Short Communication

Influence of Impression Technique and Material on the Accuracy of Multiple Implant Impressions

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This study aimed to analyze the influence of impression technique (pick-up versus reposition) and material on the accuracy of the working cast. Sixty impressions were made with 3 materials from a master cast with 4 XiVE implants. The changes in the implant axis direction, rotation, and 3-dimensional shift were assessed. The pick-up technique showed significantly ($P < .05$, *U* test) lower values for axis direction and 3D shift but higher values for rotation than the reposition technique. The differences between the materials were not significant ($P > .05$, H test). It can be concluded that the impression technique—in contrast to the impression material—has a significant influence on transfer accuracy. *Int J Prosthodont 2008;21:299–301.*

Several impression techniques have been suggested for use in implant prosthodontics. Many studies emphasize the importance of splinting transfer copings intraorally before taking the impression; however, this procedure is time consuming, and the results reported in the literature regarding the increase in accuracy are contradictory.[1] Therefore, it was the purpose of this study to analyze the accuracy obtainable with an open-tray (pick-up) impression compared to a closed-tray (reposition) impression of nonsplinted transfer posts, using different impression materials. The following null hypothesis was tested: The *(1)* impression technique and *(2)* material used do not influence the accuracy of the working cast.

Materials and Methods

Four XiVE (Dentsply Friadent) implant analogs (diameter: 5.5 mm) were laser welded to a stainless steel base plate and cemented with acrylic resin (PalaXpress, Heraeus Kulzer) to a cast of a complete maxillary arch (Fig 1). Three metal pins were inserted into the cast to serve as reference marks.

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The impression materials and techniques are shown in Table 1. All impressions were visually inspected and repeated in case of inaccuracies (eg, voids, material separating from the tray). After removal of the impression cast, analogs were applied to the impression posts. Vacuum-mixed type IV dental stone (GC Fujirock EP, GC) was used to pour the impressions. All casts were stored at room temperature (23°C ± 1°C) for a minimum of 7 days. For each of the 4 implants, a triangular metal plate with laser-printed reference marks in the corners of an equilateral triangle (measuring triangle; edge length: 13 mm) was welded onto an impression coping in a rectangular position to serve as a measuring post. For measurement, the copings were inserted into the cast analogs and tightened with their respective screws. A microscope (M420, Leitz) was used to determine the x, y, and z coordinates of all reference marks (3 per implant, 3 on the cast). The reproducibility of the measuring setup was determined as 10 µm on the horizontal plane and 20 µm on the vertical plane. From these coordinates, the angle of the implant axis in relation to the cast was calculated as the angle between the normal vectors of the planes given by the measuring triangle and the reference marks. The rotational position was assessed as the rotation of the measuring triangle in comparison to the reference mark. Three-dimensional aberrations of the implant surfaces (3D shift) were calculated using the Pythagorean theorem after the transformation of the coordinates into a common coordinate system (Fig 1).

All data sets were subjected to the Kolmogorov-Smirnov test to check for normal distribution ($P > .05$).

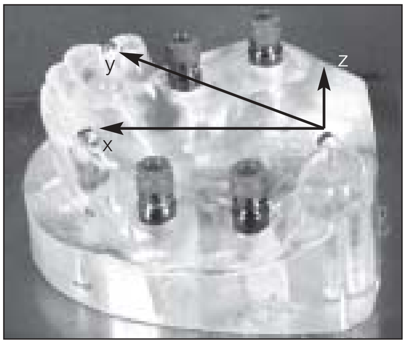
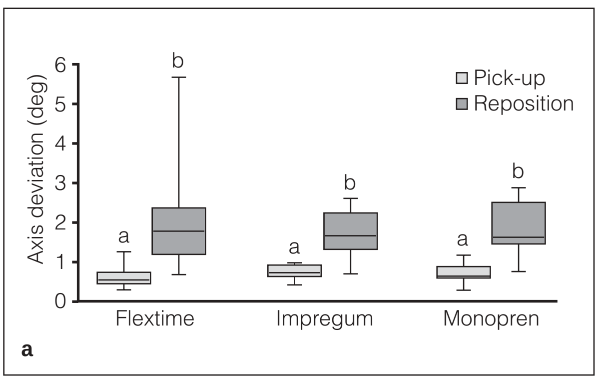


