Clinical Accuracy Outcomes of Closed-Tray and Open-Tray Implant Impression Techniques for Partially Edentulous Patients

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The aim of this research was to compare the accuracy outcomes of open- and closed-tray implant impressions for partially edentulous patients. Eleven partially edentulous spaces in seven patients with two existing implants for fixed partial dentures were included. Group I (closed-tray) and group II (open-tray) were compared using microcomputed tomography scanning. No statistically significant differences were found between the closed- and open-tray techniques ($P = .317$). The subjective evaluation of patient comfort showed no differences with either impression technique. There were no differences seen between open- and closed-tray impression techniques in partially edentulous patients when implants had less than 10 degrees of angulation. *Int J Prosthodont 2011;24:469–472.*

The dental literature reports no differences between open- and closed-tray impressions.[1] Some studies showed more accurate results with the open-tray technique[2]; others reported better accuracy with the closed-tray technique.[3] A correlation has been observed linking greater implant angulations with less accurate impressions.[4] The objective of this clinical study was to compare the accuracy outcomes of the open- and closed-tray implant impression techniques for partially edentulous patients. The null hypothesis of this investigation was that the open-tray implant impression technique would achieve a similar accuracy when compared with the closed-tray implant impression technique.

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Materials and Methods

This study was approved by the Institutional Review Board for Human Studies, Harvard Faculty of Medicine, Boston, Massachusetts. Eleven partially edentulous spaces from seven patients were included in this clinical pilot study. Inclusion criteria were as follows: patients ≥ 21 years of age with two healthy implants (Bone Level, Straumann) in the same quadrant for a multiunit fixed partial denture.

For the closed-tray technique, implant-level impression copings were inserted (Fig 1a). Custom trays loaded with a polyether impression material (Impregum, 3M ESPE) were allowed to set for 7 minutes before removal. Impression copings were removed and mounted with implant analogs and then relocated in the impression trays. A similar procedure was used for the open-tray impression technique but instead using open-tray implant-level impression copings (Fig 1b). Impression copings were picked up in the impression, and implant analogs were connected.

Verification jigs were fabricated intraorally with straight multibase abutments splinting the two implants with a resin framework (Duralay, Reliance

Fig 1a *(left)* Closed-tray impression technique.

Fig 1b *(right)* Open-tray impression technique.

Fig 2 *(left)* Resin framework connected to the implant copings.

Fig 3 *(right)* Resin framework connected to a cast to assess accuracy of fit.

Figs 4a and 4b Micro-CT scan image of *(left)* misfit and *(right)* fit.

Dental) (Fig 2). Impressions were poured within 1 hour using type IV dental stone (Silky-Rock, Whip Mix) and allowed to set for at least 2 hours. Digital photographs were used to calculate the angular difference between the two implants. These were measured twice and averaged (ImageJ, NIH). Distances between the two implants were measured using a caliper.

Microcomputed tomography (micro-CT) scanning (SCANCO Medical μCT-35) was used to scan the gap between the abutments and the verification framework for all test and control casts (Fig 3). Gaps in the digital images were assessed and measured by two independent examiners, blinded to the type of impression technique used (Figs 4a and 4b). A visual analog scale was used to assess patient perceptions regarding their impression preference.

Descriptive statistics (mean, standard deviation [SD]) and the Wilcoxon signed ranks test were used to compare the accuracy of closed- and open-tray techniques for nonparametric data. The level of significance was set at 5% ($P < .05$).

Results

Ten of 11 implant casts generated with the closed-tray impression technique were clinically accurate, and identical results were found for the casts produced with the open-tray technique (Tables 1 to 3). Kappa score showed 100% interexaminer agreement ($\kappa = 1.0$).

