

A study comparing the accuracy of single step versus dual step putty wash technique: An *in vitro* study

*¹Dr. Mohammad Altaf Tantray, ²Sandeep Koul Bali, ³Shabir Ahmad Shah

¹PG Scholar, Department of Prosthodontics, Govt. Dental College Srinagar, Srinagar, Jammu and Kashmir, India

²Professor & Head of Prosthodontics Srinagar, Govt. Dental College, Srinagar, Jammu and Kashmir, India

³Professor & Head, Department of Dental Materials, Govt. Dental College Srinagar, Jammu and Kashmir, India

Abstract

Background: An accurate impression is the preliminary requirement for the accurately fitting indirect dental restoration. Multiple techniques have been described for making definitive impression in fixed prosthodontics. Putty wash technique that has gained popularity can be categorized as single step putty wash technique and dual step putty wash technique. Single step technique in which putty and light body are mixed simultaneously. No spacer is used in this technique. In dual step putty wash technique, custom tray is made in putty with spacer followed by wash impression. The space for wash bulk can be created by polyethylene sheets, temporary crowns and grinding the impression. Several factors influence the quality of impression like technique, type of impression material, material bulk, type of tray and others.

Aims and Objectives: This study was conducted to evaluate and compare the accuracy of the dies fabricated from single step and dual step putty wash techniques.

Materials and Methods: Master model consists of the mandibular arch acrylic typodont (Nissin) with second right premolar prepared to receive porcelain fused metal crown. Sharp notches are prepared buccal and lingual cusp tips of the abutment and at the mid facio-gingival margin with round bur. The master model abutment width and height are then measured by travelling microscope from buccal to lingual cusp tip notch and buccal cusp tip notch to mid facio-gingival margin notch respectively. Ten impressions of the master model are made by single step and dual step impression techniques. Twenty casts are made by the impressions in Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India). The casts are then grouped as Group I with Ten casts from the impressions of single step impression technique and Group II with Ten casts from the impressions of dual step impression technique.

Results: The average height of the abutment on the group I and II stone casts are 5.608mm and 5.746mm with standard deviation of 0.147 and 0.025 respectively as shown in table 1. Abutment height on group I and II stone casts deviated from that of master model by -1.25%, and 1% respectively as is given in table 1. The abutment height measurements when subjected to one way ANOVA, p-Value was 0.0093 that is highly significant. The average width of the abutment on the group I and II stone casts are 4.334mm and 4.273mm with standard deviation of 0.08 and 0.04 respectively as shown in table 1. Abutment width on group I and II stone casts deviated from that of master model by 1.1%, 0.234% and 0.68% respectively as is given in table 1. The abutment width values when subjected to one way ANOVA, p-Value was 0.0049 which is significant.

Conclusion: The dual step dual mix impression technique with 2mm spacer thickness results in the dies that exhibited less variation compared to single step impression technique.

Keywords: indirect dental restoration, spacer thickness, dual step impression

Introduction

An accurate impression is the preliminary requirement for the accurately fitting indirect dental restoration. Multiple techniques have been described for making definitive impression in fixed prosthodontics. Putty wash technique that has gained popularity can be categorized as single step putty wash technique and dual step putty wash technique. Single step technique in which putty and light body are mixed simultaneously. No spacer is used in this technique. In dual step putty wash technique, custom tray is made in putty with spacer followed by wash impression. The space for wash bulk can be created by polyethylene sheets, temporary crowns and grinding the impression. Several factors influence the quality of impression like technique, type of impression material, material bulk, type of tray and others.

Aims and objectives: This study was conducted to evaluate

and compare the accuracy of the dies fabricated from single step and dual step putty wash techniques.

Materials and Methods

In this study, two putty wash impression techniques that have been compared are single step and dual step techniques. In single step technique, no spacer is used while in dual step technique, 2mm thick temporary crown is used as spacer.

