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Dr. Sayqa Aziz
MDS Scholar, Department of Prosthodontics, Government Dental College, Srinagar, Jammu and Kashmir, India

Dr. Mohsin Malik
Registrar Prosthodontics, Ministry of Health, Kuwait

Dr. Sandeep Kaur Bali
Professor Prosthodontics, Government Dental College, Srinagar, Jammu and Kashmir, India

Dr. Shazia Mir
Associate Professor, Prosthodontics, Government Dental College, Srinagar, Jammu and Kashmir, India

Dr. Nazia Majeed Zargar
Lecturer Prosthodontics, Government Dental College, Srinagar, Jammu and Kashmir, India

Corresponding Author:
Dr. Sayqa Aziz
MDS Scholar, Department of Prosthodontics, Government Dental College, Srinagar, Jammu and Kashmir, India

Assessment of accuracy of open tray and closed tray dental implant impression techniques: A comparative study

Dr. Sayqa Aziz, Dr. Mohsin Malik, Dr. Sandeep Kaur Bali, Dr. Shazia Mir and Dr. Nazia Majeed Zargar

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Abstract
Background: A dental impression is a negative imprint of an oral structure utilized to produce a positive replica of the structure that can be used as a permanent record or in the production process of a dental restoration. Hence; the present study was undertaken for assessing the accuracy of two different dental implant impression techniques.
Materials & methods: For reference model, an edentulous mandibular cast with four implant analogues in the anterior region was used. For the present study, two different types of impression trays were used as follows: Closed custom tray, and Open custom tray. The impressions were allowed to set for 10 minutes under a standard load of 500 gm. All the impressions were poured using the same quantity of Type IV dental stone. The casts were subjected to measurement after 24 hours to simulate clinical situation. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.
Results: Mean error obtained in closed custom tray technique was 0.028 while mean error obtained in open custom tray technique was 0.23. While analysing statistically, significant results were obtained.
Conclusion: Better results are obtained when open custom trays were used.

Keywords: Dental implant, Impression

Introduction
A dental impression is a negative imprint of an oral structure utilized to produce a positive replica of the structure that can be used as a permanent record or in the production process of a dental restoration. As the accuracy of an impression affects the accuracy of the cast, a precise impression is needed in order to create prosthesis with optimal fitting. A misfit in the prosthesis influences the pattern and magnitude of stress distribution in the prosthesis itself as well as the components of the implant and surrounding bone that may lead to unfavorable complications [1-3]. An implant impression is primarily a three-dimensional record of the implant and the surrounding tissues. Impression accuracy is a significant factor in implant long-term success. Inaccuracies or errors occurring at any stage of the superstructure construction may lead to a lack of precision fit between various components. The lack of potential compensatory readjustment, due to the absence of intervening periodontal ligament, may have the consequence of related complications or failure [4-6]. Hence; the present study was undertaken for assessing the accuracy of two different dental implant impression techniques.

Materials and Methods
The present research was planned for assessing the accuracy of two different dental implant impression techniques. For reference model, an edentulous mandibular cast with four implant analogues in the anterior region was used. For the present study, two different types of impression trays were used as follows:

- Closed custom tray, and
- Open custom tray

Fabrication of the custom tray was done using autopolymerizing acrylic resin. Fabrication of six identical custom trays was done by duplication. In the same trays, creation of windows was done for making the open tray impressions after the completion of closed-tray impressions. The impressions were allowed to set for 10 minutes under a standard load of 500 gm. All the impressions were poured using the same quantity of Type IV dental stone. The casts were subjected to measurement after 24 hours to simulate clinical situation. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

Results

In the present study, two different types of impression trays were used as follows: Closed custom tray technique, and Open custom tray technique. Mean error obtained in closed custom tray technique was 0.028 while mean error obtained in open custom tray technique was 0.23. While analysing statistically, significant results were obtained.

Table 1: Comparison of errors obtained

Group	Mean error	P- value
Open custom tray technique	0.028	0.000 (Significant)
Closed custom tray technique	0.23	

Discussion

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 [3-5].

Fabrication of superstructure must ensure the most attainable passive fit. The first and the most crucial step to achieve passive fit is making an accurate impression which precisely transfers interim plant dimensions. Precision of implant impressions are influenced by many factors including impression material, impression technique, splinting of impression copings, level of impression and depth and angulation of implants [6-8]. Hence; the present study was undertaken for assessing the accuracy of two different dental implant impression techniques.

In the present study, two different types of impression trays were used as follows: Closed custom tray technique, and Open custom tray technique. Mean error obtained in closed custom tray technique was 0.028 while mean error obtained in open custom tray technique was 0.23. Ebadian B et al determined the effect of different impression materials and techniques on the dimensional accuracy of implant definitive casts. Three impression techniques including open tray, closed tray using ball top screw abutments and closed tray using short impression copings and two impression materials (polyether and polyvinyl siloxane) were evaluated (n = 60). The changes in distances between implant analogues in mediolateral (x) and anteroposterior (y) directions and analogue angles in x/z and y/z directions in the horizontal plane on the definitive casts were measured by coordinate measuring machine. No statistical significant differences were observed between different impression techniques and materials. However, deviation and distortion of definitive casts had a significant difference with the master model when short impression copings and polyvinyl siloxane impression material were used ($P < 0.05$). In open tray technique, there was a significant difference in the rotation of analogs compared with the master model with both impression materials ($P < 0.05$). There was no difference between open and closed tray impression techniques; however, less distortion and deviation were observed in the open tray technique [10].

In the present study, while analysing statistically, significant results were obtained. Patil R *et al.* compared two impression techniques in terms of their dimensional accuracies to reproduce implant positions on working casts. A master model was designed to simulate a clinical situation. Impressions were made using four techniques: (1) Stock open tray (SOT) technique; (2) stock closed tray (SCT) technique; (3) custom open tray (COT) technique; and (3) custom closed tray (CCT) technique. Reference points on the hexagonal silhouette of the implant on master model and onto the analogs of the obtained master casts were compared after using the four impression techniques. The open tray impressions showed significantly less variation from the master model and all the techniques studied were comparable. All the techniques studied shown some distortion [11].

Conclusion

From the above results, the authors concluded that better results are obtained when open custom trays were used.

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