Table 1 Site-Specific Demographics

Patient no.	Site no.	Implant site	Mesiodistal angulation (degrees)	Buccolingual angulation (degrees)	Implant-to-implant distance (mm)
1	1	Maxillary posterior	2.1	3.1	15.0
1	2	Mandibular posterior	2.6	4.3	13.0
1	3	Mandibular posterior	0.9	5.1	16.0
2	4	Maxillary posterior	3.8	4.5	6.5
2	5	Maxillary posterior	3.9	2.0	6.5
3	6	Mandibular posterior	5.1	2.2	20.0
4	7	Maxillary posterior	7.8	1.5	12.5
4	8	Maxillary posterior	9.3	1.8	18.5
5	9	Maxillary anterior	1.3	4.9	17.0
6	10	Mandibular anterior	2.7	1.4	9.0
7	11	Maxillary anterior	3.5	1.5	8.0

Table 2 Descriptive Statistics

	Fit	Misfit	Mean mesiodistal angulation (degrees) (SD)	Mean buccolingual angulation (degrees) (SD)	Mean implant-to-implant distance (mm) (SD)	Mean patient comfort (%) (SD)
Closed-tray	10	1*	4 (3)	3 (2)	13 (5)	55 (35)
Open-tray	10	1*	4 (3)	3 (2)	13 (5)	60 (35)

SD = standard deviation.
*False positive.

Table 3 Statistical Results (Wilcoxon Signed Rank Test)

	Closed-tray vs open-tray	Control vs closed-tray	Control vs open-tray
Z	.000*	−1.000†	−1.000†
Asymp. sig. (two-tailed)	$P > .999$	$P = .317$	$P = .317$

*The sum of negative ranks equals the sum of positive ranks.
†Based on positive ranks.

A single site with misfit belonged to a single patient. This inaccuracy was a false positive for that site (both groups), suggesting that there was likely an error with the fabrication of the intraoral verification jig.

The Wilcoxon signed ranks test showed no statistically significant difference in the accuracy of casts obtained with the closed- and open-tray techniques ($P = .317$) (Table 3). The visual analog scale showed similar patient satisfaction for both techniques (60% for open-tray and 55% for closed-tray). The mean (SD) mesiodistal angulation of all implants was 4 (3) degrees; the mean buccolingual angulation was 3 (2) degrees.

Discussion

The findings of this clinical pilot study are in accordance with the majority of in vitro studies regarding partially edentulous situations. Favorable implant angulations have been suggested to have less adverse effects on osseointegration at the implant-abutment junction. For this study, no correlation was found between angulation and preference for the closed- or open-tray technique. However, for unfavorable implant angulations or long-span implant prostheses, it has been shown that the open-tray technique is more predictable compared with the closed-tray (transfer) technique.[5]

The use of a visual analog scale showed similar patient satisfaction for both techniques, indicating that the choice of the impression technique does not have an impact on patient comfort.

Conclusion

This pilot study suggests that closed-tray impression techniques had no statistically significant difference compared to open-tray techniques for the multiunit partially edentulous situation when implants have less than 10 degrees of angulation.

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Literature Abstract

A community-based RCT for oral cancer screening with toluidine blue

This was a community-based randomized controlled trial among individuals with high-risk oral habits to evaluate whether the use of toludine blue as an adjunctive tool for visual screening results in a higher yield of asymptomatic oral premalignant lesion (OPML) detection. This was part of a community-based multiple screening program aimed at detecting five prevalent neoplasms (cervical, breast, liver, colorectal, and oral) and three chronic diseases (hypertension, diabetes, and hyperlipidemia). Individuals aged 15 years and older (n = 28,167) were invited to participate, and 17,890 were excluded since they lacked the high-risk factor for oral habits; 2,392 refused to participate, and 7,975 were enrolled and randomized into experimental and control groups. A structured questionnaire was administered to the subjects to obtain demographic information as well as risk factor for oral habits. The experimental group was given toluidine blue solution and the control group was given a placebo with dye. The subjects were then given an oral cavity examination by one of six trained dentists with a flashlight and wooden tongue depressors. If the screening was positive, they were referred to an oral pathologist within 10 to 14 days for a consultation. The subjects' data were linked to the National Cancer Registry and the National Household Registry until December 31, 2004. This allowed information on the subjects of occurrence of oral cancer, survival status, and cause of death to be obtained. Statistical comparison between the groups was performed with the Student *t* or chi-square test. There were no significant differences in sex, mean age, distribution of 10-year age groups, or compliance with referral between the groups. The initial screen-positive group was higher in the experimental group (95% vs 8.3%, $P = .047$), and there was no significant differences detected for OPMLs (4.6% vs 4.4%) or nonOPMLs (1.9% vs 1.6%) after referral. No significant difference was found between the experimental group detecting 5% more OPMLs compared to the control. The 5-year follow-up oral cancer incidence rate in the experimental group was not significant and 21% lower than that in the control group.

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