



COMPARATIVE EVALUATION OF TWO IMPRESSION TECHNIQUES FOR ACCURACY OF MARGINAL FIT: AN IN VITRO STUDY.

Dental Science

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ABSTRACT

Aim: aim was to analyze and compare the accuracy of two impression techniques.

Materials and Methods. An extracted first molar, was prepared by standard method for full crowns with processed preparation finish line of 1 mm depth and convergence angle of 3-4°. Impression was made 20 times with one-stage technique and 20 times with two-stage technique using an appropriate tray. The distance between the restoration margin and preparation finish line of plaster dies was vertically determined in mid mesial, distal, buccal, and lingual (MDBL) regions by a stereomicroscope using a standard method.

Results. The results of independent test showed that the mean value of the marginal gap obtained by one stage impression technique was higher than that of two-stage impression technique.

Conclusion. The findings of the present study indicated higher accuracy for two-stage impression technique than for the one-stage impression technique.

KEYWORDS

impression techniques, addition silicone, die

INTRODUCTION:

Making an accurate impression especially in the finish line, and using proper impression materials and an appropriate impression technique are important in making a suitable and accurate impression [1]. The impression technique determines the restoration of finish line. The accuracy of impression techniques is revealed when restoration with suitable marginal adaptation and minimum gap is obtained [2]. Several studies have evaluated the maximal marginal gap values [3-6]. McLean evaluated more than 1000 crowns in 5 years and concluded that a marginal gap of less than 120 μm is clinically acceptable [7]; however, in vitro studies have reported values of 100 μm [5,6]. In addition to impression techniques, various factors, including preparation finish line, preparation angle, type of die, type of sprue, dye spacer [2], type of alloy and casting method, and type of impression material, influence the marginal adaptation [8]. Nowadays the common impression materials include hydrocolloid and elastomeric impression materials. In cases where there is not enough time for pouring the impression, polyether and additional silicone are used because these materials have high dimensional stability and their impression can be kept for a long time [9]. Additional polymerization silicone, also known as polyvinyl siloxane, was first introduced as an impression material in the 1970s. Additional silicones are very much similar to condensation silicone, except that additional silicone has higher dimensional stability (its dimensional stability is the same as polyether). Additional silicone is one of the most accurate and stable impression materials, which is used as single-paste, double-paste, and putty-wash systems [9, 10]. Currently, the putty-wash type is widely used in fixed prosthodontics and removable overdentures. This technique does not require a special tray and the putty-wash impression plays the role of special tray and saves time [11]. Moreover, there are two techniques for double-stage impression, impression with spacer and impression without spacer, and the latter was used in the present study. Therefore this study was conducted to evaluate and compare the accuracies of one- and two-stage impression techniques.

MATERIALS AND METHODS:

A standard tooth preparation was performed on the extracted mandibular molar with the following characteristics: 1.5 mm occlusal reduction and 1 mm axial reduction with 6-8° convergence (3-4° for each side). Round shoulder finishing line with at least 1 mm width was prepared on the lingual and facial surfaces, which were reduced in two planes, and all of the line angles were rounded to reduce stress concentrations. Then, impression making was performed 20 times with one-stage impression technique and 20 times with two-stage impression with a proper tray using Aquasil additional silicone (Dentsply, Switzerland). In one-stage impression technique, putty and wash were mixed simultaneously, putty was placed in the tray, wash was put on the tooth surface, and impression was made with the same applied pressure on the tray in the mouth during impression making. In two-stage impression technique, however, an impression was made

