Original Article

International Journal of Dental and Health Sciences
Volume 02,Issue 03

THE INFLUENCE OF PUTTY WASH IMPRESSION TECHNIQUE ON DIMENSIONAL ACCURACY OF TWO COMMERCIALLY AVAILABLE VINYL POLY SILOXANE IMPRESSION MATERIALS: AN INVITRO STUDY

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ABSTRACT:

Introduction: Several techniques have been suggested to improve the accuracy of vinyl polysiloxane impressions. This in vitro study was conducted to compare the accuracy of 1&2 step techniques using various types of spacers.

Aim Of The Study: To check the accuracy of two commercially available vinyl poly siloxane impression materials.

Methods: A machined standard milled steel die was made to serve as a model. After making several vinyl polysiloxane impressions of the master die, impressions were evaluated for accuracy with the help of travelling microscope.

Results: Intra abutment and inter abutment distance were measured with travelling microscope and statistically evaluated.

Conclusion: 2 mm coping spacer for wash material produced stone dies with minimal dimensional change compared to other spacer technique

Keywords: Putty wash impression technique, Dimensional accuracy, Poly vinyl siloxane material

INTRODUCTION:

Impression is an imprint of the teeth and adjacent structures for uses in dentistry. Impression material in one substance or combination of substances are used for making an impression or negative reproduction various impression technique are used in making a negative likeness (GPT-4).

Elastomeric impression materials are subject to dimensional changes in several factors, like the process of polymerization in which it involves cross linking of the polymer chains, can result in a reduction of spatial volume. Continuous polymerization reactions take place even after removal of the impression. The changes due to the effect of temperature, influence of material volume, bulk of the material, the condition under which the material stored and disinfection of impression [1,2,3,4].

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Several techniques have been suggested to improve the accuracy of vinyl polysiloxane impressions. One step or two step putty wash technique are the technique mostly used. The two step technique usually required a spacer to provide space for the wash material. This in vitro study was conducted to compare the accuracy of 1&2 step techniques using various types of spacers.

AIM OF THE STUDY:

The aim of the study is to assess the

1)Accuracy of 2 commercially available vinyl poly siloxane impression materials.

2)Accuracy among one step putty wash and 2 step putty wash impression technique for the two impression materials.

3)Accuracy within 2 step putty wash impression technique employing various forms of spacers such as

a. Polyethylene sheet
b. Scrapping
c. Coping

MATERIALS AND METHODS:

The accuracy of the impression was evaluated indirectly by measuring several clinically relevant dimensions on gypsum casts recovered from impressions of a master model.

A machined standard milled steel die was made to serve as a model, which simulating 3 unit fixed partial denture. (Fig. a) Reference lines were inscribed on the top and axial surfaces of abutments, which are used to assess the dimensional changes with help of travelling microscope.

A perforated tray was fabricated from the same milled steel. Orientation grooves were placed both on the tray and the metal model to ensure uniform seating for each-impression.

The materials used were listed in the tabular column as given below:

Materials	*Manufacturer*	*Consistency*
Addition Silicone	3M ESPE	i) Putty (7312) ii) Syringeable (7302) Low viscosity
Addition Silicone	Ivoclarvivadent virtual	i) Putty (Regular set) ii) Syringeable Low viscosity (Regular set)
Tray Adhesive	3M ESPE	
Tray Adhesive	Ivoclarvivadent virtual	
Die Stone	Ultra rock Type IV	

Methods:

For each technique 10 impression of the master model were made for 2 (Vinyl polysiloxane) materials. These are grouping of the samples.

Group I (3M)	***Group II (Vivadent)***
Gr. I – A	Gr. II – A
Gr. I – B	Gr. II – B
Gr. I – C	Gr. II – C
Gr. I – D	Gr. II – D

Group I: ***3M polyvinyl siloxane material used for Accuracy evaluation.***

Group IA: Simultaneous one step putty wash impression techniques. (Fig. b)

Group IB: 2 step putty wash polyethylene spacer impression technique. (Fig. c)

Group IC: 2 Step putty wash scrapping impression technique. (Fig. d)

Group ID: 2 step putty wash 2mm coping impression technique. . (Fig. e)

Group II: ***Ivoclarvivadent virtual poly siloxane material used for accuracy evaluation.***

Group IIA: Simultaneous one step putty wash impression technique. . (Fig.f)

Group IIB: 2 step putty wash polyethylene spacer impression technique. . (Fig. g)

Group IIC: 2 step putty wash scrapping impression technique. . (Fig. h)

Group IID: 2 step putty wash 2mm coping impression technique. . (Fig.i)

Impression materials were mixed in standardized proportions according to the manufacturer's recommendations. The tray adhesives were used evenly over the tray's surface.

