Original Article

Assessment of accuracy of two different impression materials in making duplicate dies: A comparative study

Ranjana Balla[1], Himanshu Gupta[2], Roshika Sudan[3]

[1]PG Student,[2] Reader, [3]Senior Lecturer, Departmetn of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar.

Abstract

Background: Dental impression making is the process of creating a negative form of the teeth and oral tissues. A variety of dental impression materials are available these days for making replica of the oral cavity. The accuracy of these impression materials shows considerable variations. Hence; we planned the study to assess the efficacy and accuracy of addition and condensation silicon impression materials in making duplicate dies. **Materials & methods:** The present study included assessment of efficacy of addition silicon and condensation silicon in making duplicate dies. Preparation of an acrylic model of the upper premolar tooth was done on the basis of conventional shoulder type marginal preparation supragingivally. Impression was taken followed by pouring of dental stone. Stone casts were separated from the impression and were stored for final setting. 20 successive impressions were then made, ten for each of the impression material. Fabrication of the die was done. All the results were analyzed by SPSS software. **Results:** On comparing the overall discrepancies, Speedex material showed significant overall discrepancy while non- significant discrepancy was observed in Panasil material. **Conclusion:** Panasil material has better marginal accuracy in making duplicate dies.

Key words: Die, Impression, Materials

Corresponding author: Ranjana Balla, PG Student, Departmetn of Prosthodontics, Maharaja Ganga Singh Dental College and Research Centre, Sriganganagar.

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INTRODUCTION

Dental impression materials are a group of dental materials which are used in the patient's mouth to make a negative replica of specific oral tissues, from which are obtained positive casts in dental gypsum products which are used in the fabrication of various dental prosthesis outside the mouth[1- 3.] Dental impression making is the process of creating a negative form of the teeth and oral tissues, into which gypsum or other die materials can be processed to create working analogues. Contemporary dentistry generates new information every year and digital dentistry is becoming established and influential[4, 5.] Although dentists should stay abreast of new technologies, some of the conventional materials and time-tested techniques remain widely used. It is important to review the impression-making process to ensure that practitioners have up-to-date information about how to safely and effectively capture the exact form of the oral tissues to provide optimal patient management[6- 8]. A variety of dental impression materials are available these days for making replica of the oral cavity. The accuracy of these impression materials shows considerable variations[9]. Hence; we planned the study to assess the efficacy and accuracy of addition and condensation silicon impression materials in making duplicate dies.

MATERIALS & METHODS

The present study was conducted in the department of Prosthodontics of the dental institution and

included assessment of efficacy of Speedex, and Panasil impression materials in making duplicate dies. Ethical approval was taken for the present study and written consent was obtained after explaining in detail the entire research protocol. Preparation of an acrylic model of the upper premolar tooth was done on the basis of conventional shoulder type marginal preparation supragingivally. For the purpose of making measuring guidelines, marginal grooves were made on the proximal, buccal and lingual sides. Two layers of wax were placed on the model for making the special trays. On step impression technique was used for making the impression followed by pouring of dental stone. Stone casts were separated from the impression and were stored for final setting. Red pencil was used for marking the master dies. Casting procedure was carried out.

Preparation of duplicated dies

20 successive impressions were then made, ten for each of the impression material. Fabrication of the die was done. Each casting from each of the master dies was placed on each of the test dies which were made from the same respective impression material. The marginal discrepancy was recorded with the use of the described measuring technique. All the results were analyzed by SPSS software. Chi-square test and student t test were used for assessment level of significance. P- Value of less than 0.05 was taken as significant.

RESULTS

When evaluated on buccal and lingual side, Panasil had significant and non- significant discrepancies in between duplicate die and model respectively (**Table 1**). However in the Speedex material, significant discrepancies were observed both on buccal side and lingual side. While comparing the overall discrepancies, Speedex material showed significant overall discrepancy while non-significant discrepancy was observed in Panasil material.

DISCUSSION

In the present study, we observed that Speedex impression material had significant overall discrepancy in between the duplicate die and model whereas no significant discrepancy was present in between the duplicate die and model in Panasil impression material. Price RB et al compared the margin adaptation of composite inlays made using the following

Table 1: Mean discrepancies in between duplicated die and model on buccal and lingual side

Type of impression material		Buccal	p-value	Lingual	p-value
Panasil	**Duplicated die**	**34.25**	**0.02***	**35.81**	**0.52**
	Model	**32.12**		**34.29**	
Speedex	**Duplicated die**	**37.41**	**0.03***	**36.88**	**0.01***
	Model	**33.18**		**31.41**	

***: Significant**

Table 2: Mean discrepancies in between duplicated die and model on mesial and distal side

Type of impression material		Mesial	P-value	Distal	p-value
Panasil	**Duplicated die**	**39.25**	**0.01***	**37.46**	**0.20**
	Model	**32.33**		**36.55**	
Speedex	**Duplicated die**	**38.44**	**0.52**	**39.22**	**0.01***
	Model	**38.12**		**35.95**	