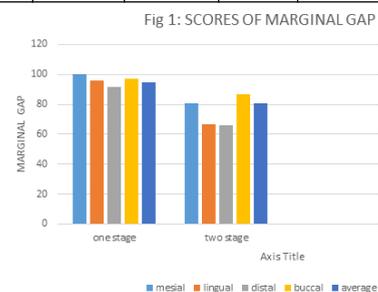
with putty from the prepared tooth and interdental papillary regions were removed afterwards. Then, several vents were created within the impression material for escape. Next, the impression was relined again with a layer of wash (3-4 mm) by using uniform thickness of material (putty or wash) by applying uniform pressure for all impressions. The casts of the intended impression were poured with plaster type IV over 30 minutes according to the manufacturer's instructions (first plaster). Then, the second part of plaster was added half an hour later using stone type III. The plaster dies with bubble at the die site and preparation finish line were excluded from the study, so a total of 40 plaster models were obtained. All of the dies were covered with two layers of spacer with resultant thickness of 30 μm . Investing and casting were done for all samples in similar laboratory conditions. After casting the metal coping, the sprue was cut and coping was seated on the dies by using fit checker and eliminating the premature points on the intaglio surface of coping. To measure the marginal gap, the distance between the copings margin and preparation finish line of plaster dies (master cast) was determined vertically in mid mesial, distal, buccal, and lingual regions by a stereomicroscope.

RESULTS:

Having ensured the normality of variables, independent *t*-test was applied. A significant difference was reported between the two impression techniques in mid mesial, distal, and lingual regions and average of all surfaces ($p < 0.05$). The results of independent *t*-test are shown in Table 1. Detailed diagram of the marginal gap in mesial, lingual, distal, and buccal side in the one- and two-stage impression techniques is demonstrated in Figure 1.

Table 1 mean and standard deviation of marginal gap in the groups.

Marginal gap	Mesial	Lingual	Distal	Buccal	average
One-stage	100.22 ± 56.66	95.95 ± 21.64	91.5 ± 36.10	97.02 ± 33.80	94.42 ± 16.09
Two-stage	80.52 ± 22.27	66.82 ± 31	66.15 ± 28.33	86.55 ± 23.47	80.76 ± 23.47
value	0.025	0.005	0.006	0.332	0.001



DISCUSSION:

Making impression for oral restoration and dental morphology is an integral part of restorative dentistry, and accurate impression is one of the most important stages of fixed prosthetic treatments. Thus, selecting the best and most accurate impression technique seems to be necessary for a successful treatment [1, 2]. One- and two-stage impression techniques are acceptable for many clinicians, and no significant difference has been reported in most of the studies [2]. In most in vitro studies similar to the present study, the prepared and standardized dies have been desirably used to evaluate the accuracy of copings, since 40 gypsum dies were made from one dental model, and precise control was exerted on preparation parameters like convergence rate of axial walls and preparation finish line. Hence, the impression technique variable was evaluated and compared and the rest of the variables were kept fixed and under control. The results of this study revealed that the marginal gap in the fabricated copings by one- and two-stage impression techniques was less than 120 μ m, which is clinically acceptable according to some studies [4–6]. Better marginal adaptation helps in decreasing the rate of fracture by increasing the consistency and can decrease microbial plaque and periodontal disease and complications consequently. Moreover the mean marginal gap is lower in the copings of two-stage impression. Therefore, this technique is preferred to one stage impression technique, which is in line with the results of the studies conducted by Mahshid et al. [12], and Dugal et al. [13]. The result of this study was similar to the result of Franco's study [14], but in this study we did not use a spacer. This subject probably was due to impression making with the spacer which is induced impression material remaining in the tray, with more accurate impression making than without a spacer. Vitti et al. evaluated the dimensional accuracy of stone casts based on the impression material and three impression techniques. They found that stone casts had high dimensional accuracy, and one-stage and two-stage putty-wash impression techniques and monophasic light-body impression technique were not significantly different for marginal gap [15]. In two-stage impression making, the marginal gap is compensated by wash material in the second stage, whereas, in one-stage, we do not have the second stage for compensating marginal gap in such surfaces.

CONCLUSION:

This study indicated no significant difference between one- and two-stage impression techniques in mid buccal region ($p > 0.05$), but a significant difference was observed between the two impression techniques in mid mesial, distal, and lingual regions and in average four surfaces ($p < 0.05$). Therefore, it can be argued that the accuracy of two-stage impression technique was higher than that of one-stage impression technique.

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