ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2017; 3(11): 20-23
www.allresearchjournal.com
Received: 09-09-2017
Accepted: 10-10-2017

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A study comparing the accuracy of the working die made from the stock and custom tray

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Abstract
Background: The indirect restoration that does not fit its preparation is the most common error that the restorative dentistry faces today. The problem is still faced despite the presence of dimensionally stable and low shrinkage elastomeric impression materials such as polyvinyl siloxane.
Aims and objectives: this study was conducted to evaluate the effect of tray selection on the accuracy of stone dies**.**
Materials and Methods: Ten impressions of the master model are made with the stock and complete arch custom tray each. The casts made from the impressions of the master model in type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India) are categorized as Group I: casts made from stock tray. Group II: casts made from complete arch custom tray.
Abutment preparation height and width and inter-abutment separation on group I and group II casts are measured with travelling microscope.
Results: the measurements of the stone dies made from stock and custom trays are subjected to statistical analysis of mean, standard deviation and percentage deviation. 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.
Conclusion: the custom tray produces more accurate dies than stock tray as it provides uniform and minimum thickness to the bulk of impression material.
As far as the stock tray is concerned, that provides non-uniform and greater thickness to the bulk of impression material, produces greater distortion in the dies.

Keywords: working die, custom tray, stock tray

Introduction
The indirect restoration that does not fit its preparation is the most common error that the restorative dentistry faces today. The problem is still faced despite the presence of dimensionally stable and low shrinkage elastomeric impression materials such as polyvinyl siloxane. Polyvinyl siloxane comes in a variety of viscosities ranging from heavy viscosity putty to low viscosity light body [1]. These technique sensitive materials are best used in conjunction with an acrylic resin custom tray [2].
Tray selection also affects the accuracy of impression material. Custom trays of acrylic resin and thermoplastic material were similar regarding die accuracy and produced clinically acceptable casts. The stock tray produced casts with greater dimensional change due to variable thickness of the impression material in the stock trays which leads to more and uneven polymerization shrinkage, resulting in dimensional changes and inaccuracies in the cast [2].
Wassel R. W. compared the accuracy of impressions made with stock and reinforced stock trays. The reinforced stock trays generated more accurate stone dies [3].
The dimensions of working dies from a custom tray impression did not differ significantly from those created with dual arch trays [4].
The rigid stock trays that enclosed the preparations created accurate dies when used with one stage putty reline technique [5].
Aims and objectives: this study was conducted to evaluate the effect of tray selection on the accuracy of stone dies.

Materials and methods

Materials

1. Master model consisting of the mandibular arch acrylic typodont (Nissin) with missing left first molar comprised the master model and with left mandibular second premolar and molar prepared.
2. Complete arch acrylic custom tray.
3. Perforated stock tray.
4. Addition silicone impression material
5. Adhesive (Caulk Tray Adhesive, Dentsply)
6. Type IV dental stone high strength (Ultrarock, Kalabhai, Karson Pvt. Ltd., India)
7. Debubblizer (dentofil)

Armamentarium

1. Rubber bowl
2. Vaccum mixer
3. Automixing syringe and dispensing gun
4. Stop watch

Method

The accuracy of the tray is assessed by indirect measurement of abutment preparations on improved stone casts made from impressions of master model. The measurement on the casts was done with travelling microscope.

The mandibular arch acrylic typodont (Nissin) with missing left first molar comprised the master model. The left mandibular second premolar and left mandibular second molar are prepared to receive porcelain-fused to metal prosthesis. The sharp notches are prepared on mid occlusofacial, mid occlusolingual and mid faciogingival line angles of the both abutment preparations on the master model. The height and width of the abutment preparations and inter-abutment separation are measured.

The 2mm thick complete arch custom trays are fabricated with 3mm of relief wax to provide space for impression material used in controlled putty reline technique with autopolymerising resin (Duralay, Reliance Dental Mfg Co). Three tissue stops (2x2mm) are prepared two at terminal molars and one at central incisors. The one coat of adhesive (Caulk Tray Adhesive, Dentsply) is applied to the tray one hour prior to definitive impression.

The stock tray is selected according to the size of master model.