***: Significant**

Table 3: Mean overall discrepancies in between duplicated die and model

Type of impression material		P-value
Panasil	**Duplicated die**	**0.82**
	Model	
Speedex	**Duplicated die**	**0.01***
	Model	

***: Significant**

5 impression/flexible die material combinations; condensation silicone/polyvinyl siloxane(CS/PVS), wash viscosity polyvinyl siloxane/medium or heavy viscosity polyvinyl siloxane (PVS/PVS), irreversible hydrocolloid impression/medium viscosity polyvinyl siloxane (IH/PVS), wash viscosity polyvinyl siloxane impression/polyether (PVS/PE), with composite inlays made using a control system of a wash viscosity polyvinyl siloxane impression and a type IV stone die. For each test and control system, 10 impressions were made of a class II composite inlay preparation in a metal master die. One die was made from each impression and one composite inlay was made and finished on each die (a total of 60 inlays). Inlays were placed on the master die and the margin opening at the buccal, distal, and gingival sites was recorded with a measuring microscope (x40 magnification). Composite inlays that were made using the PVS wash viscosity/PVS heavy viscosity system had significantly larger distal, gingival, and overall mean margin openings than all other inlays (ANOVA and Fisher PLSD test; P =.05). The separating medium required between some impression and die materials did not work consistently. Composite inlays fabricated on dies made of material different than the impression material had mean buccal, distal, gingival, and overall margin openings < or =100 microm. Composite inlays made on the CS/PVS, IH/PVS medium viscosity, PVS wash viscosity/PE flexible dies, and control PVS wash viscosity/stone dies had statistically similar (P =.05) mean buccal, distal, gingival, and overall mean margin openings that were < or =100 microm.[10]Kane LM et al evaluated the marginal and internal fit of milled Co-Cr copings produced by CAD/CAM with 2 different marginal preparation designs. Four master dies were developed from 2 ivorine central incisors and 2 ivorine maxillary molars, 1 of each prepared with a 0.8-mm chamfer and a 1.2-mm rounded shoulder. These 4 groups of teeth were replicated with polyvinyl siloxane and used as templates to fabricate epoxy dies (n=10) for each of the 4 groups; a total of 40 epoxy resin dies. Cobalt-chromium copings of standard thickness (0.4 mm) were fabricated for each die with CAD/CAM technology. Next, the working dies were scanned with a 5-axis laser scanner to produce a 3-dimensional model. A thin layer of low-viscosity polyvinyl siloxane material was placed inside each coping and seated on the die until the material set. Copings were removed from the dies, leaving the polyvinyl siloxane intact, and these silicone-coated dies were scanned. The software superimposed the 2 scans, and the marginal openings and internal fit were measured at multiple locations. The marginal opening was determined at 4 locations: mid-buccal (mB), mid-lingual (mL), mid-mesial (mM), and mid-distal (mD), and the mean of these 4 measurement locations was referred to as the group variable "edge." The internal occlusal adaptation was measured at the midpoint from buccal to lingual and mesial to distal locations and referred to as mid-occlusal (mO).Significantly smaller mean marginal openings (P=.017) were observed overall for the chamfer marginal design (anterior chamfer: 61 ±41 µm; posterior chamfer: 52 ±27 µm) compared with the shoulder design (anterior shoulder 103 ±49 µm, posterior shoulder 113 ±110 µm). The anterior chamfer had a statistically significant (P=.055) smaller mean marginal opening (61 ±41 µm) than the anterior shoulder (103 ±49 µm). The milled Co-Cr copings produced with a CAD/CAM system in this study demonstrated clinically acceptable marginal fit in the range of 52 to 113 µm before ceramic application[11]. Morgano SM et al evaluated the ability of five different impression techniques to make duplicate dies of two different types of tooth preparation. One mandibular second premolar Ivorine tooth was prepared for a complete crown and one for an onlay. A master impression was made of each tooth preparation with the use of five impression techniques for a total of 10 master impressions, and a master die was made from each of these impressions. Castings were made on these master dies, and the fit of each casting was verified on the respective Ivorine tooth. Marginal openings of the castings on the master dies were recorded under magnification at four predetermined points. Five successive impressions, with the use of each impression material, were then made of each tooth preparation for a total of 50 test impressions, and 50 test dies were made from these impressions. The fit of the respective casting was evaluated under magnification for each test die at the four predetermined points, and marginal openings were recorded. Differences between the marginal discrepancies of the casting on the master die and on the test die were tabulated and the results were statistically analyzed. Results indicated that none of the impression materials was capable of producing exact replicas. Polysulfide rubber performed significantly better than two materials for the production of duplicate dies with the complete crown preparation; and polyvinyl siloxane used with a putty-light body, single-stage technique produced mean marginal discrepancies

that were significantly greater than the other four techniques when used for the onlay preparation[12].

CONCLUSION

From the above results, the authors concluded that Panasil material has better marginal accuracy in making duplicate dies. However; future studies are recommended.

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