Italian Academy of Prosthetic Dentistry
Mario Martignoni Award: Winning Abstracts

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First Place

Comparison of the Accuracy of an Intraoral and an Extraoral Laboratory Scanner on the Totally Edentulous Maxilla: A 3D Analysis

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**Purpose:** To compare the accuracies between an intraoral scanner (TRIOS 3, 3Shape) and an extraoral laboratory scanner (DScan 3, EGSolutions) on the reference typodont of a totally edentulous maxillary arch. The accuracy of the extraoral scanner was evaluated from the direct scans of the impressions in polysulfide (through a reverse process), then from the scans of the models obtained from pouring the stone in the impressions. **Materials and Methods:** A reference typodont (RT) in polyurethane resin was made. The RT was scanned using an industrial metrologic machine (ATOS Core 80, GOM), obtaining a digital reference scan, which was saved in STL format. The areas needed for the construction of a complete maxillary denture were included in the scans. Ten intraoral scans (dIOM) were performed, proceeding longitudinally along the ridge’s occlusal side of the full arch, starting from the left maxillary tuberosity and ending at the right one, then continuing on the buccal side and, eventually, on the palatal side. The authors created a device to take impressions with a repeatable, consistent process that can guide and position an individual impression tray in resin onto the typodont with the same standardized pressure and orientation in the space. Ten impression trays were made with a dedicated software (PreForm 2.15.0, Formlabs) and printed with a 3D printer (Form 2, Formlabs) in order to obtain 10 identical impressions. With this device, 10 impressions were obtained in polysulfide (Permlastic, Kerr); then, a scan of each impression was done with the laboratory extraoral scanner. Ten digital models (dREM) were obtained by processing the physical impressions “in reverse” with a dedicated software (DentalCad, EGSolutions). Eventually, type IV stone (Elite Stone, Zhermack) was poured in the impressions to obtain 10 physical gypsum models (dEOM), which were then scanned as well by the laboratory scanner. In this way, three groups of scans were done (n = 10 each) and saved in STL format for comparison, which was performed by importing them into a dedicated software (Geomagic Control X). The accuracy was evaluated by calculating trueness and precision, measured in micrometers. Data were statistically analyzed by means of a dedicated software (SPSS 25, IBM). **Results:** Trueness values (95% CI) were: dIOM = 49.1 (37.9 to 60.3); dREM = 349.1 (290.7 to 407.6); and dEOM = 1,243 (1,130.7 to 1,355.3). Precision values (95% CI) were: dIOM = 48.7 (37.8 to 59.5); dREM = 346.8 (293.8 to 399.8); and dEOM = 1,241.8 (1,129.6 to 1,354). Statistically significant differences were detected among the experimental groups. **Conclusion:** Intraoral scanning allowed better accuracy than scanning the model with an extraoral laboratory scanner. The reverse process performed on the direct scans of the impressions guaranteed better accuracy compared to scanning of the corresponding model, but worse accuracy compared to intraoral scanning. According to the authors, these results could be explained by the distortion of the materials used to make the impression and to make the model.

Second Place

A Pilot Trial on Lithium Disilicate Partial Crowns Using a Novel Prosthodontic Functional Index for Teeth

