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Purpose: Cysts and other intrabony lesions can grow asymptomatic until being diagnosed by occasionally done radiologic examination. Missing tooth and malposition of adjacent teeth should induce clinicians to perform X-Ray diagnostic.

Methods: A 37-year-old male patient was admitted with a hopeless tooth 36, to be extracted and replaced with an implant. Clinical examination revealed also one of the lower incisors missing and malposition of remaining lower incisors. CBCT revealed horizontally impacted lower incisor surrounded by bone defect- 15 × 20 × 8 mm with the bone thickness remaining only 3.5mm in the most narrow area. The basis on strong masticatory muscles and low thickness of bone after surgical removal of tooth and lesion, prophylactic osteosynthesis was planned. To explain the surgery to the patient model of the mandible was 3D printed.

Results: Two treatment plans were presented to the patient: 1. Custom plate production according to the bone defect and the shape of remaining bone; 2. Choosing a standard plate and adjusting it on the 3D printed model. Costs of the material were 10 times higher in a custom solution. Plan 2 was then accepted. 1.2mm straight plate was pre-bent on the model and sterilized. Lesion and impacted tooth were removed in local anesthesia. Prepared plates were fixed.

Conclusions: In the presented case, the custom 3D printed osteosynthesis plate was about ten times more expensive compared to the standard osteosynthesis plate used. 3D printing of bone model may be helpful for pre-bending chosen standard plate and planning the surgery.

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Artificial landmarks and areas' accuracy gradient: a three-dimensional analysis of trueness and precision of IOS scans on the total edentulous maxilla

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Purpose: To assessing the areas' accuracy gradient of the intraoral scanner (IOS) scans on a completely edentulous maxilla and the effectiveness of artificial landmarks.

Methods: A completely edentulous maxillary typodont (MT) was scanned with an industrial metrological machine to obtain a reference scan in .stl format. Ten scans were made on MT with an IOS, subsequently superimposed to detect the areas' accuracy gradient on MT scans. Artificial landmarks of 1-mm diameter were placed in the less accurate areas following two methods. In the first, flow-composite semispherical markers were used. In the second, circular markers were drawn with a dermographic pen. Three experimental groups were made (n=10): "No-Markers" for the control group (without markers), "Embossed-markers" for flow-composite markers, and "Flat-Markers" for ink-drawn ones. The scans were imported into a dedicated software, then trueness and precision were evaluated in μm. In addition to descriptive statistics (95% CI), the Games-Howell and Kruskal-Wallis tests were run to analyze the difference among groups (α=.05).

Results: Mean values for trueness were No-Markers=48.8 (39.2-58.3); Embossed-Markers=39.2 (37.5-40.8); Flat-Markers=60.5 (47.7-73.4), with statistically significant differences for Embossed-Markers/Flat-Markers (P=.011). Mean values for precision were No-Markers=46.7 (29.7-63.7); Embossed-Markers=41.4 (34.7-48); Flat-Markers=99.8 (69.3-130.3), with significant differences for Embossed-Markers/Flat-Markers (P=0.008) and No-Markers/Flat-Markers (P=0.005). The most inaccurate areas were tuberosities, palate, and ridges' flattened areas.

Conclusions: To increase the IOS scans accuracy on the completely edentulous maxilla, it is suggested to place embossed flow-composite markers specifically in the areas of greatest inaccuracy, but to avoid using flat markers.

Keywords: accuracy; edentulous maxilla; intraoral scanner; landmarks; markers; precision; trueness

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Intraoral scanning, CBCT, and surface electromyography combination: efficiency analysis of proposed diagnostic "Trident" algorithm during complex dental rehabilitation

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Purpose: To evaluate the efficiency of dental treatment supported by the complex diagnostic algorithm consisting of digital scanning, CBCT, and surface electromyography procedures ("TRIDENT" algorithm) considering clinically objective and patient-oriented subjective criteria.

Methods: The study cohort was formed out of 47 patients, who underwent implant placement and rehabilitation with the use of implant-supported fixed dental prosthetics. Initial intraoral scanning was provided by the Medit I500 device (MEDIT corp., Seoul, Korea), while CBCT-scanning was held on Planmeca ProMax® 3D Classic (PLANMECA OY, Helsinki, Finland). Dental occlusion analysis and control over muscle adaptation were held via the Teethan device (Teethan S.p.A., Milan, Italy). OHIP-EDENT questionnaire and Oral Satisfaction Scale were used to assess the improvements of patient-oriented subjective criteria.

Results: Treatment protocol provided with the complex diagnostic "TRIDENT" algorithm supported superior time efficiency of treatment (p < 0.05), and statistically significant improvements of several domains within OHIP-EDENT (p < 0.05), OSS values (p < 0.05) and patient adaptation criterion (p < 0.05) at 1, 2, 3, 4, 5, and 6 first weeks of ongoing monitoring. Bone level changes, implant success, and implant survival parameters after 1 year of monitoring have not demonstrated statistically significant deviations as compared to those registered among patients rehabilitated by classical implant placement protocols (p > 0.05).

Conclusions: Dental implant treatment protocol with further prosthetic rehabilitation supported by the complex diagnostic "TRIDENT" algorithm demonstrated higher patient-oriented subjective efficiency up to the timepoint of 6 weeks of monitoring after initial prosthetics fixation.