Materials

1. Master model consisting of the mandibular arch acrylic typodont (Nissin) with second right premolar prepared to receive porcelain fused metal crown.
2. Perforated stock tray.
3. Addition silicone impression material(Affins Coltene Whaledent Pvt. Ltd. Switzerland)
4. Adhesive (Caulk Tray Adhesive, DENTSPLY)

5. Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India)
6. Debubbler (dentofil)

Armamentarium

1. Rubber bowl
2. Vacuum mixer
3. Automixing syringe and dispensing gun
4. Stop watch
5. Travelling microscope

Methodology

Master model consists of the mandibular arch acrylic typodont (Nissin) with second right premolar prepared to receive porcelain fused metal crown. Sharp notches are prepared buccal and lingual cusp tips of the abutment and at the mid facio-gingival margin with round bur. The master model abutment width and height are then measured by travelling microscope from buccal to lingual cusp tip notch and buccal cusp tip notch to mid facio-gingival margin notch respectively. Ten impressions of the master model are made by single step and dual step impression techniques. Twenty casts are made by the impressions in Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India). The casts are then grouped as under:

1. Group I: Ten casts from the impressions of single step impression technique.

Equal quantities of the base and catalyst of the putty (Affins Coltene Whaledent Pvt. Ltd. Switzerland) are mixed and loaded in the tray. The light body (President, Coltene Whaledent Pvt. Ltd. Switzerland) was extruded from automixing and dispensing gun on to the abutment preparation on the master model. Then, the preloaded putty tray was placed over the master model allowed to polymerize simultaneously for twice the recommended time. Ten impressions were made similarly and poured in Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India) after one hour to avoid cast porosity.

2. Group II: Ten casts from the impressions of dual step impression technique.

Two mm thick autopolymerising resin acrylic temporary cap

(Duralay, Reliance Dental Mfg. Co) was placed on the master model abutment. Equal quantities of the base and catalyst of the putty (Affins Coltene Whaledent Pvt. Ltd. Switzerland) are mixed and loaded in the tray. The tray with putty was placed on the master model and allowed to polymerize. The tray with polymerized putty acts as custom tray. The temporary cap was then removed to create space for wash bulk of light body. The light body (President, Coltene Whaledent Pvt. Ltd. Switzerland) was extruded from automixing and dispensing gun on to the putty custom tray. Tray with light body was placed on the master model for twice the recommended setting time. Ten impressions were made similarly and poured in Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India) after one hour to avoid cast porosity. The abutment die width and height on the group I and group II casts are then measured with travelling microscope and then compared with master model abutment width and height respectively.

Results

The average height of the abutment on the group I and II stone casts are 5.608mm and 5.746mm with standard deviation of 0.147 and 0.025 respectively as shown in table 1. Abutment height on group I and II stone casts deviated from that of master model by -1.25%, and 1% respectively as is given in table 1. The abutment height measurements when subjected to one way ANOVA, p-Value was 0.0093 that is highly significant at $p < 0.05$.

The average width of the abutment on the group I and II stone casts are 4.334mm and 4.273mm with standard deviation of 0.08 and 0.04 respectively as shown in table 1. Abutment width on group I and II stone casts deviated from that of master model by 1.1%, 0.234% and 0.68% respectively as is given in table 1. The abutment width values when subjected to one way ANOVA, p-Value was 0.0049 which is significant at $p < 0.05$.

Percentage deviation was measured by dividing the difference of mean of stone model (msm) and mean of master model (mmm) by mean of master model multiplied by 100. Percentage deviation = $\frac{msm - mmm}{mmm} \times 100$.

Table 1: Comparison of abutment height on master model with the height of abutment on group I and II stone casts.

	Master model (mm)	Group I (mm)	Group II (mm)
1.	5.753	5.412	5.732
2.		5.533	5.781
3.		5.624	5.734
4.		5.304	5.722
5.		5.695	5.775
6.		5.647	5.756
7.		5.739	5.703
8.		5.712	5.769
9.		5.713	5.732
10.		5.709	5.758
mean		5.608	5.746
St. dev		0.147	0.025
%deviation		-2.5%	-0.12%

