

Dimensional accuracy of 3 silicone dental impression materials

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مضبوطة الأبعاد لثلاث من مواد الطبقات السنية السيليكونية

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الخلاصة: أُجريت هذه الدراسة لقياس التغيرات في الأبعاد في مواد الطبقات السنية السيليكونية، والتي قد تؤثر على ملائمة البدلات السنية. وقد تم إعداد 20 عينة للطبقات السنية لكل من المواد السيليكونية الثلاثة، وهي الزانتوبرين - هـ وبريزيدنت وفولدنت، وذلك باستخدام طرق المزج المزدوج والمزج الأوحده. ثم أُجريت قياسات منتقاة على قوالب حجرية لكل طبعة، وفي الحالات الثلاثة جميعها أدى المزج الأوحده إلى قوالب أكثر دقة مما آلت إليه طريقة المزج المزدوج. وكانت طبقات الزانتوبرين - هـ هي الطبقات الأكثر مضبوطة.

ABSTRACT This study was carried out to measure the dimensional changes in silicone impression material, which can affect the fitness of the prosthesis. Using both single and double mix techniques, 20 impression samples for each of 3 different proprietary silicones, Xantopren-H, President and Fulldent, were made. Selected measurements were made on the stone casts made from each impression. In all 3 cases, the single mix gave more accurate casts than the double mix technique. The Xantopren-H impressions had the most accurate dimensions.

Exactitude dimensionnelle de trois matériaux d'empreinte dentaire à base de silicone

RÉSUMÉ La présente étude a été réalisée pour mesurer les changements dimensionnels du matériau d'empreinte dentaire à base de silicone qui peuvent affecter l'ajustement de la prothèse. Au moyen des techniques des simple et double mélanges, 20 prélèvements d'empreintes ont été effectués pour chacune des trois différentes silicones : Xantopren H, President et Fulldent. Certaines mesures ont été réalisées sur des moulages en plâtre fabriqués à partir de chaque empreinte. Dans l'ensemble des trois cas, le simple mélange a produit des moulages plus précis que la technique du double mélange. Les empreintes Xantopren H avaient les dimensions les plus précises.

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Introduction

Several studies have been carried out aimed at enhancing the physical properties of silicone impressions. Of the physical properties which may adversely affect the fit and retention of dental prostheses, dimensional change in the impression material is considered the most serious. It is therefore considered the main feature of any impression material, and needs to be taken into consideration to achieve a good restoration [1,2]. Accuracy of impressions depends on the composition and manipulation technique of the impression as well as the die cast material itself [1,3]. A number of studies have been carried out to evaluate the accuracy of impression techniques [4–8]. In many, metal or ceramic casts were used [9–11]; acrylic resin casts have also been used [10].

The mixing technique for silicone impressions can be either single or double mix. This study was carried out to examine the dimensional accuracy of 3 silicone impression materials and the single and double mixing techniques for each of them.

Methods

This study was carried out in 2003 in Garafa Medical Complex, Doha, Qatar.

Sample impressions made with 3 different silicones, Xantopren-H (Bayer Dental, Leverkusen, Germany), President (Coltene AG, Altsatten, Switzerland) and Fullident (JTC-Fullident SA, Arsier, Switzerland) were used to prepare stone casts (GC Company, Tokyo). For each material, 20 impressions were made, 10 using the single mix technique and 10 using the double mix. All the impressions were mixed following the manufacturer's instructions. The single mix technique was carried out by mixing and

applying the putty (heavy body) and allowing it to harden before applying the wash (light body). The double mix technique was carried out by mixing the heavy and light bodies together before applying.

The impressions were taken over a resin master cast. This was used in view of its low wettability, low thermal conductivity and low price [12]. Undercut areas of the cast, especially in the embrasure areas, were blocked out with cold cure acrylic prior to impression.

Reference grooves to be used as measurement points were first cut on the master cast using a wide, straight fissure bur (the grooves would then be duplicated on the stone casts produced from the experimental impressions). These grooves were positioned as follows: on the buccolingual surface of the distobuccal cusp of the left second molar, on the buccolingual surface of the buccal cusp tip of the first premolar; and mesiodistally on the distolingual cusp of the left and right first molars [10].

