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Clinical performance of angulated screw channel retained implant-supported zirconia FDP: a preliminary prospective study

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Aim

The retention type of implant-supported fixed dental prostheses (FDP) becomes a critical choice when the dental implant is not placed in a prosthetically ideal position. In recent years, CAD-CAM technology has permitted the angular correction of screw emergence, anywhere between 0° to 25° in a 360° radius, into the prosthesis. This treatment provides the correction of implant angulation, reversibility, an aesthetic solution and the absence of cement; however, there is a lack of controlled clinical studies that assess the frequency of technical complications in the angulated screw channel (ASC) restorations. The aim of this prospective study was to evaluate mechanical and biological complications of ASC retained zirconia implant-supported FDP.

Materials and methods

Thirty-six partially edentulous patients were included in the study. A total of 37 FPDs were placed, supported by 50 dental implants. All patients were followed up 3, 6, and then yearly after insertion of the prostheses. Mechanical data included implant diameter, screw channel angle (<10° vs > 10°), prosthetic type (single crown vs. multiple FDP), antagonist type (natural dentition vs. FDP) and clinical crown-to-implant ratio (CI<2 vs. CI> 2). At each follow-up, plaque level and bleeding scores were assessed and periapical radiographs were taken to record marginal bone loss (MBL). The main outcomes were prosthesis success, implant survival, marginal bone level change, and mechanical complication. A generalized linear mixed model was estimated to identify the predictors of MBL.

Results

All patients were included in this preliminary prospective study because they attend the 1-year follow-up. The mean follow-up duration was 24.4 months. One mandibular single-tooth implant failed after 1 year in one patient. Cumulative implant survival and prosthesis success at 2 years was 97.96%. The mean MBL at 2 years was 0.13 mm (SD = 0.08). One single crown screw worked loose three times on the same patient. No significant relation between MBL and implant diameter, screw channel angle, prosthetic type, antagonist type, and CI were found.

Conclusions

With the limitation of this study, ASC is a valid aesthetic alternative to restore non parallel implants in the anterior and posterior zone.

Mini-invasiveness, advanced concepts. Calibrated and guided tooth reduction technique for crowns and bridges

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Aim

This work aims to submit innovative prosthetic techniques. They are techniques which promote revisions and new solutions achieved by a careful evaluation of the current dental art status. Among the most accredited and listed tooth preparation techniques in the literature, there are: the orientation grooves technique (deep guide channels) proposed by Preston in 1977, Stein in 1977, Sozio R.B. in 1983 and Miller L.L. in 1983; McLean J.W. in 1979 suggested to remove half a tooth at a time, in order to use the other half as a reference to better control the removed dental tissue and its direction; in 1961 Martignoni proposed the sloped cutting technique, which was partially adjusted in the following years by other authors with the addition of a diamond ball bur, to reduce the cervical area. We believe that all these techniques are empirical techniques. Below, we will explain the revised technique in the tools and in the procedure.

Materials and methods

The AS-micro depthmarkers conceptually similar to their predecessors, the AS depthmarkers, shall be used in the rear, upper and lower sectors (posterior teeth), to define the chosen cutting depth in specific areas, that is in the primary and secondary pits, used in correspondence of each cuspidal apex, in the centre (on the vertex) of each internal triangular crest and in correspondence of the junction grooves, in the occlusal-buccal and occlusal-palatal/lingual transition point, marking the same depth. Thanks definitely to the reduced and tapered shape, the rotating tool will easily enter the narrow spaces of the pits, thus marking the desired depth which shall represent the most apical point of the occlusal reduction. At this point, there will be nothing left but to carry out the reduction cut with a cylindrical diamond bur (green ring) with a rounded head, first following a highly geometric pattern, taking care to align the points A-A1; B-B1; C-C1; D-D1, corresponding to the depth of the newly shaped little wells and later, a second surface improvement stage for the tooth preparation with a red ring diamond bur, by which all the roughness shall be rounded.

