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Evaluation of dimensional accuracy of two step putty wash impression technique using different spacers: An in-vitro study

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***Abstract*---**Purpose- To investigate the accuracy of impressions taken by two step putty wash impression technique using various spacers. Materials and methods – A maxillary typodont teeth assembly was taken as the master model with missing right maxillary first molar and prepared 2nd premolar and molar. The inter abutment, premolar and molar height measurements were recorded using Digimatic Indicator (Mitutoyo) and Tool maker microscope (Hauser P32C). Impression (Flexceed GC India Dental Pvt Ltd) was taken using the two step putty wash impression technique using four different types of spacer protocols, GROUP 1- No spacer; GROUP 2- Cellophane sheath; GROUP 3- Antero-posterior rocking with escape groves; GROUP 4- Shimstock articulating paper. All the impressions were poured with type IV dental stone (Kalrock Kalabhai Dental Pvt Ltd) with base. These dies were examined for any irregularities or porosities and the fine dies were selected. The molar and premolar heights were measured using Digimatic Indicator (Mitutoyo) and the inter-abutment height was measured with tool maker microscope (Hauser P32C). The data was collected and statistically analysed. Result- When coming to inter-abutment, premolar and molar height distance there was significant difference. The data revealed that Group 3 had dimensional accuracy close to that of the typodont when coming to premolar and inter-abutment distance. Where as Group 4 showed more dimensional accuracy in molar height. Conclusion – the study

revealed that, the use of various spacer protocols had a significant effect on dimensional accuracy of the dies while using two step putty wash impression technique. Antero-posterior rocking with escape grooves and Shimstock articulating paper had dimensions closest to that of typodont master model. Further clinical studies have to be conducted for the confirmation of these laboratory studies.

***Keywords*---**two-step putty wash impression, dimensional accuracy, spacer, putty material, light body material.

Introduction

Fixed partial Dentures are one of the most common and efficient method for replacing the function and aesthetics of partially edentulous patients. Various steps are present in the fabrication of fixed partial denture, out of which impression making is the most critical step. The procedure of impression making requires meticulous reproduction of the tooth and surrounding tissue before the fabrication of the prosthesis. Thus, the skill and technique used by the dentist for making an impression plays a very important role for the success of the final prosthesis[1]. There are several impression techniques for the fabrication of fixed partial and implant supported dentures:

1) Single step and single consistency (Monophase) technique, here the impression is made with the help of only medium body loaded onto the tray.
2) Single step and double consistency technique, which involves the loading of putty impression material on the tray and light body over the prepared tooth. Then the impression is made.
3) Double step and double consistency technique, here in the first step putty impression is made with the help of spacer on the prepared tooth. In the second step the impression is taken with light body over the putty impression after spacer is removed.
4) Triple tray technique, where single step upper and lower impression along with bite registration is obtained[2,4].

The two-step putty/light-body technique has been reported to be more accurate than the one step putty/light body technique, but however there are drawbacks such as dimensional changes, excessive requirement of material etc[3]. So, in the present study we are evaluating the accuracy of two step putty/light body impression technique with various spacer materials in a typodont jaw set.

Methodology

A typical maxillary typodont teeth assembly was taken as the master model which resembles missing right maxillary first molar. The abutment teeth were prepared to a 1 mm chamfer finish line using 0.5 mm round end taper diamond bur. Impressions of the prepared typodont teeth were taken with the help of two step putty wash impression using various spacers. A total of five groups were present including the control group and four different spacers. Group 1: no spacer used. Group 2: cellophane sheath (Fig 1). Group 3: tray moved in antero-posterior

rocking with escape groves (Fig 1). Group 4: metallic Shimstock film (Fig 1) of thickness 12µm used as spacer between putty and light body.

According to each group the putty impression material (Flexceed GC India Dental Pvt Ltd) was mixed manually and was placed into the sectional tray and then the impression was taken of the prepared typhodont teeth assembly. After the impressions had set, they were separated from the typhodont teeth assembly with single axial movement. The light body impression material (Flexceed GC India Dental Pvt Ltd) was injected into the prepared die section for the final impression. All the impressions were evaluated for defects and the defected impressions were discarded and procedure was repeated. Then these impressions were stored at room temperature for 2 hours to allow elastic recovery of the elastomeric materials.