The dual mix dual viscosity controlled putty wash technique is used to make impression of the master model using heavy viscosity putty (Affins Coltene Whaledent Pvt Ltd. Switzerland) and low viscosity light body (president, Coltene Whaledent Pvt Ltd. Switzerland). Two 2mm thick copings of autopolymerising resin (Duralay, Reliance Dental Mfg Co) on the abutment preparations are used as spacer for putty reline impression.

Ten impressions of the master model are made with the stock and complete arch custom tray each. The casts made from the impressions of the master model in type IV dental stone high strength (Ultra rock, Kalabhai, Karson Pvt. Ltd., India) are categorized as

Group I: casts made from stock tray.

Group II: casts made from complete arch custom tray.

Abutment preparation height and width and inter-abutment separation on group I and group II casts are measured with travelling microscope.

Results

The measurements of the stone dies made from stock and custom trays are subjected to statistical analysis of mean, standard deviation and percentage deviation. 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 preparation heights in mm on master and stone models

	Master model		Custom tray		Stock tray	
	Pm	**Molar**	**Pm**	**molar**	**pm**	**molar**
			5.073	5.045	5.07	5.044
			5.072	5.042	5.073	5.045
			5.071	5.043	5.076	5.056
			5.076	5.044	5.077	5.060
			5.077	5.046	5.078	5.061
			5.079	5.047	5.079	5.047
			5.074	5.049	5.075	5.050
			5.075	5.048	5.079	5.052
			5.076	5.042	5.074	5.052
			5.079	5.041	5.071	5.041
mean	5.077	5.045	5.0752	5.0447	5.075	5.05
St. deviation			0.0027	0.0027	0.0031	0.0067
%deviation			0.03%	0.019%	0.04%	0.09%

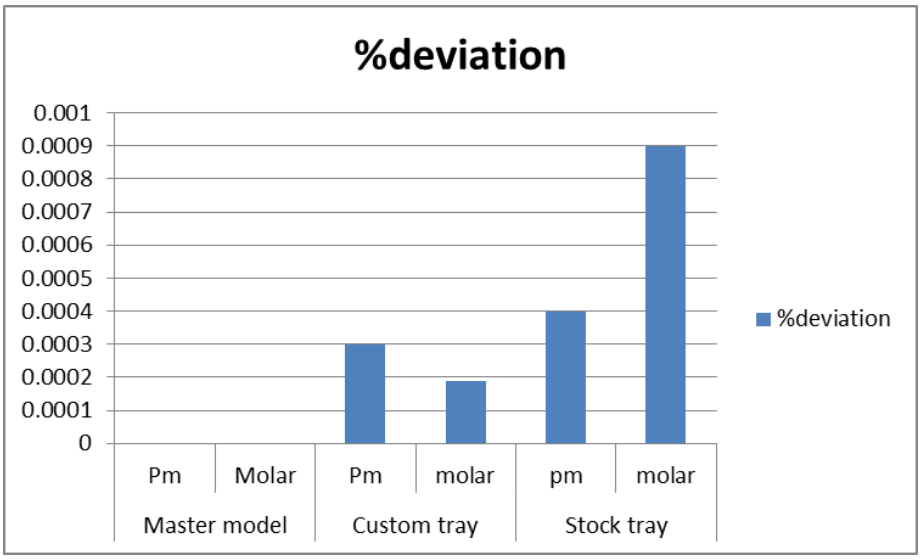


Table 2: Comparison of abutment preparation widths in mm on master and stone models

	Master model		Custom tray		Stock tray	
	Pm	Molar	Pm	molar	pm	molar
	4.021	5.044	4.023	5.041	4.021	5.041
			4.023	5.045	4.022	5.044
			4.041	5.047	4.027	5.046
			4.021	5.048	4.025	5.043
			4.027	5.048	4.030	5.041
			4.025	5.043	4.024	5.043
			4.024	5.044	4.023	5.051
			4.030	5.046	4.025	5.041
			4.042	5.051	4.017	5.043
			4.027	5.043	4.018	5.042
mean			4.028	5.045	4.023	5.043
St. Deviation			0.007	0.0029	0.003	0.003
%Deviation			0.017	0.002	0.049	0.019

