

Evaluation of Defects in Surface Detail of 2 Phase One Step Versus 2 Phase Two Step Impression Techniques: An In Vitro Study

Defects in Surface Detail of 2 Phase One Step VS 2 Phase Two Step

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ABSTRACT

Objective: To compare frequency of defects in surface detail of 2 phase one step versus 2 phase two step impression techniques.

Study Design: Randomized control trial study

Place and Duration of Study: This study was conducted at the Department of Prosthodontics, Institute of Dentistry, CMH Lahore Medical College from 14-5-2018 to 14-11-2018.

Materials and Methods: A total of 618 impressions were taken on a stainless steel abutment which were prepared and fabricated according to American Standards Institute- American Dental Association specifications. This model was incorporated in auto polymerizing resin and fixed onto a base. The auto polymerizing resin was then modeled to allow reproducible positioning of impression trays on the model. All impressions were made in stock perforated trays. The Impressions were divided into two equal groups i.e. Group A (Two phase one step) and Group B (Two phase two step). The impressions were then removed from master model. The Number of defects produced in both groups were evaluated and counted by an examiner trained in standardized technique for recognition and classification of surface defects. They were further confirmed by taking pictures of individual impressions.

Results: The defects in surface were noted in 54.5% impressions. Out of these 337 impressions Type I (group A) classification was found in 273(81%) impressions and type II (group B) classification was noted 19% in impressions. In group-A the defect in surface noted in 59.9% impressions and in group B the defect in surface noted in 49.2% impressions (p-value=0.008).

Conclusion: This present study showed that 2 phase two step impression techniques showed significantly lower defect rate than to 2 phase one step technique in evaluation of defects in surface.

Key Words: Impression Techniques, Two Step, One Step, Defect, Surface

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INTRODUCTION

An impression is a negative replica of a surface; a dental impression is an imprint of the teeth and surrounding tissues. A complete record of the patient's hard and soft tissues is generated via the use of impressions. The final shape, fit, and function of both removable and permanent restorations are determined mostly by this stage.^{1,2}

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The accuracy and surface details are primary focus in fixed prosthodontics. The goal is to achieve a defect free negative representation of a prepared tooth which will produce an accurate cast. Various impression materials e.g. alginate, polyether and silicones are used to achieve this objective. Among these materials addition silicones are among the most recommended impression material in fixed prosthodontics and have become the material of choice.^{3,4} Addition silicones are among the most dimensionally stable and accurate impression materials available⁵. These are available in four consistencies i.e. Type 1- Heavy body putty, Type 2- Medium body putty, Type 3- light body material and Type 4- extra light body material Impression techniques using addition silicones have been categorized according to 2 phase one step and 2 phase two step impression techniques.^{6,7} Two phase one step or two phase two step procedures are performed using putty and light body. Two phase one step technique is one in which both materials polymerize simultaneously. Its advantages include reduced chair side time and saving

of impression material. A disadvantage is that occasional ledges are formed at junction of putty and wash material⁸. For the first stage of the two-step imprint process, a high-viscosity substance (putty) is employed, and for the second step, a lower-viscosity material is utilized. The lightweight material used in the second phase of this process leaves a detailed imprint. Distortion, more time in the operating room, and more supplies are just a few of the drawbacks. Materials for the wash should ideally extend throughout the whole of the pretreatment for both methods.^{9,10} However, in the therapeutic setting, this goal is not always attainable. In a recent clinical trial from 2015, researchers found that more than 89% of impressions they examined had at least one obvious inaccuracy, highlighting the need for a more careful review on the side of dentists. Technique, impression material, volume of material, and other variables may all affect the quality of imprints¹. A high viscosity substance should be used for the bulk of the mixture, while a low viscosity material should be used to capture the fine details of the margins.¹¹

MATERIALS AND METHODS

This was a Randomized control trial conducted at Department of Prosthodontics, Institute of Dentistry, CMH Lahore Medical College during six months' time period. i.e. 14-5-2018 to 14-11-2018.

Sample Size: A total of 618 impressions were taken. They were divided equally in two groups i.e. 309 impressions in each group. The sample size was calculated using expected percentage of defects 55% in Two phase 1-step and 45% in Two phase 2-step. We used 80% power of test and 95% confidence of level and 5% margin of error. Sample selection was done with the help of non-probability consecutive sampling. Following inclusion and exclusion criteria was adopted for sample selection.

Inclusion criteria: Impressions that are seated in impression tray after taking impressions with both techniques

Exclusion Criteria: Impressions that dislodge from tray and impressions taken from condensation silicones.

Data collection procedure: The dimensions of the cast (8.015 mm in height, 6.330 mm and 8.450 mm at the base, and 28 mm as the distance between the centre of the two abutments) adhere to the American Standards Institute-American Dental Association specifications no 19. Figure V shows the putty and light body silicon imprints made from the stainless steel abutments used as a reference. Two-phase one-step and two-phase two-step imprint methods were used. In this research, we looked at how many problems each method had in comparison. Included in self-polymerizing resin and securely fastened to a foundation is this model.

