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A study evaluating the effect of delayed and repeat pours on the accuracy of controlled dual step dual mix putty wash impression technique: An *in vitro* study

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Abstract
Background: The putty wash technique is most commonly used in making impressions with elastomers. It consists of polymerizing lower viscosity elastomer (light body, LB) against the higher viscosity elastomer (putty). The putty in perforated stock tray that supports the light body capturing fine details of the abutment preparation acts as custom tray. The putty custom tray carries controls and confines the light body against the abutment preparation. The spaces for light body in the putty custom tray can be created by polyethylene sheets, wax omvivac thermoplastic sheets, temporary crowns and grinding the putty. The temporary crown provides the controlled and uniform thickness to the wash bulk of light body to increase the accuracy of impression.
Aims: This study was conducted to evaluate the effect of delayed and repeat pours on the accuracy of controlled dual step dual mix putty wash impression technique.
Materials and Methods: The master model consisted of a dentate mandibular arch of an acrylic resin typodont (Columbia Dentoform Corp., Long Island City, USA) with second right premolar prepared to receive porcelain fused metal crown. The sharp notches are prepared on the 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 controlled dual step dual mix putty reline impression techniques. Thirty casts are made by pouring the impressions in Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India).
Results: The average height of the abutment on the group I, II and III stone casts are 5.738 mm, 5.726mm and 5.700mm with standard deviation of 0.376, 0.0215 and 0.0379 respectively. The average width of the abutment on the group I, II and III stone casts are 4.304, 4.316 mm and 4.322mm with standard deviation of 0.084, 0.075 and 0.086 respectively.
Conclusion: The delayed and repeated pour of the addition silicone made with controlled dual step dual mix putty wash technique results in short and wider dies in relation to master model abutment dimensions.

Keywords: repeat pour, addition silicone, putty wash

Introduction

The putty wash technique is most commonly used in making impressions with elastomers. It consists of polymerizing lower viscosity elastomer (light body, LB) against the higher viscosity elastomer (putty). The putty in perforated stock tray that supports the light body capturing fine details of the abutment preparation acts as custom tray. The putty custom tray carries controls and confines the light body against the abutment preparation. The spaces for light body in the putty custom tray can be created by polyethylene sheets, wax omvivac thermoplastic sheets, temporary crowns and grinding the putty. The temporary crown provides the controlled and uniform thickness to the wash bulk of light body to increase the accuracy of impression.

The duplicate models when required, the accuracy of the impression with repeated pours is desired. The dimensions of the model are affected with delayed and repeat pours by

1. Continued polymerization shrinkage and,
2. Induced deformation by cast retrieval.

Aims and objectives: This study was conducted to evaluate the effect of delayed and repeat pours on the accuracy of controlled dual step dual mix putty wash impression technique.

Materials and methods

Materials

1. The master model consisted of a dentate mandibular arch of an acrylic resin typodont (Columbia Dentoform Corp., Long Island City, USA) 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. Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India)
5. Debubblizer (dentofil)
6. 2mm thick temporary cap (Duralay, Reliance Dental Mfg. Co.).

Armamentarium

1. Rubber bowl
2. Vacuum mixer

3. Automixing syringe and dispensing gun
4. Stop watch
5. Travelling microscope

Methodology

The master model consisted of a dentate mandibular arch of an acrylic resin typodont (Columbia Dentoform Corp., Long Island City, USA) with second right premolar prepared to receive porcelain fused metal crown. The sharp notches are prepared on the 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 controlled dual step dual mix putty reline impression techniques. Thirty casts are made by pouring 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 cast: It consists of ten casts made by pouring the ten putty reline impressions at first hour of making the impression.
2. Group ii casts: It comprises of ten casts made by pouring the ten putty reline impressions at 24 hours of making the impression.
3. Group iii: It consists of ten casts made by pouring the ten putty reline impressions at 48 hours of making the impression.

The abutment die width and height on the group I, II and group III 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, II and III stone casts are 5.738 mm, 5.726mm and 5.700mm with standard deviation of 0.376, 0.0215 and 0.0379 respectively. Abutment height on group I, II and III stone casts deviated from that of master model by -0.26%, -0.46% and -0.92% respectively. The abutment height measurements when subjected to one way ANOVA, p-Value was 0.042 that is significant at $p < 0.05$.