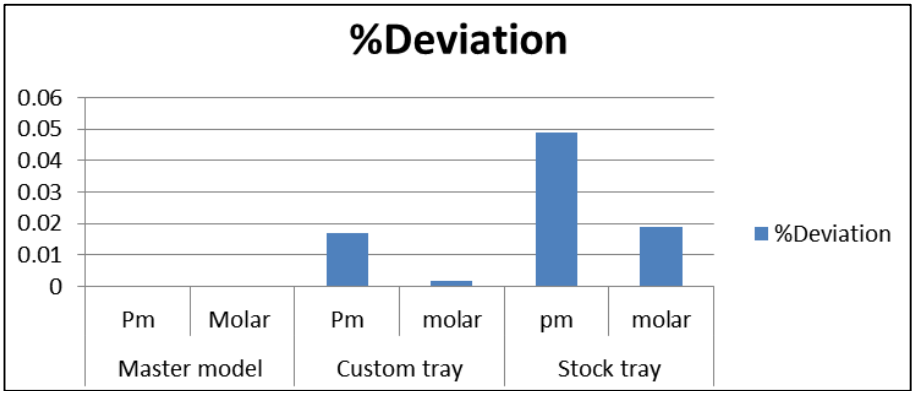
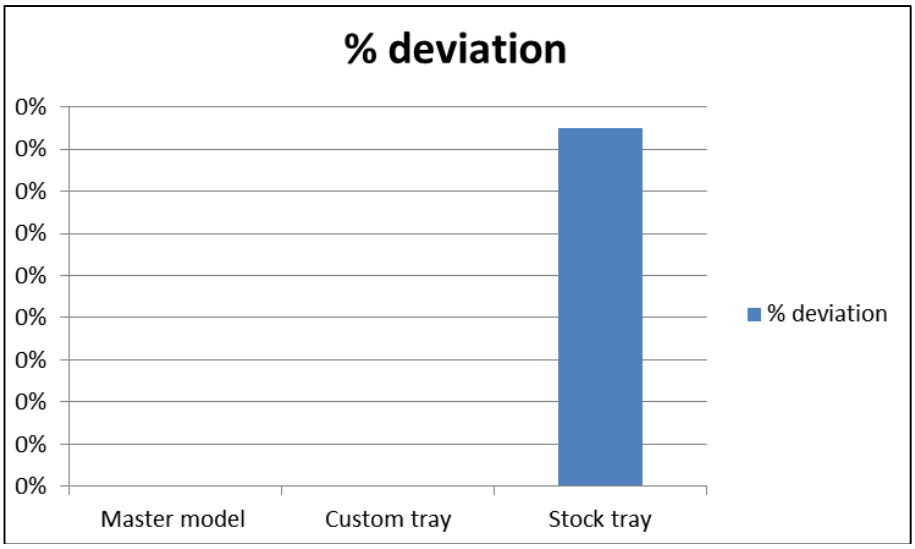


Table 3: Comparison of inter abutment preparation distance on master and stone models

	Master model (mm)	Custom tray (mm)	Stock tray (mm)
		17.034	17.023
		17.032	17.027
		17.030	17.029
		17.031	17.030
		17.032	17.028
		17.033	17.029
		17.027	17.031
		17.029	17.033
		17.031	17.031
		17.033	17.021
mean	17.031	17.031	17.028
Standard deviation		0.002	0.003
% deviation		0%	0.017%



Discussion

Height: The percent deviation in the height of the die made from custom tray is less that of the die height made from stock tray. The custom tray provides less bulk to the impression material leading less dimensional change and more accurate dies as compared to stock trays that provide more bulk to the impression material.

Width: the dies produced from both the stock and custom trays are wider than master model because of polymerization shrinkage of impression material towards the tray flanges.

Inter-abutment separation: the 0% deviation of the inter-abutment separation on the cast fabricated from the custom tray was observed.

Conclusion

The custom tray produces more accurate dies than stock tray as it provides uniform and minimum thickness to the bulk of impression material.

As far as the stock tray is concerned, that provides non-uniform and greater thickness to the bulk of impression material, produces greater distortion in the dies.

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