Type IV dental stone (Kalrock Kalabhai Dental Pvt Ltd) was used to pour these impressions and they were separated from the impression after 2 hours. The measurement between the standard points is done in the prepared maxillary typhodont teeth assembly and these measurements are compared with that obtained from the 4 groups. The measurements obtained were 1) premolar height from the point on the line angle of distal finish line till point on distal line angle, 2) molar height from the point on the line angle of mesial finish line till point on mesial line angle, 3) inter abutment distance from the point on the distal line angle of premolar till the point on the mesial line angle of molar. These measurement of the molar and premolar was done by a Digimatic Indicator (Mitutoyo) and the measurement was done in millimetres, were as the inter abutment distance was measured using a Tool maker microscope (Hauser P32C).

Sample Groups

S.NO	GROUPS	SPACERS
1.	Group 1	No spacer
2.	Group 2	Cellophane sheath
3.	Group 3	Antero-posterior rocking with escape groves
4	Group 4	Shimstock articulating paper

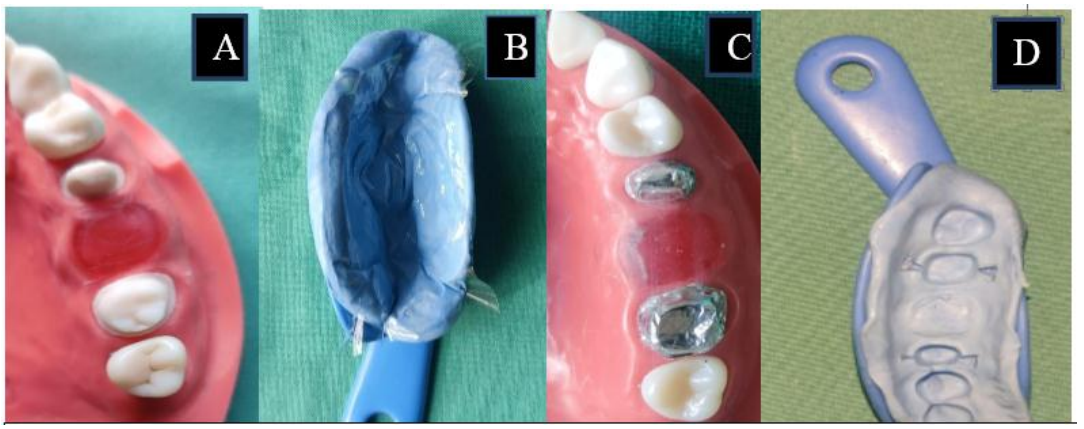

Fig 1- A) Typodont master model, B) Cellophane spacer, C) Shimstock articulating paper, D) Antero-posterior rocking with escape groves