Keywords: CBCT; electromyography; intraoral scanning; Oral Satisfaction Scale

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C-Factor impact and class II direct restoration success: 1 year analysis using complex digitally improved research modelOleksandr Tsutskov^{1,*}, Viktoriia Voitovych¹, Alessandro Cavalcanti², Anastasiia Bilei¹¹ Uzhhorod National University, Uzhhorod, Ukraine² Universidade Estadual da Paraíba, Campina Grande, Brazil**Purpose:** To verify the potential impact of the C-factor and its subcomponents on the clinical success of Class II direct composite restorations by using a complex digitally-improved research model.**Methods:** During caries treatment 64 Class II cavities were prepared among patients of University Dental Clinic (Uzhhorod National University, Ukraine). Each prepared cavity was scanned by Medit i500 intraoral scanner (MEDIT corp., Seoul, Korea). The second scanning procedure was provided after direct composite restoration placement with its further contouring, polishing and occlusal correction. Obtained pairs of *.stl-files were imported into Autodesk Meshmixer software (Autodesk Inc., San Rafael, CA, USA), and pair-wised analyzed in means of exact cavity volume, the surface area of the cavity walls, width, length, and height of each cavity, exact filling volume, objectified C-factor value.**Results:** Mean 1-year success rate for Class II restoration by the USPHS criteria was 90.71±4.27%, while no statistically significant correlation was registered between C-factor value (C=2) and registered level of composite direct restoration success ($p > 0.05$). Meanwhile, the statistical association was established ($p < 0.05$), when the C-factor was objectified as the ratio of absolute surfaces' areas (Cmean=2.71±0.54) based on obtained digital scans. Geometrical subcomponents of C-factors, such as depth of cavity ($p < 0.05$) and restoration volume ($p < 0.05$) also demonstrated statistically augmented relations with clinical success of fillings after 1-year of monitoring.**Conclusions:** Digitally-improved research model helped to establish the clinically valuable level of inter-relations between C-factor subcomponents and success of direct composite Class II restorations, while the analog investigational approach has not supported prominent evidence regarding such interdependence.

Keywords: c-factor; digital model; direct restoration; stl

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Virtual planning and volumetric evaluation of wound healing following regenerative surgical treatment of intrabony periodontal defectsDaniel Palkovics^{1,*}, Eleonora Solyom¹, Csaba Pinter², Peter Windisch¹¹ Department of Periodontology, Semmelweis University, Budapest, Hungary² Empresa de Base Tecnológica Internacional de Canarias, Las Palmas de Gran Canaria, Spain**Purpose:** Our aim was to present a virtual surgical planning process in the regenerative treatment of intrabony periodontal defects and to evaluate volumetric and 3D morphological changes by the superimposition of pre- and post-operative cone-beam computed tomography (CBCT) datasets.**Methods:** Eight intrabony periodontal defects were enrolled in the present investigation. CBCT and intraoral scans (IOS) were taken prior

to and 6 months after periodontal regenerative surgery. Utilizing a semi-automatic segmentation method 3D models were generated from CBCT scans using an open-source radiographic image processing software (3D Slicer). Hybrid models were acquired with the superimposition and subsequent free-form surface modeling of the segmented CBCT model and the IOS. Hybrid models visualizing all relevant anatomical structures separately (alveolar bone, teeth, soft tissues) were used to plan each step of the procedure virtually prior to surgery. Superimposition of the pre- and post-operative CBCT scans was performed to validate volumetric and 3D morphological alterations.

Results: Based on the hybrid models, periodontal defect morphology was visualized in 3D. Following healing, hard tissue fill averaged at $43.04 \text{ mm}^3 \pm 24.47 \text{ mm}^3$. Hard tissue resorption could be detected in three cases.**Conclusion:** Hybrid models acquired with the technique allowed a better understanding of the 3D defect morphology and therefore more precise surgical planning could be performed. With the spatial registration of pre- and post-operative CBCT scans volumetric and 3D morphological alterations could be visualized that provided a better understanding of the healing dynamics.

Keywords: 3D diagnostics; CBCT; periodontal regenerative surgery; radiographic image segmentation; virtual planning

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Full-mouth rehabilitation of a young adult with Type-II dentinogenesis imperfectaGellért Joós-Kovács^{1,*}, László Kádár², Péter Hermann³, Judit Borbély⁴¹ Assistant lecturer, Semmelweis University, Budapest, Hungary² Senior lecturer, Semmelweis University, Budapest, Hungary³ Professor, Head-of-Department, Vice-Rector of Semmelweis University, Budapest, Hungary⁴ Associate professor, Semmelweis University, Budapest, Hungary**Background:** Dentinogenesis imperfecta is a hereditary autosomal dominant disorder. Type-II symptoms are discoloration, tooth/root dysmorphia, and chipping of enamel. Coverage of all teeth is recommended.**Purpose:** To restore esthetics and masticatory function of the patient with dentinogenesis imperfecta.**Methods:** A 24-year-old male patient had multiple caries but no occlusion on the right side. The examination revealed DMF-T 31, tulip-shaped and short/rounded radices, shell-like chipping of enamel, which led to the diagnosis of type-II dentinogenesis imperfecta. After elimination of all decays an intraoral scanner (Trios 3, 3Shape, Copenhagen, Denmark) was used to capture the initial surface information on both arches. The 3D-mirroring technique was performed: the tooth shapes were copied from the less-damaged surfaces on the left side to the right side, and smile design (3Shape Smile Design) was performed to reconstruct the esthetics of the fronts. Reconstructed 3D tooth surfaces were generated. All teeth were prepared and digitalized. Sectioned bite registration and digital bite acquisitions were performed. Reconstructed 3D tooth surfaces were copied onto the prepared teeth data and temporaries were 3D printed (NextDent 5100, NextDent B.V., Soesterberg, Netherlands) out from resin (NextDent C&B MFH) and cemented. After 3 months of wearing, the temporaries were rescanned intraorally, master casts were printed. Metal frameworks were sintered based on the prepared teeth scans, then porcelain layering is done on printed master casts in an adjustable articulator (PROTAREvo3, KaVo, Biberach, Germany).**Results:** The tooth shapes and masticatory function were restored.