Conclusions

In doing so, besides the cut depth, the dentist shall, above all, have full control of the cutting direction, thus doing a guided and calibrated reduction in full compliance with the prosthetic project, previously agreed with the patient and providing the technician with the appropriate thickness, for the prosthesis creation.

Evaluation of internal and external hexagon connections in immediately loaded full-arch rehabilitations: a split-mouth trial

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Aim

To evaluate if a different morphology of the implant-abutment connection (internal vs. external hexagon) is able to condition the behaviour of hard and soft peri-implant tissues in full-arch immediate loading rehabilitations.

Materials and methods

Twenty patients with signficantly unfavorable prognoses for their residual maxillary or mandibular dentitions were selected and rehabilitated with immediately loaded fixed full-arch rehabilitations following the Columbus Bridge Protocol in two different centres. Four to six implants with identical macro- and micro-topography were inserted in each arch: external hexagon implants (EHC) in one randomly selected side of the dental arch and internal hexagon implants (IHC) in the other side. Primary outcome measures were the success rates of the implants and prostheses. Any technical and biological complication was recorded. Secondary outcome measures were: peri-implant marginal bone level (MBL) changes, plaque index (PI), probing depth (PD) and bleeding on probing (BoP), evaluated at implant insertion and at 3, 6, 12 and 36 months post-loading.

Results

Forty-three EHC and 40 IHC implants were inserted in 20 patients. No patients dropped out. Two implants failed; one IHC after 3 months and one EHC after 6 months in two different patients (difference IHC vs. EHC at patient level: 0.06%; 95% CI: -1.9 to 2.1; P=0.99). No prosthesis failed. No biological complications were identified and three loose prosthetic abutment screws were identfied in three different patients (two EHC and one IHC); difference at patient level IHC vs. EHC: 2.1% (95%CI: -0,8 to 5; P=0.43). Overall marginal bone loss was not signficantly different between the two treatment groups at any time point. The mean difference of bone levels between EHC and IHC was 0.25 mm (95%CI: -0.18 to 0.69) at implant placement. Mean difference between IHC and EHC was -0.01 mm at 3 months, 0.13 mm at 6 months, 0.11 mm 12 months and 0,04 mm at 36 months. All the implants showed good periodontal health at the 3-year-in-function visit, with no statistically signficant differences between groups regarding PI, PD and BoP. No signficant effect of centres over all outcomes was identified (P=0.71 for MBL, P=0.14 for PI, P=0.14 for PD and P=0.20 for BoP).

Conclusions

On the basis of the present trial the two types of implant connections were clinically reliable. After 36 months in function, both implants provided good clinical outcomes, without statistically significant differences between the two groups.

Prediction of titanium implant success by analysis of microRNA expression in peri-implant tissue. A 5-year follow-up study

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Aim

The aim of the present study is to evaluate the expression of microRNA (miRNA) in peri-implant soft tissue and to correlate epigenetic information with the clinical outcomes of the implants up to the five-year follow-up.

Materials and methods

Seven patients have been rehabilitated with fixed screw-retained bridges each supported by implants. Peri-implant bone resorption and soft tissue health parameters have been recorded over time with a five-year follow-up. Mini-invasive samples of soft peri-implant tissue have been harvested three months after implant insertion. miRNA have been extracted from cells of the soft tissue samples to evaluate gene-expression at the implant sites by microarray analysis. The epigenomic data obtained by microarray technology has been statistically analyzed by dedicated software and compared with measured clinical parameters.

Results

Specific miRNA expression profiles predictive of specific clinical outcomes were found. In particular, some specific miRNA signatures appeared to be "protective" from bone resorption despite the presence of plaque accumulation.

Conclusions

miRNA may be predictors of dental implant clinical outcomes and may be used as biomarkers for diagnostic and prognostic purposes in the field of implant dentistry.

Comparison of three intraoral scanning techniques on totally edentulous maxilla: a 3D analysis

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Aim

The first aim of the present *in vitro* study was to compare the accuracy of an intraoral scanner (TRIOS 3, 3Shape) on 2 similar totally edentulous typodonts of a maxilla, characterized by a different definition of the anatomical landmarks. The second aim was to evaluate the accuracy of 3 different scanning techniques with the same intraoral scanner.