Three measurements were taken for each cast by measuring the distance between the left first premolar and the distobuccal cusp of the left second molar (mesiodistal) and a straight measurement (buccolingual) was taken between the distolingual cusp of the first molar and the distolingual cusp on the opposite side (Figure 1) [10]. The third measurement (diagonal) was taken from the left first premolar to the mesiobuccal cusp tip of the right second molar [10]. These measurements were carried out in duplicate for the casts made from each of the 3 materials and the mean distances calculated. All measurements were taken by a single examiner using an electronic vernier calliper. Measurements of the resin master cast were taken in a similar manner as for the controls.

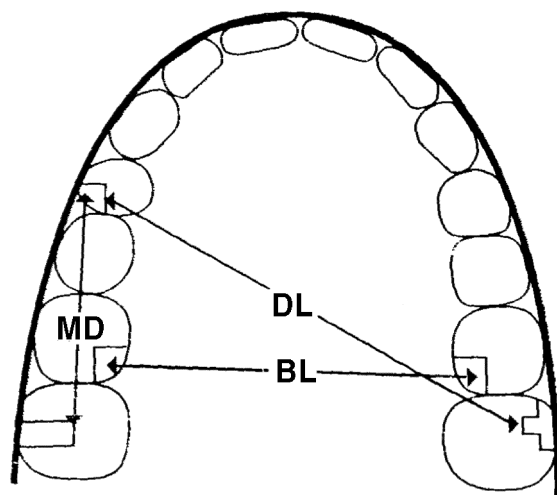


Figure 1 Diagram showing the reference points and measurement lines (DL = diagonal; MD = mesiodistal; BL = buccolingual) on the casts

Results

Table 1 shows the reference measurements for the master cast. The results obtained for each measurement of each subgroup, single and double mix, are shown in Table 2.

Xantopren-H silicone gave the most accurate dimensions as the measurements taken were almost equal to the dimensions of the standard master cast. The other 2 silicones showed slight dimensional inaccuracy.

For all 3 materials, the single mix sample showed better accuracy than the double

mix, but the differences were not statistically significant.

Discussion

Silicone is considered one of the best available impression materials for fixed prostheses [2,3]. The dimensional accuracy of different silicone impression materials and the benefit of different mixing procedures, single and double mix, were studied. The mixing technique is considered an essential factor in impression accuracy [9,10]. The difference between single and double mix in accuracy and elasticity may be attributed to the rate of polymerization: faster polymerization will prohibit the penetration of free radicals. The light body component occupies a minute volume, so its effect on the resultant deformation will be slight [4,5].

In this study it was shown that Xantopren-H gave better dimensional accuracy than President and Fulldent impressions.

Table 1 Measurement of master cast

Line	Teeth	Distance (cm) Mean (SD)
Buccolingual	6-6	4.5 (0.6)
Mesiodistal	4-7 (same side)	3.0 (0.2)
Diagonal	4-7 (opposite sides)	5.2 (0.1)

SD = standard deviation.

Table 2 Measurement of casts made from the 3 test materials

Line	Distance (cm)					
	Fullident mix		President mix		Xantopren-H mix	
	Single Mean (SD)	Double Mean (SD)	Single Mean (SD)	Double Mean (SD)	Single Mean (SD)	Double Mean (SD)
Buccolingual	4.1 (0.8)	4.1 (1.0)	4.0 (1.6)	4.0 (0.2)	4.5 (0.6)	4.1 (1.6)
Mesiodistal	2.8 (0.7)	2.9 (1.1)	2.9 (1.5)	2.9 (1.2)	3.0 (0.8)	3.0 (0.2)
Diagonal	5.0 (0.3)	5.1 (1.2)	5.1 (1.7)	5.1 (0.8)	5.1 (0.9)	5.1 (1.0)

SD = standard deviation.

Besides, the study illustrates that the single mix techniques is better than the double mix technique in all samples. This agrees with the findings of previous studies, which recommend using single mix rather than double mix [10,12–15].

A 3-scale measurement was used for each sample to minimize the effect of error in the results. Therefore, it is believed that this method is the best and the most suitable for dimensional accuracy tests of elastomeric impressions.

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Oral Health Country/Area Profile Programme

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The database can be accessed from the CAPP home page at <http://www.whocollab.od.mah.se/>. Data for countries of the WHO Eastern Mediterranean Region can be found at: <http://www.whocollab.od.mah.se/emro.html>