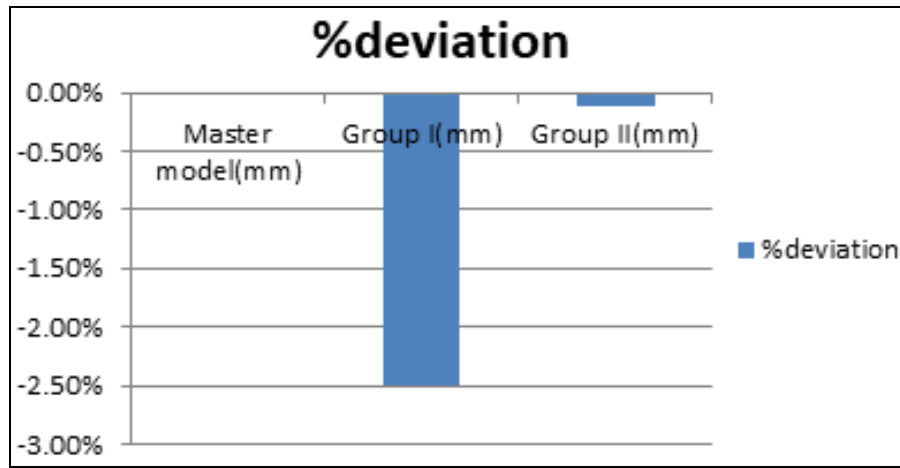


Fig 1: Percentage deviation of group I and group II cast abutment die heights from the master model abutment height.

Table 2: Comparison of abutment width on master model with that of the abutment on group I and II stone casts.

	Master model (mm)	Group I (mm)	Group II (mm)
1.	4.257	4.317	4.214
2.		4.415	4.279
3.		4.424	4.275
4.		4.275	4.375
5.		4.247	4.249
6.		4.256	4.269
7.		4.267	4.271
8.		4.377	4.273
9.		4.291	4.275
10.		4.472	4.257
mean		4.334	4.273
St. dev		0.081	0.040
%deviation		1.8%	0.37%

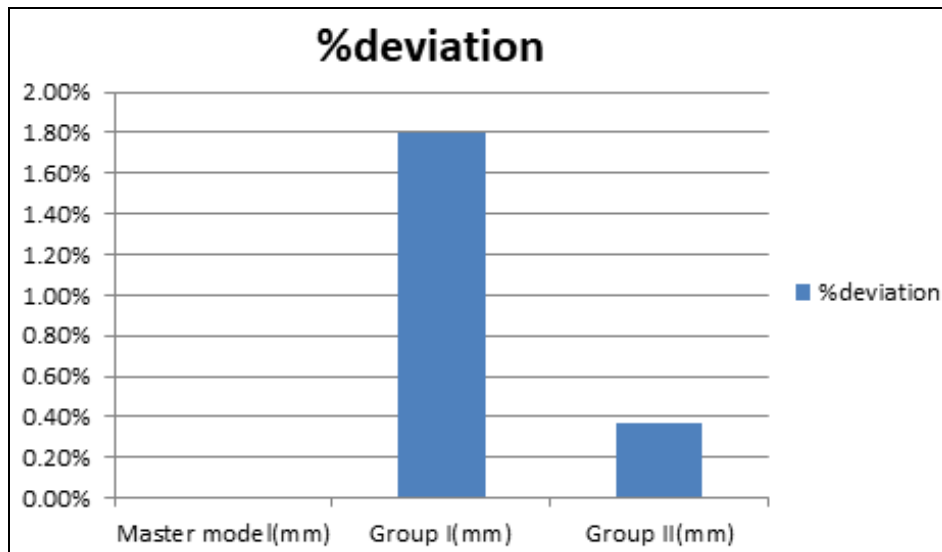


Fig 2: Percentage deviation of group I and group II cast abutment die widths from the master model abutment width.

Discussion

Hung *et al.* proposed that there is no differences in the accuracy of single step versus dual step putty reline impression technique. However, in the present study dual step impression technique produced more accurate dies as compared to single step impression technique.

Johnson *et al.* and Saunders *et al.* criticized the single step impression technique in producing inaccurate dies. This technique lacks the control of the thickness of the wash bulk of lower viscosity impression material and has a high risk of capturing the critical areas like finish line of the abutment preparation in putty rather than light body.

Saunders *et al.* states that putty lacks the ability of fine detail reproduction.

Abutment Height: The height of the die fabricated from single and dual step impression techniques deviated from master model abutment height by -2.5% and -0.12% respectively. The short dies result from centre ward polymerization shrinkage of impression material. Single step impression technique resulted in the dies shorter than those of dual step impression technique almost by 20 times. The uniform and controlled of wash space to lower viscosity impression material enhanced the accuracy of dual step impression technique.

Abutment Width: The width of the die fabricated from single and dual step impression techniques deviated from master model abutment height by 1.8% and 0.37% respectively. The dies from single step impression technique are wider than those from dual step impression technique. The polymerization shrinkage towards the flanges of the tray and towards the centre interproximally causes the wider dies.

Conclusion

The dual step dual mix impression technique with 2mm spacer thickness results in the dies that exhibited less variation compared to single step impression technique.

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