Materials and methods

Two reference similar typodonts made-up of polyurethane resin of a totally edentulous maxilla were fabricated: the "wrinkled-typodont" (WT) with palatal rugae, and the "smoothed-typodont" (ST) without palatal rugae and with smoother mucosal surfaces than WT. Both reference typodonts were scanned using an industrial metrological machine (Atos Core-80, GOM), so obtaining 2 digital reference scans in ".stl" format. In the scanning technique-1 (T1), the scanning proceeded longitudinally along the ridge's occlusal side of the full arch, starting from the left maxillary tuberosity, ending at the right one, then continuing on the buccal side and finally on the palatal side, scanned with a circular movement in a counterclockwise direction along the palatine vault and finally in posterior-anterior direction along the palate's median line. In technique-2 (T2) the scanning started from the buccal side of the left maxillary tuberosity, moving the scanner with bucco-lingual and linguo-buccal alternate movements along the ridge, from one side to the other, and finally the area along the palate's median line was detected in posterior-anterior direction. In technique-3 (T3) the scanning proceeded 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 palatal side and finally on the buccal side. The palatal side was scanned with a circular movement in a clockwise direction along the palatine vault until the left maxillary tuberosity and finally with a counterclockwise movement until the contralateral tuberosity. Six groups of scans were obtained (n=10), respectively named WT/T1, WT/T2, WT/T3, ST/T1, ST/T2 and ST/T3 according to both the presence/absence of palatal rugae and the scanning strategy. The scans in ".stl" format were imported into a dedicated software (Geomagic Control X) and the accuracy of each one was evaluated calculating trueness and precision in micrometers.

Results

Trueness values (95% CI):

- WT/T1=48.7[37.8-59.5]; WT/T2=65.9[54.9-77.4];
- WT/T3=109.7[96.1-123.4]; ST/T1=48.1[42.4-53.7];
- ST/T2=56.4[43.9-68.9];
- ST/T3=61.1[53.3-69].

Precision values (95% CI):

- WT/T1=46.7[29.7-63.7];
- WT/T2=53.6[37.6-69.7];
- WT/T3=90[59.1-120.9];
- ST/T1=46[39.7-52.3];
- ST/T2=76[55.5-96.6]
- ST/T3=52.9[41.9-63.8].

Conclusion

The scans performed on the typodont with more defined anatomical landmarks were less accurate than the ones performed on the typodont with less defined landmarks, but the precision of the scans made with the scanning technique-2 on this typodont was better than on the typodont with more defined landmarks. On both typodonts the scanning technique-1 showed a better accuracy than technique-2 and technique-3.

Comparison of the accuracy of an intraoral and an extraoral laboratory scanner on the totally edentulous maxilla: a 3D analysis

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Aim

The aim of this study was to compare the accuracy between an intraoral scanner (TRIOS 3, 3Shape) and an extraoral laboratory scanner (DScan 3, EGSolutions) on the reference typodont of an upper totally edentulous jaw. The accuracy of the extraoral scanner was evaluated from the direct scans of the impressions in polysulphide (through a reverse process), then from the scans of the models obtained 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 metrological machine (Atos Core-80, GOM), obtaining a digital reference scan, saved in ".stl" format. The areas needed for the construction of a complete maxillary denture were included in the scans. 10 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. 10 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 ones. With this device, 10 impressions in polysulphide (Permlastic, Kerr) were obtained; then, by the laboratory extraoral scanner, a scan of each impression was done. With a dedicated software (DentalCad, EGSolutions) 10 digital models (dREM) were obtained processing "in reverse" the physical impressions. Eventually, a type IV stone (Elite Stone, Zhermack) was poured in the impressions to obtain 10 physical gypsum models (dEOM), then scanned as well by the laboratory scanner. In this way, 3 groups of scans were done (n=10) and saved in ".stl" format for the comparison, performed importing them into a dedicated software (Geomagic Control X), and the accuracy was evaluated calculating trueness and precision, measured in micrometres. Data were statistically analyzed by means of a dedicated software (SPSS 25, IBM).