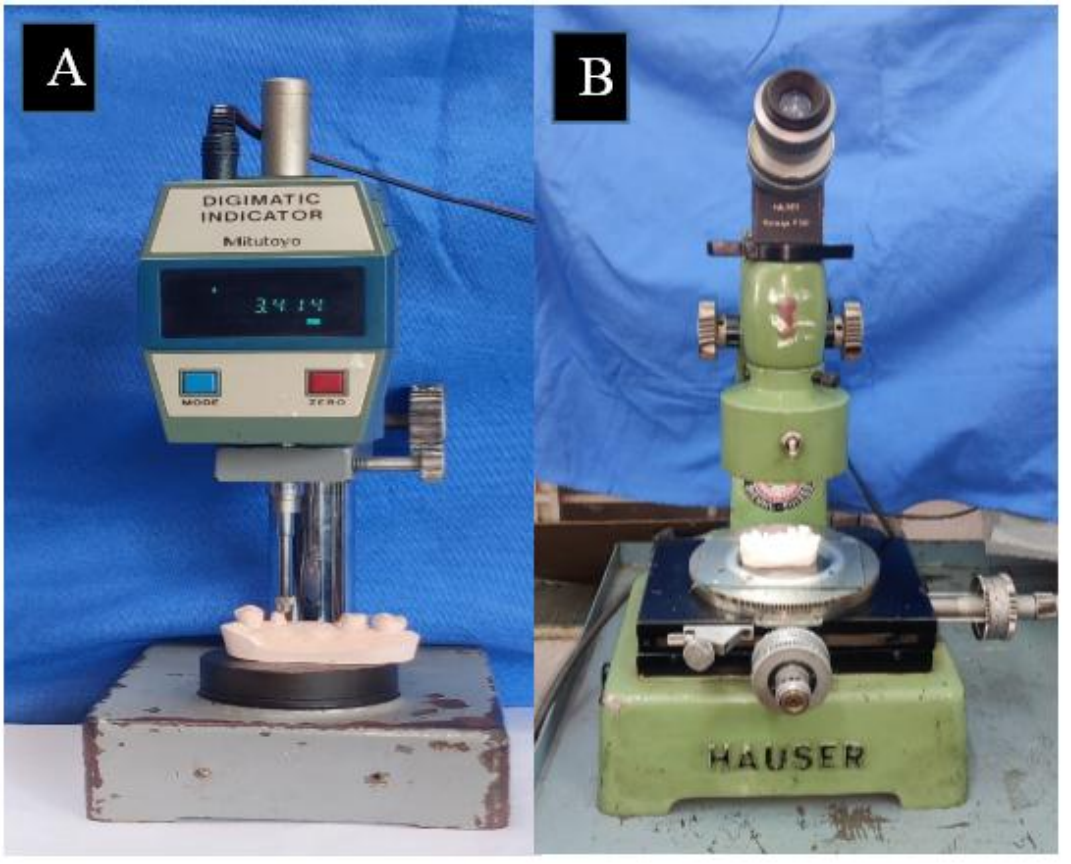

Fig – A) Premolar and molar height calculated with help of Digimatic Indicator (Mitutoyo); B) Inter-abutment distance calculated with Tool maker microscope (Hauser P32C)

Results

a) Inter-abutment distance – The typodont has an inter-abutment measurement of 15.113mm. The typodont measurement showed statistically significant ($p<0.05$) difference with all groups. Group 3 spacer showed the dimensions closest to that of typodont followed by group 4, group 1 and group 2 (Tab 2) (CHART I).

Table 2
Inter-abutment distance

Groups	Mean	Standard deviation	F	Sig.
Group 1	14.04142	0.62757	17.604	**0.001(HS)**
Group 2	14.64142	0.31556		
Group 3	15.19657	0.08077		
Group 4	15.31714	0.20886		

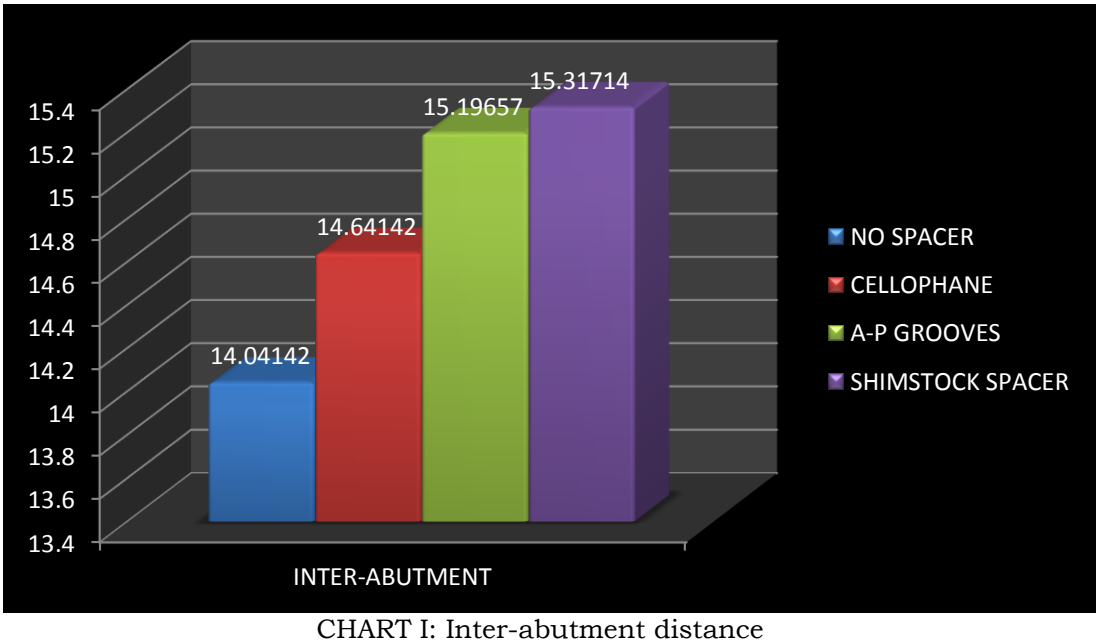

CHART I: Inter-abutment distance

b) Premolar height – The typodont has premolar height measurement of 3.115mm. The typodont measurement showed statistically significant ($p<0.05$) difference with all groups. Here also Group 3 (antero-posterior rocking with escape grooves) dies showed dimensions close to that of typodont followed by Group 4, group 2 and group 1 (Tab 3) (CHART II).

