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Accuracy of different materials used in impressions for fixed partial dentures

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Abstract
Background: There are several elastic impression materials available for dental use. The present study evaluated accuracy of different materials used in impressions for fixed partial dentures.
Materials & Methods: A master model of partially edentulous mandibular left hemi-arch segment was used. Custom trays were prepared with auto-polymerizing acrylic resin and impressions were taken using alginate and elastomeric materials and stone casts were formed. For the silicones, impression techniques were compared.
Results: The mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.38 mm, in group II was 0.20 mm, in group III was 0.15 mm and in group IV was 0.34 mm. The difference was significant ($P< 0.05$).
Conclusion: Polyether, polysulfide and condensation silicone were more accurate than the other materials.

Keywords: Condensation silicone, polyether, impression material

Introduction
Prosthodontics, as a speciality, has evolved abundantly in past few years. Materials and technological advances keep changing the face of every field every day [1]. Twentieth century witnessed remarkable changes with regard to human longevity worldwide, and the twenty-first century is set to carry forward the gains in longevity further, both in the developing word and the developed world. Precise working casts are essential to fabricate passively fitting implant prostheses [2]. Accurate implant impressions play a significant role and serve as a starting point in the process of producing good working casts. 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 [3].
There are several elastic impression materials available for dental use: synthetic elastomeric materials, including polysulfide, condensation silicone, addition silicone and polyether; and hydrocolloids [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 re-joining with a minimal amount of the same material to minimize polymerization shrinkage [5]. However, inconsistent results have been obtained. The present study evaluated accuracy of different materials used in impressions for fixed partial dentures.

Materials and Methods
The present study materials such as alginate, polysulphide, and polyether and condensation silicone impression material were used. The ethical approval for conduction of the study was obtained.
A master model of partially edentulous mandibular left hemi-arch segment was used. Custom trays were prepared with auto-polymerizing acrylic resin and impressions were taken using alginate and elastomeric materials and stone casts were formed. For the silicones, impression techniques were 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 1: Distribution of materials used in the study

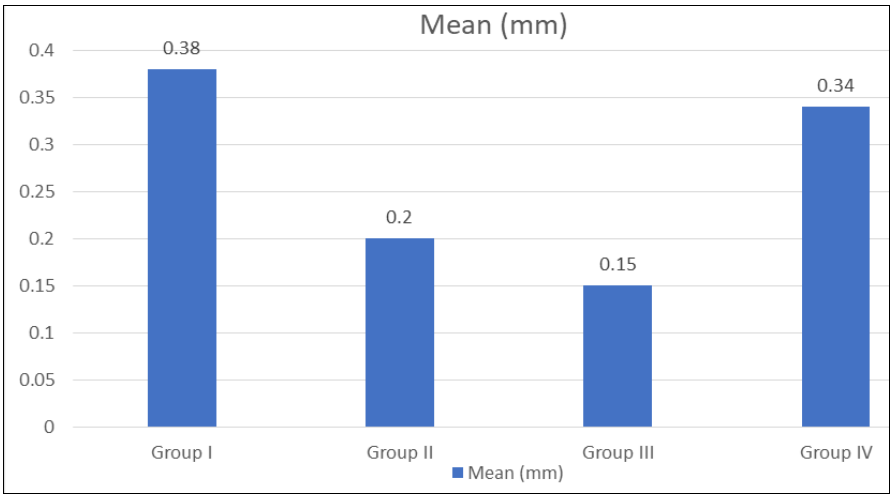
Groups	Group I	Group II	Group III	Group IV
Materials	Condensation silicone	Polysulphide	Polyether	Alginate

Table 1 shows that materials used in group I was condensation silicone, polysulphide in group II, polyether in group III and alginate in group IV.

Table 2: Assessment of discrepancies between the prepared tooth edges in the master model and in the stone casts

Groups	Mean (mm)	P value
Group I	0.38	0.01
Group II	0.20	
Group III	0.15	
Group IV	0.34	

Table 2, graph 1 shows that mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.38 mm, in group II was 0.20 mm, in group III was 0.15 mm and in group IV was 0.34 mm. The difference was significant ($P< 0.05$).



Graph 1: Assessment of discrepancies between the prepared tooth edges in the master model and in the stone casts

Discussion

All dental 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 [6]. 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. 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 [7]. Separated from the cast, this die enables improved marginal adaptation of the prosthetic crown that will be constructed on it [8]. 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 [9]. The present study evaluated accuracy of different materials used in impressions for fixed partial dentures.

In present study, materials used was condensation silicone impression, polysulphide, polyether and alginate, material. Lin *et al.* [10] in their study the accuracy of 12 impression materials of six different types were studied by using complete-arch FPD impressions. Sixty impressions were made of a Columbia dento form maxillary model with complete cast crown abutment preparations on the canines and the second molars. A one-piece casting was constructed by connecting the four individual castings made for the four abutment teeth. The master prosthesis was seated on the stone casts produced from the impressions. The marginal adaptation on the four abutments was then evaluated with a travelling microscope. The individual marginal adaptation of the four castings on the abutments was also examined after sectioning the four joints. The polyethers produced the most accurate complete-arch replicas. The second most accurate were the vinyl polysiloxanes, followed by the polysulfides and the irreversible-reversible hydrocolloids. The least accurate were the reversible hydrocolloids and the irreversible hydrocolloids. The polyether impression materials exhibited the most consistent accuracy for a master cast to fabricate a complete-arch FPD.

We found that mean discrepancies between the prepared tooth edges in the master model and in the stone casts in group I was 0.38 mm, in group II was 0.20 mm, in group III was 0.15 mm and in group IV was 0.34 mm. Valente *et al.* [11] compared the dimensional accuracy of stone casts obtained with vinyl polysiloxanes 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 inter-abutment 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.

Faria *et al*. [12] 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.

Moldi *et al*. [13] in their study a total of 1000 questionnaires were sent to various practitioners in India, out of which 807 questionnaires were filled. The results showed that 84.8% of prosthodontists (65.56%, urban areas) use elastomeric impression materials as well as irreversible hydrocolloids and 15.2% use irreversible hydrocolloid only. Amongst other practitioners, 55.46% use irreversible hydrocolloid (45%, rural and semiurban areas) and 44.54% use elastomeric impression materials. Elastomeric impression technique practiced most commonly is putty reline with/without spacer (77.2%); other techniques are multiple-mix and monophase techniques. Chauhan *et al*. [14] assessed accuracy of different materials used in impressions for fixed partial dentures. 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. 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 ($P< 0.05$).

The limitation of the study is that only few impression materials were compared.

Conclusion

Authors found that polyether, polysulfide and condensation silicone were more accurate than the other materials.

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