECT RETAINERS INTO REMOVABLE PARTIAL DENTURES FOR EDENTULOUS SPACES: A CASE REPORT

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Aim: the increasingly prominent social demand in removable prosthodontic rehabilitation's field is to combine both functionality and aesthetics in prosthetic device design. The aim of this study has been to prove predictability, reliability, aesthetics, and functionality through new retentive means's design.

Methods: it has been described a clinical case highly impacting aesthetics and functionality of a male patient S.A, 58 years old and HIV+, with partial upper edentulism with intercalated edentulous. Patient's occlusion and parafunctions have been examined. Plaster model's study made most aesthetic desirable undercuts possible. The new design of retentive means arises from the proximal plate modification making it more adherent

and retentive and designing two small extensions on both sides of the tooth that embrace the upper part of the undercut.

Results: the patient immediately accepted the removable partial denture with modified retention means, as the aesthetics, retention, and stability of the device during masticatory function have satisfied the patient.

Conclusions: long term follow-up and the high degree of satisfaction reported by the patient confirmed the prosthetic stability, the correct restoration of masticatory, phonetic and swallowing functions associated with high aesthetic performance, demonstrating the predictability and reliability of the new retention means design.

PASSANT SCREW OF DENTAL IMPLANTS: AN *IN VITRO* SEM STUDY

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Aim: the use of dental implants in oral rehabilitations has become increasingly common, thanks to the safety and predictability of these rehabilitations.

The purpose of the study is to highlight what surface alterations could be using different screwing pairs or repeating the screwing process several times analyzing through a SEM.

Methods: in this study, 40 through screws (Osstem, South Korea Dental Implant Ebony Gold) were examined in the scanning electron microscope (SEM) Zeiss EVO LS 10, with an acceleration voltage of 20 kV. The through screws have been divided into 4 groups: tightening torque of 30 Nmm; maximum tighten-

ing torque; tightening torque of 2 times 30 Nmm; no screwing, new (control group).

Results: this observational study did not reveal any defects or fractures through SEM analysis in the different groups, claiming a 100% success rate. Surely, thanks to this study and others that will follow, it will be possible to optimize these materials.

Conclusions: in the SEM images no significant differences were found in the surfaces of the through screws, and 100% of the through screws are free of defects or fractures. Further studies and investigations will certainly be needed to improve these devices.

QUALITATIVE EVALUATION OF SEEGER RINGS AND SCREWS IN ALL-ON-4 OT-BRIDGE AFTER LOADINGS

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Aim: this study aimed to evaluate the seeger rings and screws wear of a simulated all-on-four mandibular model using OT-Bridge system after one-year of cyclic loadings.

Methods: a Co-Cr prosthetic framework with OT-Bridge system for an all-on-four model was fabricated through milling. The system underwent 400000 bilateral cyclic loadings on a 7 mm distal cantilever. Depending on the presence or absence of one or two anterior screws, three groups were created: Gr.1 (3 screws), Gr.2 (2 screws), CTR (4 screws). The loading cycle was repeated five times for each group; after each test the seeger rings and the screws were evaluated under a stereomicroscope.

According to the level of wear, a score from 0 to 3 was established for each component. Wear levels found were related to

the loss of preload of the screw at each abutment position and data were statistically analyzed.

Results: the results showed a statistically significant difference in screw wear among the three groups with Gr.1 showing the highest mean screw wear levels. The mean seeger deformation in Gr.1 and Gr.2 was significantly higher than in CTR. The loss of preload of each screw after cyclic loadings was directly related to the seeger wear and indirectly to screw wear.

Conclusions: posterior screws experienced more wear than anterior ones while anterior seegers showed higher deformation at the internal margin compared to posterior because of the distal cantilever loadings. The relation between preload loss and wear pattern of screws and seeger rings means that the components of the OT-Bridge system work synergically.

DIAMOND-LIKE CARBON COATING REDUCES CONNECTION SCREW HEAD STRIPPING AFTER MULTIPLE TIGHTEN

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Aim: the stability of implant-abutment joint is fundamental for the long-term success of implant rehabilitation. The screw loosening, fracture and head deformation are among the most common mechanical complications. Several surface treatments of titanium screws have been proposed to improve their resistance and stability. Diamond-like carbon (DLC) coating of the materials is widely used to increase their wear resistance and durability. The aim of the present study was to evaluate the effect of carbon fiber coating of the screw head on screw removal torque and screw head stripping.

Methods: 100 titanium implant screws were used, 50 without coating (Group 1) and 50 with DLC coating of the screw head (Group 2). Each screw was tightened with a torque of 25 Ncm and unscrewed 10 times. For each loosening the removal

torque was measured with a digital cap torque tester. Optical 3d measurement of the screw head surface was performed by a fully automatic machine before and after multiple tightening in order to investigate surface modifications.

Results: the reverse torque values showed a decreasing trend with repeated tightening and loosening cycles in both groups, without significant differences ($p > 0.05$). Optical measurements of surface dimensions revealed average changes of 0.0357 mm in Group 1 and 0.02312 mm in Group 2, that resulted to be statistically significant ($p < 0.001$).

Conclusions: the DLC coating of retention screw head can prevent its distortion and wearing, especially after multiple tightening. Further studies are needed to confirm its clinical relevance.