Table 3
Premolar height

Group	Mean	Standard deviation	F	Sig.
Group 1	3.10129	.087315	6.013	**0.003(HS)**
Group 2	3.01557	.088374		
Group 3	3.17414	.043751		
Group 4	3.13957	.065721		

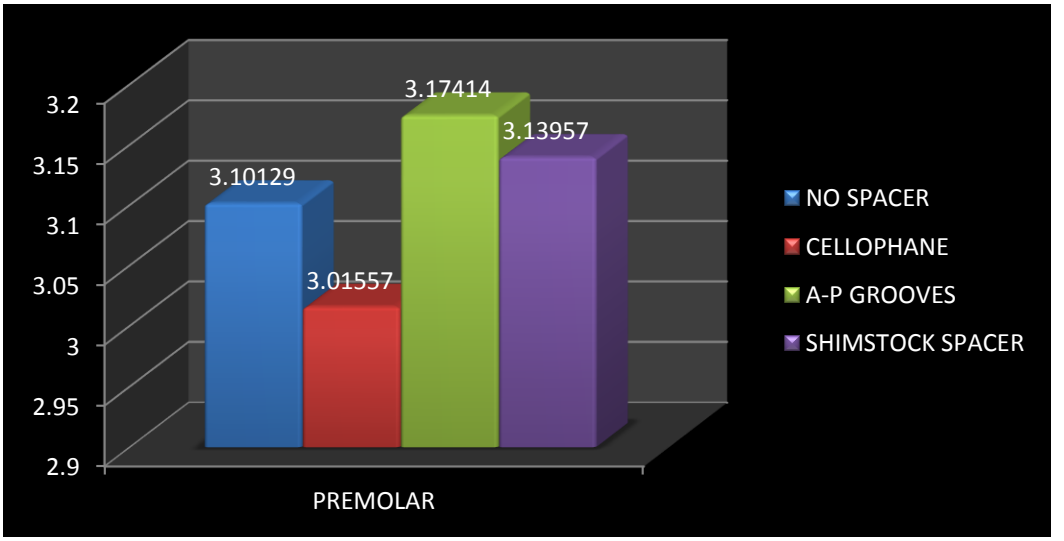

CHART II: Premolar height

c) Molar height – The typodont has a molar height of 3.255mm. The typodont measurement showed statistically significant ($p<0.05$) difference with all groups. Here group 4 (Shimstock articulating paper) dies showed dimensions close to that of typodont followed by Group 1, whereas group 2 and group 3 showed almost similar dimensions (Tab 4) (CHART III).

Table 4
Molar height

Group	Mean	Standard deviation	F	Sig.
Group 1	3.12171	0.05605	6.843	**0.002(HS)**
Group 2	3.13486	0.07543		
Group 3	3.25358	0.07586		
Group 4	3.20814	0.03589		