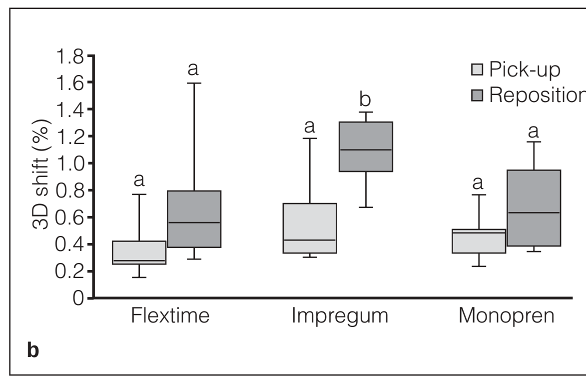
Fig 1 Master cast prepared with 4 impression copings for the repositioning technique. Note the 3 reference marks used.

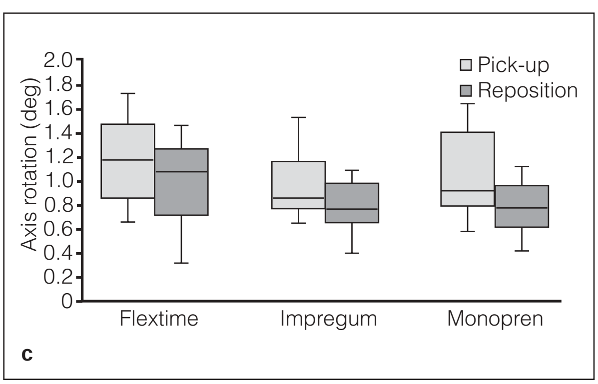
Table 1 Impression Materials and Techniques Used

Brand name	Manufacturer	Type	Impression technique*	Tray
Flexitime Heavy Tray + Flexitime Light Tray	Heraeus Kulzer	Polyvinyl siloxane	Pick-up Reposition	Custom† Stock‡
Impregum Penta	3M ESPE	Polyether	Pick-up Reposition	Custom† Stock‡
Monopren Transfer	Kettenbach	Polyvinyl siloxane	Pick-up Reposition	Custom† Stock‡

*n = 10 per material and technique. All impressions were taken at ambient room temperature (23°C ± 1°C). All impression materials were automixed.
†Palatray XL (Heraeus Kulzer).
‡Jescoform stainless steel tray (Aesulap).







Figs 2a to 2c **(a)** Deviation of axis direction, **(b)** 3D shift, and **(c)** axis rotation of the impression techniques and materials. Boxes denote interquartile range; bars denote 10% to 90% range. Same superscript letters indicate no significant difference ($P > .05$, H test).

Because the test results revealed that the data were not normally distributed, statistical analysis was performed using nonparametric statistics (H and *U* test for unpaired sample groups; $P = .05$).

Results

The pick-up technique showed significantly ($P < .05$, *U* test) lower changes in axis direction (Fig 2a) and 3D shift (Fig 2b) but significantly higher ($P > .05$, *U* test) rotational errors (Fig 2c) compared to the reposition technique. There were no significant differences between the impression materials ($P > .05$, H test), except regarding the transverse dimensions of the reposition technique, in which both polyvinyl siloxanes performed better than the polyether ($P < .05$, *U* test).

Discussion

XiVE implants were selected because they make it possible to use either the pick-up or reposition technique with the same impression posts.

