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Assessment of accuracy of different materials used in impressions for fixed partial dentures

Dr.Ankur Chauhan[1], Dr.Rohit Singh[2], Dr. Manish Shivaji Jadhav[3], Dr. Siddharth Swarup[4], Dr. Sharv Ahuja[5], Dr. Sanjeev Soni[6]

1. PG 3rd year, Dept. Of Conservative Dentistry and Endodontics, Bhojia Dental College and Hospital, Baddi, H.P.;
2. Associate Professor, Dept. of Conservative Dentistry and Endodontics, Institute of Dental Education and Advance studies, (IDEAS Dental college),Gwalior-Etawah road, M.P.;
3. Assistant Professor, Dept. of Prosthodontics, Dr D. Y. Patil Vidyapeeth, Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune;
4. Associate Professor, Dept. of Prosthodontics, Dr D. Y. Patil Vidyapeeth, Dr. D. Y. Patil Dental College and Hospital, Pimpri, Pune;
5. Senior lecturer, Dept of Endodontics, Desh Bhagat Dental College, Mandi Gobindharh, Punjab;
6. Principal & Prof & HOD, Dept of Orthodontics, Desh Bhagat Dental College, Mandi, Gobindharh, Punjab

ABSTRACT

Background: Accurate implant impressions play a significant role and serve as a starting point in the process of producing good working casts. The present study was conducted to assess accuracy of different materials used in impressions for fixed partial dentures.

Materials & Methods: It comprised of alginate, polysulphide, polyether and condensation silicone impression material. Digital photographs of the master model and of the stone casts were taken to evaluate the impression materials' accuracy and the discrepancies between them were measured.

Results: The mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.32 mm, in group II was 0.18 mm, in group III was 0.14 mm and in group IV was 0.36 mm. The difference was significant ($P< 0.05$).

Conclusion: Different impression materials and techniques influenced the stone casts' accuracy in a way that polyether, polysulfide and condensation silicone were more accurate than the other materials.

Key words: Condensation silicone, Polyether, Polysulfide

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Introduction

Precise working casts are essential to fabricate passively fitting implant prostheses. Accurate implant impressions play a significant role and serve as a starting point in the process of producing good working casts.[1] Thus, the comparative accuracy of the impression techniques becomes a significant issue in consideration of passive fit. An inaccurate impression may result in prosthesis misfit, which can lead to further problems such as mechanical and/or biological complications.[2]

There are several elastic impression materials available for dental use: synthetic elastomeric materials, including polysulfide, condensation silicone, addition silicone and polyether; and hydrocolloids.[3] All these materials are used for reproducing oral conditions in order to construct restorations. One example of hydrocolloid is alginate, a popular material in the last years because of its easy mixing and low cost when compared to elastomers. Although some professionals have been using alginate in clinical practice for definitive impressions, problems with dimensional stability and unsatisfactory detail reproduction are some of the limitations to its use.[4]

To ensure maximum accuracy, some authors emphasized the importance of splinting impression copings together intraorally before making an impression and some authors sectioned the splint material leaving a thin space and then rejoining with a minimal amount of the same material to minimize polymerization shrinkage.[5] However, inconsistent results have been obtained. The present study was conducted to assess accuracy of different materials used in impressions for fixed partial dentures.

Materials & Methods

The present study was conducted in the department of prosthodontics. It comprised of alginate, polysulphide, polyether and condensation silicone impression material.

A master model representing a partially edentulous mandibular right hemi-arch segment whose teeth were prepared to receive full crowns was used. Custom trays were prepared with auto-polymerizing acrylic resin and impressions were performed with a dental surveyor, standardizing the path of insertion and removal of the tray. Alginate and elastomeric materials were used and stone casts were obtained after the impressions. For the silicones, impression techniques were also compared. Digital photographs of the master model and of the stone casts were taken to evaluate the impression materials' accuracy and the discrepancies between them were measured. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

Table I Distribution of materials

Groups	Group I	Group II	Group III	Group IV
Materials	Alginate	Polysulphide	Polyether	Condensation silicone