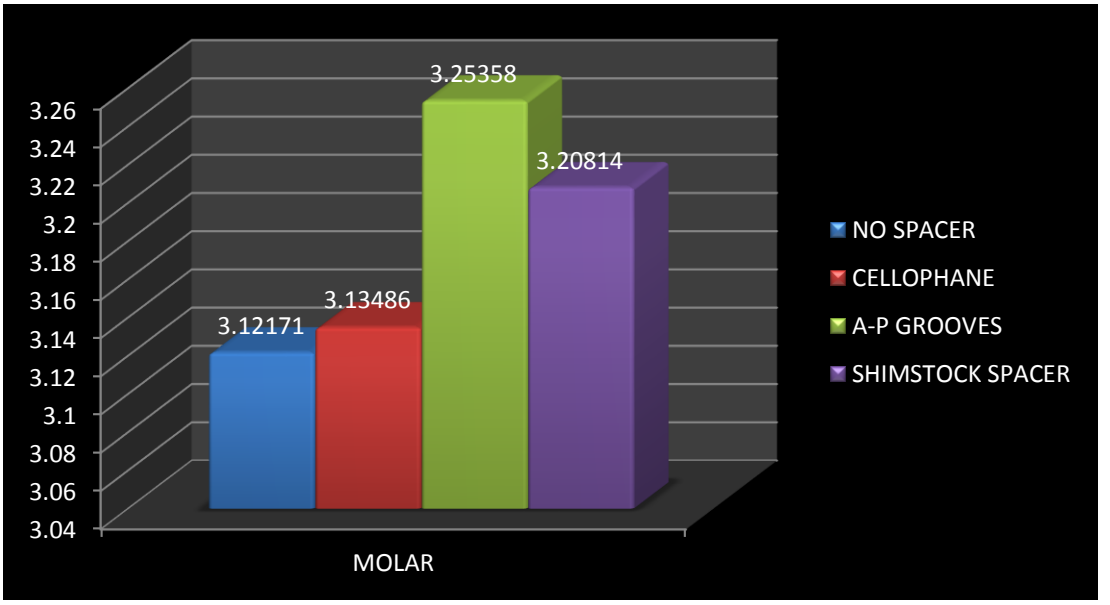

CHART III: Molar height

Discussion

The accuracy of an impression depends on various factors like stress, elastic recovery, dimensional stability etc.[9] Dimensional stability in turn depends on shrinkage due polymerization after removal of impression and the release of byproducts from the material and various other chemical reactions.[1,5] All these factors play a crucial role in the success of the final prosthesis, especially the marginal adaptation.[2,3]

The two-step putty wash impression technique involves the placement of tray two times into the oral cavity which constitutes tray with putty impression material for the first time and later it is relined with light body wash material. During the process of reseating the tray for relining procedure the light body impression material induces tension into the already set putty impression, thus resulting in elastic recovery of putty impression material after removal which was reported in the study conducted by Asmussen and Peterson. This elastic recovery can have an impact on the dies obtained, to be smaller when compared with the original tooth, thus resulting in inappropriate crowns.[8]

Many studies have been conducted to prove that the accuracy of an impression depends mainly on the material used for the procedure, whereas few authors have said that the technique used is more important than the material used.[2,3,6,7] In the present study we have made impression with two step putty wash impression using various spacers to check which spacer gives the best accuracy, the material used was polyvinyl siloxane putty and light body impression material as wash (Flexceed GC India Dental Pvt Ltd).

It was seen that Group 3 spacer (anterio-posterior rocking with escape grooves) gave dies which were very close to the dimension of the typodont. This is probably

due to more amount of space available for the wash impression material and the presence of escape grooves which helped in accommodation of excess material. Thus, compensating to the elastic recovery of putty material. Next comes Group 4 (metallic shimstock articulating film). This film must have given space for excess material, but it is shown to give excess inter-abutment space then the measurement in the typodont.

Cellophane sheet in group 2 showed less accuracy compared to that of group 4 and 3. This may be due the very this section of the sheet which doesn't provide enough space for the light body and relief for the putty impression material. Last comes Group 1 (no spacer). It has been seen that the dies retrieved from no spacer had unusual small dimensions then the typodont. This is probably due to lack of space, as well as elastic recovery of putty impression material while removing the impression from the mouth. Thus, it has been seen that wash impression material didn't have enough space and seemed to be trapped in the tray in group 1 and group 2 causing the dies to be inaccurate.[1] Here the final impression especially in group 1 was done without any relief, resulting in elastic recovery of the putty impression material.[2]

The present study shows us that the selection of spacer is very important while making an impression using two step putty wash impression technique. It must be emphasized that there are limitations in the present in-vitro study, like the process of making an impression in the patient oral cavity is completely different and various factors like patient mouth opening, saliva content were not considered in this study. Thus, further clinical studies have to be conducted for the confirmation of the present laboratory findings.

Conclusion

With the limitation of the study, it was proved that various spacer protocols effect the dimensional accuracy of impressions taken by two step putty wash impression technique. It also proved that Antero-posterior rocking with escape grooves was more dimensionally accurate followed by Shimstock articulating paper. Further clinical research should be done to support these laboratory findings.

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