The data do not support acceptance of part 1 of the null hypothesis, since the impression technique significantly influenced the accuracy of the casts. Consequently, this part of the null hypothesis was rejected. Similar results were reported by Bambini et al[2] and Daoudi et al,[3] who also used casts with parallel-aligned implants. In contrast, in situations with diverging implant axes, Conrad et al[4] did not observe technique-related differences. The higher errors in axis direction and 3D shift are most likely caused by the replacement of the impression copings in the impression.[5]

With regard to part 2 of the null hypothesis, the data do support acceptance, since the materials used did not significantly affect the accuracy of the working cast. This was also reported by Liou et al.[5]

In contrast to these results, Daoudi et al[3] found significant differences between the pick-up and reposition techniques with regard to the rotational errors. This discrepancy may be the result of the more angulated impression copings used in that study.[1]

Conclusion

Within the limitations of this study, it can be concluded that the selection of the impression technique has a decisive influence on the accuracy of the transfer of the implant position in the XiVE implant system; on the other hand, the material used is of minor influence. The pick-up technique should be used whenever possible because of its greater accuracy.

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Literature Abstract

Immediate rehabilitation of the completely edentulous jaw with fixed prostheses supported by either upright or tilted implants: A multicenter clinical study

The aims of this prospective clinical study were to investigate the treatment outcome with immediately loaded full-arch fixed prostheses supported by a combination of upright and tilted implants in patients with completely edentulous jaws up to 5 years and to compare the outcomes for upright and tilted implants. This paper reports on the preliminary data on implant survival and peri-implant bone loss after up to 3 years of function. Sixty-five patients (43 women, 22 men) with a mean age of 59.2 years were enrolled. Ten patients were smokers. Twenty-four mandibles (96 implants) and 41 maxillae (246 implants) were reconstructed with immediately loaded full-arch fixed prostheses supported by both upright and tilted implants. In the mandible, 2 posterior implants were then placed at a tilt of approximately 25 to 35 degrees. Two implants were then placed upright interforamina anteriorly between the 2 posterior implants, giving a total of 4 implants in all mandibles. For the maxilla, the most posterior implant on each side was then placed 3 to 4 mm from and parallel to the anterior sinus wall at a tilt of 30 to 35 degrees, with the posterior side 1 to 2 mm anterior to the medial sinus wall. Subsequently, 2 implants were placed upright in the anterior maxilla parallel to the midline. Finally, 2 implants were placed on each side in the available space between the implants already placed, giving a total of 6 implants in all maxillae. All implants were placed in a 1-stage procedure, with angulated abutments used as healing abutments if implant inclination exceeded 30 degrees. Success criteria included: no clinical mobility; no peri-implant radiolucency or infection; no complaints of pain, neuropathy, or paresthesia; and crestal bone loss that does not exceed 1.5 mm at the end of the first year of function or 0.2 mm per year subsequently. Using a computer-aided radiographic technique, bone loss around tilted and upright implants was compared using unpaired Student *t* test. Significance was set at $P = .05$. Cumulative implant survival over time was assessed using Kaplan-Meier analysis. The maxillary cumulative implant survival rate was 97.59% up to 40 months, with mean follow-up of 22.5 months. There were no failures recorded in the mandible, yielding a 100% success rate. No prostheses failed in either arch. At the 12-month follow-up, crestal bone loss for upright maxillary implants averaged 0.95 ± 0.44 mm compared with 0.88 ± 0.59 mm for tilted implants. For the mandible, bone loss averaged 0.82 ± 0.64 mm for upright implants and 0.75 ± 0.55 mm for tilted implants. There was no significant difference in crestal bone loss between tilted and upright implants in either arch at 12 months. The authors concluded that immediate loading on combined upright and tilted implants could provide a predictable clinical outcome. However, they rightly recommended that this procedure should be reserved for expert clinicians, in view of the highly technique-sensitive surgical procedures.

Capelli M, Zuffetti F, Del Fabbro M, Testori T. *Int J Oral Maxillofac Implants* 2007;22:639–644. **References:** 22. **Reprints:** Dr Matteo Capelli, Galeazzi Institute, Via R. Galeazzi 4, 20161 Milan, Italy. E-mail: matcap@dentalbrera.com—*Elvin W.J. Leong, Singapore*