The average width of the abutment on the group I, II and III stone casts are 4.304, 4.316 mm and 4.322mm with standard deviation of 0.084, 0.075 and 0.086 respectively. Abutment width on group I, II and II stone casts deviated from that of master model by 1.1%, 1.38 and 1.52% respectively. The abutment width values when subjected to one way ANOVA, p-Value was 0.86 which is highly insignificant 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= msm-mmm/mmmx100.

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

	Master model		Group I		Group II		Group III	
	height	width	height	width	height	width	height	width
1.			5.722	4.211	5.746	4.244	5.712	4.247
2.			5.713	4.317	5.775	4.249	5.724	4.276
3.			5.704	4.427	5.704	4.377	5.633	4.357
4.			5.754	4.323	5.717	4.335	5.723	4.257
5.			5.675	4.247	5.735	4.289	5.641	4.475
6.			5.787	4.258	5.726	4.467	5.712	4.454
7.			5.769	4.249	5.723	4.373	5.706	4.257
8.			5.742	4.274	5.714	4.233	5.732	4.359
9.			5.793	4.264	5.702	4.345	5.743	4.289
10.			5.729	4.473	5.725	4.257	5.674	4.249
mean	5.753	4.257	5.738	4.304	5.726	4.316	5.700	4.322
Standard deviation			0.376	0.084	0.0215	0.075	0.0379	0.086
% deviation			-0.26%	1.1%	-0.46%	1.38%	-0.92%	1.52%

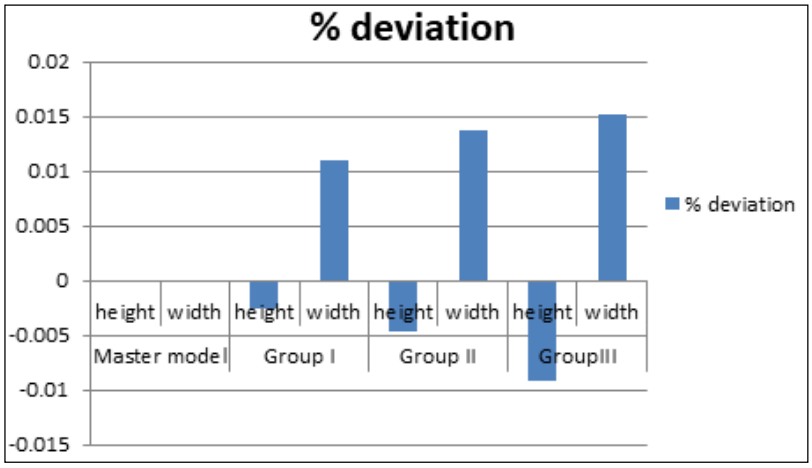

Fig 1: Percentage deviation of group I, II and group III cast abutment die height and width from the master model abutment height and width.

Discussion

Researchers concentrate on the accuracy and dimensional stability of impression that is affected by tray type, impression bulk, impression technique, spacer thickness, timing of impression pouring, filler content, polymerization and thermal shrinkage.

The continued and time dependent tray wall ward contraction of the impression material and centre ward contraction interproximally together with cast retrieval induced deformation resulted in short and wider dies in group I, II and III.

As is obvious from the table1 and figure1, there is increase in horizontal dimension of the abutment in group I, II and III casts by 1.1%, 1.38% and 1.52% respectively in relation to master model abutment width.

There is reduction in the vertical dimension of the abutment in group I, II and III casts by -0.26%, -0.46% and -0.92% respectively in relation to master model abutment height.

This study is in agreement with Gorden *et al.*, Johnson and Craig. According to these authors, the addition silicone produces shorter and wider dies.

The limitation of this study is that the ivorine tooth of the typodont (Columbia Dentoform Corp., Long Island City, USA) instead of natural tooth. Affinity of the impression for ivorine tooth is different from that of natural one. Oral temperature and oral moisture conditions were not simulated in this study.

Conclusion

The delayed and repeated pour of the addition silicone made with controlled dual step dual mix putty wash technique results in short and wider dies in relation to master model abutment dimensions.

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