Results

Trueness values (95% c.i.) were:

- dIOM=49,1[37,9-60,3];
- dREM=349,1[290,7-407,6];
- dEOM=1243[1130,7-1355,3].

Precision values (95% c.i.) were:

- dIOM=48,7[37,8-59,5];
- dREM=346,8[293,8-399,8];
- dEOM=1241,8[1129,6-1354].

Statistically significant differences were detected between the experimental groups.

Conclusion

Intraoral scanning allows better accuracy than the scanning of the model with an extraoral laboratory scanner. The reverse process performed on the direct scans of the impressions guarantees better accuracy compared to the scanning of the corresponding model but worse accuracy compared to the intraoral one. 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.

Influence of implant position over the accuracy of intraoral optical surface scanning (IOS) for complete-arch implant impression: a randomized *in vitro* trial

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Aim
The aim of this study was to evaluate the influence of implant position on the accuracy of a confocal microscopy intraoral scanner for complete-arch implant impression.

Materials and methods
An edentulous maxillary master model set-up with 6 internal connection dental implant analogues, placed with different depth and inclination, was scanned with an extraoral optical scanner to achieve a standard tessellation language (STL) file to be used as a reference for the study measurements. Six titanium scan bodies were screwed onto the implants and scanned with an intraoral scanner by 3 operators to obtain 45 test STL files. The test files were aligned to the reference scan with a 0,01-mm tolerance best fit algorithm. Linear (X, Y and Z-axis) and angular deviations (δANGLE) were measured for each analogue (n=270). Absolute values of the linear discrepancies were summed up to obtain a tridimensional discrepancy value (δASS). Implant position influence over δASS and δANGLE was statistically analyzed through a hypotheses test for mixed model analysis of variance with Tukey adjustment for multiple comparison ($p<0,05$).

Essential results
Considering δASS, implant 2.6 resulted as the less accurate one (estimated mean 172.4 micron), with a significant difference compared to implants 1.2 ($p = 0.0107$), 2.2 ($p = 0.0004$) and 2.4 ($p = 0.0200$). Implant 2.2 resulted as the most accurate one (estimated mean 81 micron) with a significant difference compared to implant 2.6 ($p = 0.0004$). Considering δANGLE implant 2.4 resulted as the most accurate (estimated mean 0.4625°) with a significant difference compared to all the other implants 1.6 ($p = 0.0061$), 1.4 ($p = 0.0002$), 1.2 ($p < 0.0001$), 2.2 ($p < 0.0001$) and 2.6 ($p = 0.0010$). Implant 2.2 resulted as the less accurate (estimated mean 0.8681°) with a significant difference compared to implant 1.6 ($p = 0.0233$) and 2.4 ($p < 0.0001$).

Conclusions
Within the limitations of this study, the accuracy of digital complete-arch implant impressions obtained through a IOS confocal microscopy is influenced by implant angulation and position considering linear deviation and angular deviation respectively.

Accuracy of digital intraoral impressions for complete dentures manufacturing: comparison of three different protocols

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Aim
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 old, referring to the Prosthodontic Department of the Dental School of the University of Brescia, were included in this study. Inclusion criteria were: patients with one or both edentulous dental arches, no syndromes or cognitive deficits, 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, Atlanta, GA, USA) coupled with the NOLA Dry Field retraction system, and the second with Schreinemakers 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 impressions 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 an interview was conducted among patients and operators to collect their opinion about digital workflow ergonomics, according to the experience gained during the trial. In the laboratory phase alginate impressions were cast in stone models and digitally scanned (3Shape®, Copenhagen, Denmark). Each scan was aligned with the corresponding STL files generated with the intra-oral scanner. Through the Splint Studio software (3Shape®, Copenhagen, Denmark) a section was

created in correspondence of six reference points (tubers, canine's prominences, median point of the third palatal ruga) and the discrepancy between the three overlapping impressions was measured. Statistical analysis was performed with SPSS software (SPSS Inc., Chicago, IL). Data were normally distributed and were tested using one-way ANOVA, in order to highlight the presence of statistically significant differences between the three methods for each reference point: when ANOVA test was significant ($p < 0.05$), post-hoc Tukey test was applied to to identify where the differences occurred between groups.