Setting time, according to the manufacturers was doubled to compensate for impression making at room temperature instead of at mouth temperature[5].

All impressions were stored at room temperature for 1 hour as per manufacturer instruction. Type IV dental stone was mixed by hand spatulation as per the water powder ratio specified by manufacturer. The model was poured with improved stone. (Fig. j)

All measurements from the master and stone models were measured with (a measuring) microscope suswax optic traveling microscope, capable of measuring up to 1 µm was used to measure the master and stone model.

Travelling Microscope .(Fig. k) has 2 main scales graduated on steel plates. One is fixed horizontally and another vertically to measure both the horizontal and vertical displacements of the microscope. These fixed main scales are provided with vernier caliper which slides the over main scale on moving the microscope. The model is placed on the horizontal base of the traveling microscope adjusted to view the model.

The vertical and horizontal crosswire is made to coincide with vertical & horizontal line on the model by moving the head slightly while viewing if the cross wire shifts with respect to the focused point, then by pulling the eye piece slightly out or pushing in adjustment is made to avoid error. (Fig. l and m)

Main scale and vernier scale reading (R_1) are taken. Then the microscope is moved along the same direction and the crosswire made to coincide with the line present in the next abutment of the model. Corresponding main scale and vernier scale readings (R_2) are taken.

The difference between these 2 readings (R_1& R_2) gives the distance between the 2 posts in the model. In this study with this method distance between (R-C, C-L, R-L, R, C, L) distances are determined. Each distance on the stainless steel model at each measurement location was measured 10 times.

The mean and standard deviation or all distance measurements are calculated and used as the standard measurement for comparison between the 2 techniques with 2 materials.

Data Analysis:

The percentage deviation of each distance of the putty wash one step / 2 step technique from the stainless steel master model was computed by calculating difference between the mean of each distance on the stone models “MSM” and the mean of each corresponding distance on the master model multiplied by 100.

Percentage deviation =

$$\frac{MSM - MMM}{MMM} \times 100$$

One way analysis of variance (ANOVA) was used to compare the difference among the 4 putty wash impression techniques and between the 2 impression materials and the master model for each measurement.

RESULT:

The accuracy of impression material was assessed by comparing the measurements, intra-abutment & Inter-abutment obtained from master model with measurement of the stone model.

The results of the accuracy of the impression material obtained by measuring intra & inter- abutment distances is evaluated and tabulated. They were then subjected to statistical analysis.

STATISTICAL ANALYSIS

The values were statistically analysed using,

1) One way anova

2) Dunean's multiple range test

One way anova:

One way anova is employed to compare the nears of 3 or more independent groups of observations. The observed variability in the samples is subdivided into 2 components. Variability of the observation within a group about the group means.

Duncan's Multiple range test:

The mean of the all groups for each property evaluated was then compared by using Duncan's multiple range test calculated at 0.05% significant.

The Duncan's grouping is represented as alphabets in Superscript. Different alphabets denotes that values are significant at 5% level.

DISCUSSION:

This viscoelastic property of elastomeric impression materials allows accurate reproduction of both hard and soft structures of oral cavity including the undercuts and interproximal spaces.

Among the elastomeric impression materials available poly vinyl siloxane are extremely popular because of their combination of excellent physical properties, handling characteristics and dimensional stability. They are available in various consistencies (light body, medium body, heavy body & putty) and are commonly used for fabrication of fixed restorations.

Several impression methods are followed with these impression materials. The most common are one step and two step putty wash technique.