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**Purpose:** Lithium disilicate is now an accepted material for indirect restorations. The aim of this trial was therefore to evaluate the clinical performances of two lithium disilicate systems using a novel prosthodontic Functional Index for Teeth (FIT) after
3 years of clinical service. **Materials and Methods:** Partial adhesive crowns on natural abutment posterior teeth were made for 60 patients. Patients were divided into two groups: group 1 = IPS e.max press (Ivoclar Vivadent); and group 2 = Initial LiSi press (GC). The restorations were followed up for 3 years, and the FIT evaluation was performed at the final recall. The FIT is composed of seven variables (interproximal, occlusion, design, mucosa, bone, biology, and margins), each of which is evaluated using a 0-1-2 scoring scheme and investigated with an oral radiograph and occlusal and buccal pictures. Three variables have three scores made based on the presence or absence of major, minor, or no discrepancies (interproximal, occlusion, and design); the presence or absence of keratinized and attached gingiva (mucosa); the presence of bone loss > 1.5 mm, < 1.5 mm, or not detectable (bone); the presence or absence of bleeding on probing and/or Plaque Index (biology); and the presence or absence of detectable gap and marginal stain (margins). Mann-Whitney U test was used, and the level of significance was set at \( P < .05 \). The success (restoration in place without any biologic or technical complications) and survival (restoration still in place with biologic or technical complication(s)) of the crowns were evaluated. **Results:** Regarding FIT scores, all partial crowns showed a stable level of the alveolar crest without detectable signs of bone loss in the radiographic analysis. All other evaluated parameters showed a high score of between 1.73 and 2. No statistically significant differences emerged between the two groups in any of the assessed variables (\( P > .05 \)). All FIT scores were compatible with the outcome of clinical success, no restoration was replaced or repaired, and the success rate was 100%. **Conclusion:** The results showed that it is possible to evaluate the clinical performance of partial crowns using the FIT. The FIT proved to be an effective tool for monitoring the performance of the restorations and their compatibility with periodontal tissues at the recall. The FIT can be helpful for a standardized evaluation of the quality of therapy in prosthodontic dentistry. The two lithium disilicate materials showed similar results after 3 years of clinical service.

**Third Place**

**Accuracy of Digital Intraoral Impressions for Complete Dentures Manufacturing: Comparison of Three Different Protocols**

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**Purpose:** The primary aim of this study was to evaluate the accuracy of three different digital intraoral impression protocols for the realization of a removable complete denture. The secondary aim was to assess patients’ comfort and the ergonomics of a fully digital workflow. **Materials and Methods:** After ethical approval (protocol number: PRODIG01), 12 adult patients (4 women and 8 men) aged between 64 and 82 years who were referred to the Prosthodontic Department of the Dental School of the University of Brescia were included in this study. The inclusion criteria were: patients with one or both edentulous dental arches; no syndromes or cognitive deficits; and no serious respiratory pathologies. The study consisted of a clinical phase and a laboratory phase. In the clinical phase, three sessions of impressions were performed for each patient by a single operator. In each session, two impressions of the edentulous arch were obtained: the first with an intraoral scanner (CS 3600, Carestream Dental) coupled with the Nola Dry Field retraction system, and the second with Schreinemaker impression trays and alginate (gold standard). In the first session, an impression of the edentulous arch was obtained. In the second session, metallic landmarks were applied on the alveolar crest and on the hard palate before impression acquisition. In the third session, the same metallic landmarks were applied in the vestibular fornix and in correspondence with the postdam. At the end of the third session, a colloquial interview was conducted among the patients and the operator about digital workflow ergonomics according to the experiences gained during the trial. In the laboratory phase, alginate impressions were cast in stone models and digitally scanned (3Shape). Each scan was aligned with the corresponding STL file generated with the intraoral scanner. Using Splint Studio software (3Shape), a section was created in correspondence with six reference points (tubers, canine prominences, median points of the third palatal rugae), and the discrepancy among the three overlapping impressions was measured. Statistical analyses were performed with SPSS software (IBM). Data were normally distributed and tested using one-way ANOVA in order to highlight the presence of statistically significant differences among the three methods for each reference point. When ANOVA was significant (\( P < .05 \)), post hoc Tukey test was applied to identify where the differences occurred between groups. **Results and Conclusion:** A statistically significant difference among the three methods of between 0.24 and 0.84 mm was found only at the third palatal ruga reference point level. Patients participating in the study and the operator unanimously expressed their preference for impressions detected with an intraoral scanner. The use of metal reference points had no strategic effect on increasing impression accuracy.