Results and conclusions

A statistically significant difference between the three methods, comprised 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 point had no strategical effect on increasing impression accuracy.

A novel digital workflow integrating navigation surgery and CAD/CAM guided prosthesis for immediate loading of single implants in the esthetic zone: a 1 year cohort study

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Aim

Nowadays both clinicians and patients have set more stringent benchmarks for implant success. Optimal implant positioning through a prosthetically driven decision-making is mandatory to achieve function and satisfactory aesthetics. Patients no longer expect only improved function when replacing missing teeth, but they also anticipate a natural-appearing, fixed provisional restoration that can be delivered immediately. Dynamic navigation/guidance is the use of a system that allows the surgeon to visualize implant site development while the drills are in function. Deviations from the predetermined plan can be seen in "real time" and changes to the plan can be made at the time of surgery. Aim of this work is to report a digital integrated workflow for immediate loading implants for single tooth gap in the esthetic zone in one visit using dynamic navigation surgery.

Materials and methods

Patients referred for implant surgery and immediate loading to rehabilitate missing single tooth in the esthetic zone. A case study was executed, in which the file DICOM and the STL file of the digital impression were matched with the digital implant and the prosthetic rehabilitation. Implants were placed according to one-staged dynamic surgical navigated procedure (X-Guide) and loaded immediately. A total of 62 implants (Nobel Parallel - Nobel Biocare AG) were inserted with immediate load. All implants were placed in maxillary and mandibular anterior and premolar teeth in healed sites and post extractive sockets. The digitally designed temporary shell with proximal wings was relined and fitted onto the abutment connected to the implant that was just placed by means of the dynamic navigation system. Among the implants placed, 14 (22.58%) were implanted in healed sites, of which 8 (57.14% of healed site) in regenerated bone, 48 (77.42%) were placed in post-extractive sockets.

Results

No patient dropped out of the study in the first year. One implant failed before the definitive prosthesis delivery, accounting for a cumulative success rate of 98,38%. No definitive prostheses failed. Marginal bone remodeling at 1 year was 0.63 ± 0.25 mm (the mean was the same for the mesial and distal zone). At the 1-year follow-up session ($n=62$), bleeding on probing was 10%, and the plaque index was 8%. All patients were successfully rehabilitated and had their definitive prostheses in function at the end of the 1-year post-loading follow-up.

Conlcusion

Integrating these comprehensive clinical data into a 3D visualization of the implant recipient site characteristics and neighboring anatomy provides the clinician with better insight into the surgical, prosthetic, and esthetic treatment requirements and, as such, may improve decision-making, increasing the predictability of the overall implant treatment. The navigation surgery was a tool that allowed the realization of a completely digital protocol and a direct and continuous control of surgical procedures.

Randomized controlled trial on reproducibility of subgingival vertical margins by iOS impression: a pilot study

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Aim

The aim of this prospective clinical study was to evaluate the possibility to record the most apical part of the vertical preparations, located at three different depths (iuxtagingivally, 1 mm into the sulcus and following BOPT technique) with intra-oral digital impressions versus analogic impressions.

Materials and methods

Sixty patients in need of full crowns on natural abutment in posterior sites were selected and randomly divided in three groups of 20 samples each. In Group 1 the vertical preparation finishing line was positioned iuxtagengivally, in Group 2 less than 1 mm into the sulcus and in Group 3 BOPT (with the margins deeper than 2 mm into the sulcus) was followed. For each abutment two impressions were taken with the double cords retraction technique: one digital (Aadva iOS 200, GC Co.) and one analogic (Ex'lance polyvinilsiloxane, GC Co.) on each abutments. The files generated by the iOS were delivered to the lab while the analogic impression was poured in stone and then scanned with a lab scanner (AAdva lab scanner, GC Co.). Then, the two .stl files were sovra-imposed and the different depth of margins were evaluated. Measures were taken at the interproximal margins and at buccal margins.

