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Analysis of accuracy of two different implant impression techniques: A comparative study

Dr. Bhushan Bangar

Professor, Dept of Prosthodontics, Midsr Dental College Latur
Email: drbangar24@gmail.com

Dr. Sashi Deepth Reddy J.

Associate Professor (Dept. of Prosthodontics), Govt. Dental College and Hospital - Vijayawada
*Corresponding author email: drsashi_24@yahoo.co.in

Dr. Shaik Mohammed Arif

Professor, Department of Conservative Dentistry and Endodontics Care Dental College, Guntur Andhra Pradesh

Dr. Vipul Asopa

Professor, Department of Prosthodontics, Pacific Dental College and Research Centre, Udaipur

Siddharth Swarup

Associate Professor. Dept of Prosthodontics. Dr. D.Y. Patil Dental college and Hospital, Pimpri, Pune

Dr. Inderpreet Kaur B.

DS Private Practitioner Amritsar Punjab India

Abstract---Background: Comparatively evaluate the accuracy of two different implant impression techniques. Materials & methods: For the present study, reference models used were an edentulous mandibular cast with four implant analogues in the anterior region and a metallic insert in the posterior. Two impression techniques were studied as followed: Group 1: Polyvinyl siloxane impressions (putty and light body) using stock metal tray, and Group 2: Polyether impressions (medium body) using stock metal tray. Connection of the impression posts was done to implant analogues with the screws tightened manually such that their flat surfaces were facing buccally. The longer impression posts were connected to the anterior analogues and shorter were connected to the posterior analogues. A self-calibration test was performed to determine the accuracy obtained by the single

evaluator. Results: Mean error among the specimens of Group 1 was 0.0441 while mean error among the specimens of Group 2 was 0.0425 respectively. While comparing the mean error among the two study groups, non-significant results were obtained. Conclusion: From the above results, the authors concluded that both the impression techniques can be used with equal effectiveness in implant procedures.

Keywords--implant, impression, accuracy, techniques.

Introduction

Passive fit is a necessary requirement for the long-term success in implant-supported prostheses. The first step to ensure the passive fit of the implant-supported framework is accurate recording of the implants' positions and distances through the impression procedure. Prosthesis misfit may lead to mechanical and biological problems in supporting implants. Mechanical complications that might arise from prosthesis misfit include screw loosening, abutment or implant screw fracture and occlusal inaccuracy. In addition, misfit and consequently marginal gap between the abutment and prosthesis can cause plaque accumulation and undesirable reactions in the soft and hard tissues adjacent to dental implants.¹⁻⁴

There are many potential factors which influence the accuracy of implant-supported superstructures such as mandibular flexure, impression technique, impression material and fit tolerance between intra-oral abutments using the impression copings. Various techniques have been suggested to achieve an accurate master cast. Open and closed trays are the most common techniques. In some situations, closed tray technique is preferable; however, it might be very difficult to place the impression copings into the impression material precisely. In open tray technique, rotation of impression copings is possible during fastening of impression copings into analogs, which may cause the misfit of components. Some studies have not shown any difference between the two techniques. However, the other studies indicated that open tray impression technique is a more accurate technique.⁵⁻⁸ Hence; the present study was undertaken for comparatively evaluating the accuracy of two different implant impression techniques.

Materials and Methods

For the present study, reference models used were an edentulous mandibular cast with four implant analogues in the anterior region and a metallic insert in the posterior. Two impression techniques were studied as followed: Group 1: Polyvinyl siloxane impressions (putty and light body) using stock metal tray, and Group 2: Polyether impressions (medium body) using stock metal tray. Connection of the impression posts was done to implant analogues with the screws tightened manually such that their flat surfaces were facing buccally. The longer impression posts were connected to the anterior analogues and shorter were connected to the posterior analogues. A self-calibration test was performed

to determine the accuracy obtained by the single evaluator. All the results were recorded in Microsoft excel and were subjected to analysis by SPSS software.

Results

In the present study, we assessed the accuracy of two different implant impression techniques. Two impression techniques were studied as followed: Group 1: Polyvinyl siloxane impressions (putty and light body) using stock metal tray, and Group 2: Polyether impressions (medium body) using stock metal tray. Mean error among the specimens of Group 1 was 0.0441 while mean error among the specimens of Group 2 was 0.0425 respectively. While comparing the mean error among the two study groups, non-significant results were obtained.