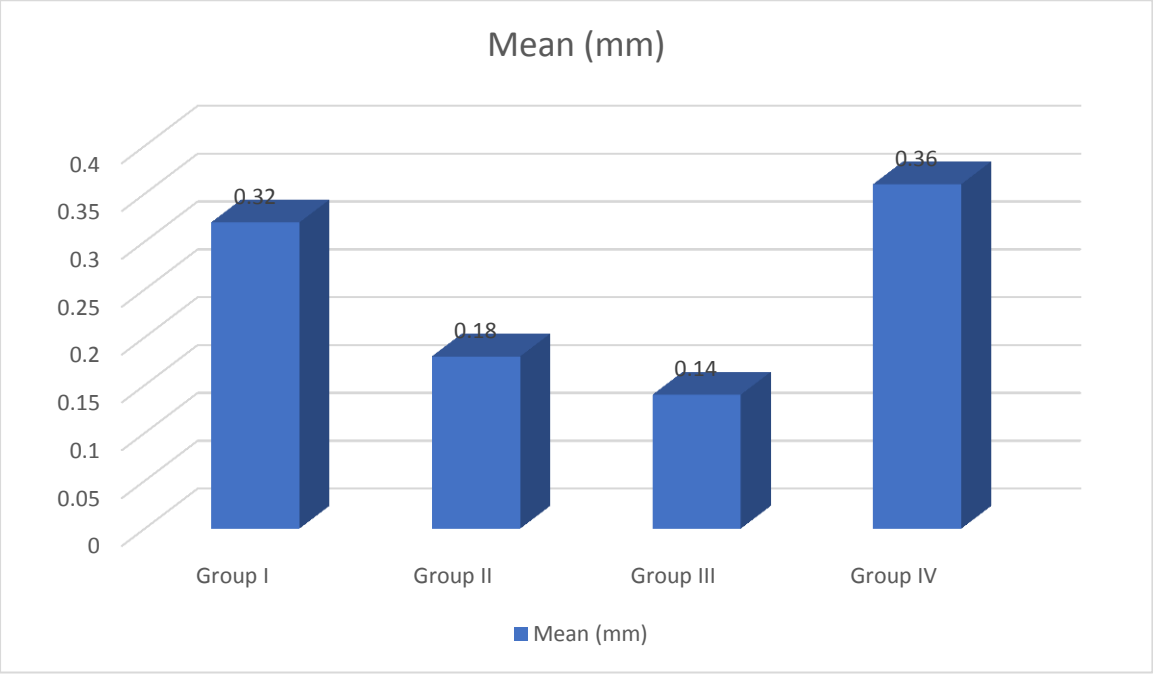
Table I shows that materials used was alginate, polysulphide, polyether and condensation silicone impression material in group I, II, III and IV respectively.

Table II Measurement of discrepancies (mm) between the prepared tooth edges in the master model and in the stone casts

Groups	Mean (mm)	P value
Group I	0.32	0.01
Group II	0.18	
Group III	0.14	
Group IV	0.36	

Table II, graph I shows that mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.32 mm, in group II was 0.18 mm, in group III was 0.14 mm and in group IV was 0.36 mm. The difference was significant (P< 0.05).

Graph I Discrepancies (mm) between the prepared tooth edges in the master model and in the stone casts



Discussion

In order to construct a fixed prosthesis, a stone die must be made by cutting the stone cast that was obtained through an impression technique. Separated from the cast, this die enables improved marginal adaptation of the prosthetic crown that will be constructed on it.[6] Although current techniques for making removable stone dies have developed and become increasingly more accurate, the cutting out of a stone die results in significant dimensional

change in the distances between abutments.[7] In this scenario, producing more than one cast from the same mold may be an option for preserving the marginal adaptation of prostheses—a result for which obtaining stone dies is required—while at the same time, preserving the dimensional accuracy of the distances between the prosthetic abutments.[8]

A deficiency to making impressions in fixed prosthodontics is failure to follow basic principles inherent to the manipulation of impression materials. Stock trays are used extensively, and the importance of control of bulk is ignored. Putty/wash materials also are used extensively, usually in an inappropriate manner, resulting in impressions with less than optimal accuracy.[9] Since the most costly item of any oral rehabilitation treatment is the clinical time of the dental professional, the possibility of obtaining several casts from the same mold without changing their characteristics and dimensions could contribute to reducing the professional's clinical time, therefore reducing the overall cost of the prosthesis.[10] The present study was conducted to assess accuracy of different materials used in impressions for fixed partial dentures.

In present study, materials used was alginate, polysulphide, polyether and condensation silicone impression material. Faria et al[11] in their study found that polyether and addition silicone following the single-phase technique were statistically different from alginate, condensation silicone and addition silicone following the double-mix technique ($p \leq 0.05$), presenting smaller discrepancies. However, condensation silicone was similar ($p \geq 0.05$) to alginate and addition silicone following the double-mix technique, but different from polysulfide. The results led to the conclusion that different impression materials and techniques influenced the stone casts' accuracy in a way that polyether, polysulfide and addition silicone following the single-phase technique were more accurate than the other materials.

We found that mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.32 mm, in group II was 0.18 mm, in group III was 0.14 mm and in group IV was 0.36 mm. Valente et al[12] compared the dimensional accuracy of stone casts obtained with vinyl polysiloxane molds through the double-impression technique with three pours into the same mold. A stainless steel master model was constructed simulating a three-unit fixed prosthesis. Twelve impressions were taken of this master model with addition silicone, using the double-impression technique. Three pours of type IV gypsum were then made into each mold, thus producing 36 casts. The pours were made 1 hour, 6 hours and 24 hours after the impression procedure. Next, intra- and interabutment measurements were made in a coordinate measuring machine. Comparative analysis of the dimensional accuracy of stone casts resulting from multiple pours was not statistically significant in pours first and second. These values, however, were statistically significant at third pour in the height in abutment 1 and upper distance inter-abutment.

Conclusion

Authors found that different impression materials and techniques influenced the stone casts' accuracy in a way that polyether, polysulfide and condensation silicone were more accurate than the other materials.

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