Results

The results of this trial showed that margin's position was the key factor to obtain accurate impressions. In Group 1 no differences were found at interproximal and buccal sites between the two impressions. In Group 2 a deeper margins of 0.34 mm interproximally and 0.12 buccally was recorded. In Group 3 the differences in depth of the recorded margins was 0.95 and 0.65 respectively at interproximal and buccal sites. No statistically significant differences between two type of impressions when margins were located iuxtagingivally.

Conclusions

The findings of this pilot clinical trial showed that when margins are located till 1 mm into the sulcus, it can be more difficult to catch margins with digital impression. BOPT is no indicated when a digital impression is planned.

A pilot trial on lithium disilicate partial crowns using a novel prosthodontic Functional Index for Teeth (FIT)

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Aim

Lithium disilicate is now an accepted material for indirect restorations. The aim of this trial was to evaluate clinical performances of two lithium disilicate systems using a novel prosthodontic Functional Index for Teeth (FIT) after three years of clinical service.

Materials and methods

Partial adhesive crowns on natural abutment posterior teeth were made on 60 patients. Patients were divided into two groups: Group 1 IPS e.max press (Ivoclar-Vivadent, Schaan, Liecthestein), and Group 2 Initial LiSi press (GC Co., Tokyo, Japan). The restorations were followed-up for 3 years, and the FIT evaluation was performed at the last recall. The FIT is composed of seven variables (Interproximal, Occlusion, Design, Mucosa, Bone, Biology and Margins), each of them are evaluated using a 0-1-2 scoring scheme and is investigated by an oral radiograph and occlusal and buccal photographs. More in details, three variables have the three scores made on the presence or not of major, minor or no discrepancy (for 'Interproximal', 'Occlusion' and 'Design'), presence or not of keratinized and attached gingiva ('Mucosa'), presence of bone loss >1.5 mm, <1.5 mm or not detectable ('Bone'), presence or not of Bleeding on Probing and or Plaque Index ('Biology'), presence of detectable gap and marginal stain or not ('Margins'). The Mann-Whitney 'U' test was used and the level of significance was set at $p<0.05$. Also, "success" of the crowns (restoration in place without any biological or technical complication) and "survival" (restoration still in place with biological or technical complication) 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, between 1.73 and 2. No statistically significant differences emerged between the two groups in any of the assessed variables ($p>0.05$). All FIT scores were compatible with the outcome of clinical success and no restoration was replaced or repaired and the success rate was 100%.

Conclusions

The results showed that it is possible to evaluate the clinical performance of partial crowns using FIT. The FIT proved to be an effective tool to monitor the performance of the restorations and their compatibility with periodontal tissues at the recall. The FIT can be really helpful for a standardized evaluation of the quality of the therapy in prosthodontic dentistry. The two lithium disilicate materials showed similar results after 3 years of clinical service.

Precision of two intraoral scanners to scan single posterior abutments *in vitro*

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Aim
To compare the accuracy of digital impressions of single abutments prepared for esthetic overlay obtained by two current intraoral scanners *in vitro*.

Materials and methods
Twenty extracted intact molars were used for this *in vitro* study. The samples were prepared to receive an overlay. The abutments were scanned with two intraoral scanners (Trios 3, AAdva iOS 200) by one single operator. Twenty scanning shots for each iOS were made. The .stl files generated by the two scanners were elaborated with the Exocad software and were one by one over-imposed in order to detect possible differences. Differences were visibly evaluated by a color scale ranging from 0 to 100 microns of difference. Statistical analysis across the scanner groups was performed using ANOVA with Bonferroni correction.

Results
All over-impositions of full arches showed a minor discrepancy between the iOS impressions (media around 20 microns). A wider discrepancy was noted mainly at the bottom of the inter-proximal margins and/or in small areas of axial wall of the interproximal box (till 100 microns). There was no difference between the two iOS systems.

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

Precision of two intraoral scanners to scan full and half arch *in vitro*

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Aim
To compare the accuracy of full arch and half arch digital impressions produced by two current intraoral scanners *in vitro*.