Table 1
Comparison of mean error among both the study groups

Group	Mean error	SD	p- value
Group 1	0.0441	0.023	0.118
Group 2	0.0425	0.036	

Discussion

Osseo integrated implants have provided alternative treatments option to conventional prosthesis for patients who were partially and completely edentulous and achieved predictable and favorable long-term results. An accurate and passive fit of an implant framework prosthesis, as well as the successful surgical operation is suggested as one of the critical requirements for long-term implant success. Presence of uneven distribution of occlusal loads and torquing stresses on the various portion of implant elements causes problems related to poor fit of frameworks connected to implant and may also lead to marginal bone loss and failure of implants, as well as in relation to mechanical problems as loosening of screws and fatigue fractures of implant components. It may not be probably possible to connect a multi-unit implant prosthesis with a completely passive fit in clinical situation because there are many potential inaccuracies with current materials and techniques, which include dimensional changes in impression materials, expansion of gypsum die product, dimensional changes in wax and acrylic pattern, dimensional changes in investment materials and volumetric shrinkage of metal casting on solidification and the clinicians skill.^{6- 10}

In the present study, we assessed the accuracy of two different implant impression techniques. Two impression techniques were studied as followed: Group 1: Polyvinyl siloxane impressions (putty and light body) using stock metal tray, and Group 2: Polyether impressions (medium body) using stock metal tray. Mean error among the specimens of Group 1 was 0.0441 while mean error among the specimens of Group 2 was 0.0425 respectively. While comparing the mean error among the two study groups, non-significant results were obtained. Alessandro Pozzi, et al compared splinting techniques for impression copings of osseointegrated implants with different angulations. Materials and methods: Replicas (N = 24) of a metal matrix (control) containing two implants at 90 degrees and 65 degrees in relation to the horizontal surface were obtained by using four

impression techniques: Technique 1 (T1), direct technique with square copings without union in open trays; Technique 2 (T2), square copings splinted with dental floss and autopolymerizing acrylic resin; Technique 3 (T3), square copings splinted with dental floss and autopolymerizing acrylic resin, sectioned and splinted again with autopolymerizing acrylic resin; Technique 4 (T4), square copings splinted with prefabricated acrylic resin bar. The impression material was polyether.

The replicas were individually scanned to capture the images, which were assessed in a graphic computation program. The program allowed the angulation between the bases of the replicas and the reading screws to be measured. All groups showed significant differences in the implant angulations in comparison with the control group ($p < 0.05$). Group T1 showed the highest difference (1.019 degrees) followed by groups T2 (0.747 degrees), T3 (0.516 degrees), and T4 (0.325 degrees), which showed the lowest angular alteration compared to the control group. There were significant differences between inclined and straight implants in all the groups, except in group T4. The splinting of pick-up impression copings is indicated for osseointegrated implant impressions.¹⁰

Humberto Gennari Filho et al compared splinting techniques for impression copings of osseointegrated implants with different angulations. Replicas (N = 24) of a metal matrix (control) containing two implants at 90 degrees and 65 degrees in relation to the horizontal surface were obtained by using four impression techniques: Technique 1 (T1), direct technique with square copings without union in open trays; Technique 2 (T2), square copings splinted with dental floss and autopolymerizing acrylic resin; Technique 3 (T3), square copings splinted with dental floss and autopolymerizing acrylic resin, sectioned and splinted again with autopolymerizing acrylic resin; Technique 4 (T4), square copings splinted with prefabricated acrylic resin bar. The impression material was polyether. The replicas were individually scanned to capture the images, which were assessed in a graphic computation program. All groups showed significant differences in the implant angulations in comparison with the control group ($p < 0.05$). Group T1 showed the highest difference (1.019 degrees) followed by groups T2 (0.747 degrees), T3 (0.516 degrees), and T4 (0.325 degrees), which showed the lowest angular alteration compared to the control group. There were significant differences between inclined and straight implants in all the groups, except in group T4. The splinting of pick-up impression copings is indicated for osseointegrated implant impressions.¹¹

Conclusion

From the above results, the authors concluded that both the impression techniques can be used with equal effectiveness in implant procedures.

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