In 2 step technique the 1st step involves making of a putty impression followed by wash impression with a light body. In the 2nd step, the thick putty material is placed in a stock tray and preliminary impression is made. This results in what is essentially an intra oral custom made tray formed by the putty. Space for the light body wash material is provided by various means like scrapping, polyethylene sheet etc.

An alterative to the 2 stage procedure is the single stage procedure in which the wash material is syringed in to place and simultaneously putty loaded impression tray seated over the light body material in a single step. The main disadvantage with this

one step technique is that the lighter viscosity putty material will displace less viscous wash material resulting in the reproduction of critical areas of the tooth preparation in putty rather than in light body.

This is the critical point to be considered because the putty is too viscous to replicate the required details. Moreover with this single step technique distortion (or) incomplete details reproduction can occur because of excessive pressure applied to the setting putty.

These distortions can also occur with the set putty used in 2 step technique. But in this technique the wash impression is carried out after the putty has set and contracted. The putty merely acts as a custom tray for light body the controlled wash bulk formed in the second stage compensates for the contraction of the putty with minimal dimensional changes. In spite of this, distortion can be expected in the 2 stage technique if the wash bulk cannot be controlled. Uneven wash bulk produces differential compensation resulting in uneven dimensional changes.

In this study 2 poly vinyl siloxane impression materials (Group I 3M PVS material and Group II virtual PVS Material) were selected to evaluate the accuracy of one step and 2 step putty wash impression technique using various forms of spacers. Each group was divided into 4 subdivisions and they were named as (A,B,C,D)

Group IA, & Group II A represents - simultaneous one step putty wash technique.

Group I B & II B represents - two step poly ethylene spacer putty wash technique.

Group I C & II C represents - two step scrapping putty wash technique.

Group I D & II D represents - two steps 2 mm copping putty wash technique for two materials accordingly.

The accuracy of the impression materials was evaluated by comparing the ability of these materials to reproduce the details of a machined standard milled steel die simulating a 3 unit fixed partial denture. The die was scored with reference lines on the top and the axial surfaces of the abutment. The stone models were constructed from the impression made by the various technique explained above. The accuracy of the material was evaluated by measuring the intra-abutment (R,C,L) and inter-abutment (RC, CL, RL) distances on the stone model and comparing these with the measurements obtained from the master model. The accuracy was evaluated using traveling microscope (suswax optic) capable of measuring up to 1 µm. The results were tabulated and were subjected to statistical analysis using one way ANOVA, Duncan multiple range test & student T-test.

The results revealed significant difference between one step and 2 step putty wash technique.

Among the 2 groups tested group II showed less dimensional change with one step putty wash technique (Group II - 99µm Group I - 197) than group I.

Group I showed less dimensional change with all types of 2 step putty wash technique than Group I.

Within the 2 step technique the prefabricated coping 2 step putty wash technique resulted in less dimension change (Group I: -6µm, Group II:-31 µm) followed by poly ethylene spacer technique (Group I: -62 µm, Group: - 63 µm) and scrapping technique (Group I:– 80µm, Group II: – 94µm).

All the 3 modes of 2 step putty wash technique used in this invitro study produced better results than one step technique.

The differences seen in 2 technique tested may be due to the difference in the wash bulk. In the one step technique employed in this study the putty material irrespective of 2 group tested displaced the wash material resulting in the die reproduction in putty medium rather than an wash medium. The uncompensated putty contraction may be the cause for the dimensional changes encountered with one step technique. This result is consistent with earlier studies by Chee and Donovan [5-6].

Though 2 step putty wash technique produced better results than one step technique, the wash bulk obtained with various forms of spacer produced a significant different within the various types of 2 step putty wash impression technique.

The 2 mm coping spacer technique (I D, II D) employed was most accurate as it produced complete control of wash bulk and thickness. Similar results were also reported by Nissan & Othes [7]. Standardized metal coping spacer created a uniform wash space which is very essential for a dimensionally stable impression.

In the poly ethylene spacer and scrapping method the wash bulk could not be controlled which allowed differential contraction resulting in uneven dimensional changes [8-16].

In discussion, the results of this in vitro study reveals that with one step technique group Ii (virtual PVS material) produced better result than Group I (3M PVS Material). In 2 stage technique Group I (3M PVs material) showed less dimensional changes for all the spacer techniques than Group II (Virtual). With the group II the customized coping showed improved results than the other spacer technique.