Materials and methods
A Frasaco dental model was used for this *in vitro* study. The model was scanned with two intraoral scanners (Trios 3, AAdva iOS 200) by three operators. Then, the model was scanned with a lab scanner as control (Aadva lab scanner). Two different scanning shots were made: full arch impression and half mouth impression. The .stl files generated by the three scanners were elaborated with the Exocad software and were two by two over-imposed in order to detect possible differences. Differences were visibly evaluated by a color scale ranging from 0 to 100 microns of difference. Statistical analysis across the scanner groups was performed using ANOVA with Bonferroni correction.

Results
All over-impositions of full arches showed higher discrepancy between the iOS impressions and the lab scanner in the molar area (around 100 microns). Reducing the surface area to be scanned, the discrepancy was lower (around 50 microns). There was no difference between the two iOS systems.

Conclusions
The two intraoral scanners produced similar precision in scanning full and/or half mouth. The higher discrepancy was recorded in the molars area when full arch was scanned.

Reliability of two intraoral scanners to scan single posterior abutments *in vivo*: a pilot study

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Aim
To compare the accuracy of digital impression of single posterior abutments prepared for esthetic overlay obtained by two current intraoral scanners under clinical conditions.

Materials and methods
Ten patients requiring an overlay in posterior teeth were selected. After being prepared, the teeth were scanned with two intraoral scanners (Trios 3, AAdva iOS 200) by one single operator. For each abutment two scanning shots for each iOS were made plus a traditional impression in polyvinilsiloxane (Ex'lance, GC) as control. Scanning time was recorded for each iOS to be compared. The .stl files generated by the two scanners were elaborated with the Exocad software and were one by one over-imposed on that generated by the traditional impression scanned in the lab (Aadva lab scanner) in order to detect possible differences. Differences were visibly evaluated by a color scale ranging from 0 to 100 microns of difference. Then the digital impressions were printed by a 3D printer in order to create corresponding casts. Three crowns were fabricated from the three impressions of each abutment and tried-in into the corresponding abutment. The fit of each crown was evaluated with a sharp explorer and Fit Checker Advanced Blu paste (GC) and its thickness was recorded. Finally, the best fitting crown was luted. Statistical analysis across the scanner groups was performed using ANOVA with Bonferroni correction regarding scanning time *in vivo*, the over-imposition and the Fit Checker thickness.

Results
All over-impositions of abutments showed a minor discrepancy among the iOS and lab scanner impressions (media around 20 microns). A wider discrepancy was noted mainly at the bottom of the inter-proximal margins and/or in small areas of axial wall of the interproximal box (till 100 microns). There was no difference between the two iOS systems. Fit Checker Advanced Blu thickness ranged in all groups between 50-120 microns. Scanning time was shorter when Trios 3 was used than Aadva 200, but without statistically significant differences.

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

Randomized controlled trial on reproducibility of supragengival horizontal margins by iOS impression: a pilot study

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Aim
The aim of this prospective clinical study was to evaluate the possibility to record horizontal margins of onlays located supragingivally, with intra-oral digital impressions versus analogic impressions.

Materials and methods
Thirty patients requiring partial adhesive crowns on natural abutment in posterior sites were selected. For each abutment two impressions were taken with the double cords retraction technique: one digital (Aadva iOS 200, GC Co.) and one analogic (Ex'lance polyvinilsiloxane, GC Co.). The files generated by the iOS were delivered to the lab while the analogic impression was poured in stone and then scanned with a lab scanner (AAdva lab scanner, GC Co.). Then, the two .stl files were over-imposed and the different depth of margins were evaluated. Measures were taken at the inter-proximal margins and at buccal and lingual margins.

Results
The results of this trial showed that a supragingival margin position was the key factor to have good impressions. In all sample teeth no differences were found at any sites between the two impressions. No statistically significant differences between two type of impressions when margins were located iuxtagingivally.

Conclusions
The findings of this pilot clinical trial showed that when margins are located supragingivally both digital and analogic impressions can be used and permit a high quality reproduction of the horizontal preparations.