CONCLUSION:

Within the limitations of the study it can be concluded that;

1. There is significant difference existing between one step and 2 step putty wash impression technique.

2. There is significant difference existing among two step putty wash impression technique when different spacers are used for wash material.

3. 2 mm coping spacer for wash material produced stone dies with minimal dimensional change compared to other spacer technique.

4. Among the 2 PVS material 3M PVS material produced better results, with two step technique than virtual material.

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FIGURES:

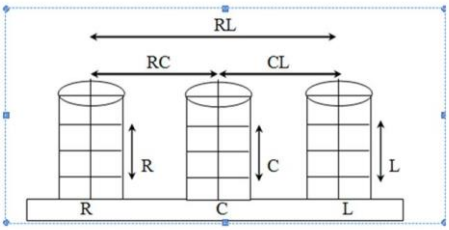

Fig: 1 Diagram of master model displaying interabutment (RC, CL,RL) and Intraabutment (R,CL) measurement

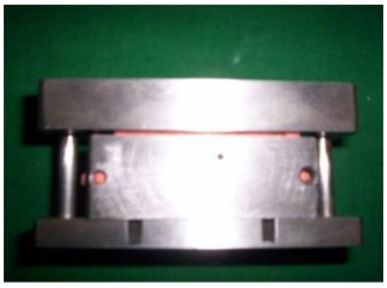

Fig: 2 Simultaneous One Step Putty Wash Technique

Fig: 3 Two Step Polyethylene Spacer Technique

Fig: 4 Two Step Coping Technique

Fig : 5 Two Step Scrapping Technique

Fig: 6 Simultaneous One Step Technique

Fig :7 Two Step Putty WashTechnique

Fig: 8 Two Step Scrapping Technique

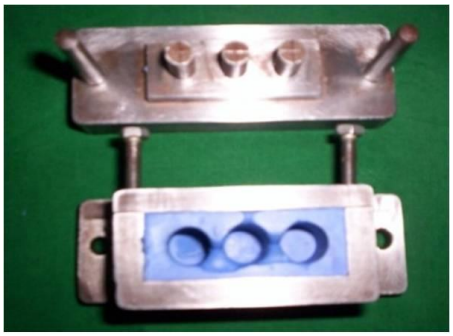

Fig: 9 Two Step Coping Technique

Fig: 10 Stone Models of Group I&II (ABCD)

Fig: 11 Traveling Microscope

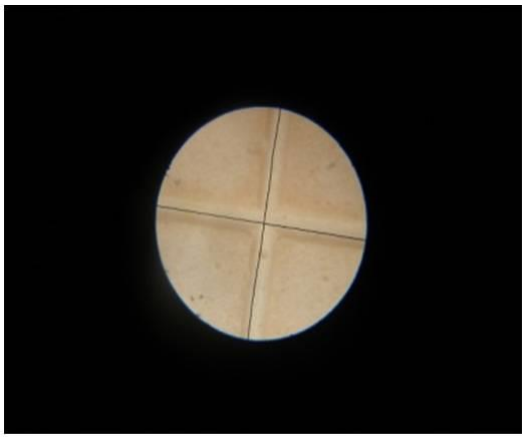

Fig: 12 Travelling Microscope View of Master Model

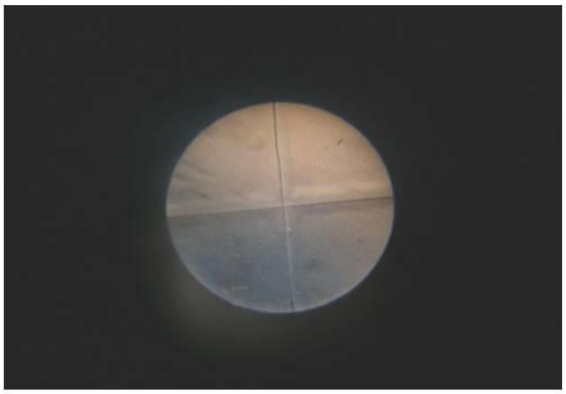

Fig: 13 Traveling Microscope View of Stone Model