The auto polymerizing resin was then modelled such that imprint trays could be placed on the model in a

consistent fashion. Stock perforated trays were used for all impressions. Added 3M Express vinyl polysiloxane (PVS) silicone was used to make the impressions. Due to the imprints being taken at ambient temperature rather than in the mouth, the polymerization periods were twice from what was indicated by the manufacturer. Group A consists of people who are taught the one-step, two-phase impression technique, while Group B consists of people who are taught the two-step, two-phase impression technique. Both groups' outputs were analyzed for their fault rates. Two types of impressions were taken: one-step impressions with putty and light body, and two-step impressions with 2mm thick acrylic resin copings inserted on each abutment to produce a homogeneous area for light body impression material.

The proportions were standardised using electronic callipers (Mitytoyo, Japan) and the coping was created from acrylic by eliminating material with a carbide bur until a consistent thickness was reached. After the first putty imprint was formed, the coping was taken off and a light body impression was made. Light body was reinserted until it made solid contact with the tray's edge, and then left to polymerize. Master model impressions were discarded.

An expert in standardised methods for detecting and categorizing surface flaws then analysed the removed impressions. To do this, we looked at all of the abutment's surfaces from a distance of about 150 mm and counted the amount of open voids (about 2-4 mm) and bubble-like contained voids (2 mm) we could see. To provide further evidence, we took digital photographs of each impression using a Nikon D 7100 and a Nikko macro lens of 105mm. We just tallied the number of flaws in the abutment's prepped surface. Type 1 faults (bubble-like enclosed voids) and Type 2 defects (open voids) were used to categorize the total number of flaws on each sample. The variation in defect rates was studied. You'll find a complete breakdown of the findings in the accompanying Performa.

Data Analysis: All data was entered and analyzed using SPSS version 20. Frequency and percentage applied for categorical data like defects (as per operational definition). Chi square tests applied to compare defects in both groups. P-value ≤ 0.05 was considered as significant. Data was stratified for type of voids (open/close). Post stratification chi square test was used taking p value ≤ 0.05 as significant.

RESULTS

In this study a total of 618 impressions were taken. Out of which 309 impressions were taken by Two phase one step (Group A) and 309 impressions were taken by Two phase two step impression techniques (Group B). According to this study the defect in surface was noted in 337(54.5%) impressions. In these 337 impressions

the defects classified as closed voids (type I classification) were found in 273(81%) impressions and defects classified as open voids (type II classification) were found in 64(19%) impressions. The frequency of surface defects was found in 337(54.3%) impressions. In this study in Two phase one step impression technique (group A) 309 impressions were taken. The defects in surface were noted in 185(59.9%) impressions. In Two phase two step impression technique (group B) 309 impressions were taken and the defects in surface were noted in 152(49.2%) impressions. This difference was statistically significant. i.e. p-value=0.008. Out of 337 impressions, in group A the type I defect noted in 138(74.6%) subjects and in group B the type I defect in surface noted in 135(88.8%) subjects. Similarly, in group A the type II defect noted in 47(25.4%) subjects and in group B the type II defect in surface noted in 17(11.2%) subjects. This difference was statistically significant. i.e. p-value=0.001.

DISCUSSION

This study compared the defect rates of two-phase one-step impressions to those of two-phase two-step impressions, and the research was conducted by the Department of Prosthodontics at the Institute of Dentistry at CMH Lahore Medical College. Improvements in imprint accuracy have been made possible by both technological and material advancements. Many various impression methods have been proposed, however when polyether and vinyl polysiloxane materials are utilized, the double-mix techniques have shown to be the most successful. Putty and light body, putty and medium body, or heavy body and light body may be used for either a one-step or two-step method.^{6, 12, 13}

In our study the defect in surface was noted in 337(54.5%) subjects, type I classification was found in 273(81%) subjects and type II classification was noted 64(19%) subjects. In Two phase, 1 step group the defect in surface noted in 185(59.9%) subjects and in Two phase, 2 step group the defect in surface noted in 152(49.2%) subjects. Two phase, 2 step Group showed significantly lower defects than to two phase, 1 step group. i.e. p-value=0.008. The number of close void defects were less in number in Two Phase two step impression technique. Also the number of open voids were less in Two phase two step impression compared with two phase one step impression technique.

Some of the studies are discussed below showing their results as. It has been shown in a research by EB Franco et al. that when the first impression is not relieved, the 2-step hydraulic and hydrophobic impression procedure produces stone dies with large disparities. Compared to the two-step hydraulic and hydrophobic imprint without relief, the single-step method yielded more accurate

stone dies from the impression materials studied here.⁽¹⁴⁾. Levartovsky S et al. found findings that were consistent with ours in their investigation. Short distances had more disparities than long distances did across all materials and all periods, as indicated by the author's research. There were fewer mistakes and more precision using the two-step imprint method compared to the one-step method. A deviation of less than 0.5% between the two sets of parallel lines was considered satisfactory across all materials and testing conditions. Variations in the President's substance were more pronounced than in the others¹⁵. However, research by Justin L. Boulton and colleagues shows that polysulphide provides the least precise impressions of particular abutment dimensions, both vertically and laterally. On the other hand, when a bespoke tray was used, there were no statistically significant variations in the horizontal distances between the abutments.

All evaluated materials showed inconsistent results when measured in stock trays^{15,16}. Across all six parameters, Shirley Hung et al. found no statistically significant difference in accuracy between the one-step and two-step putty wash impression procedures. There was less deformation seen in a two-step impression of Mirror 3 putty compared to either a one-step or two-step impression of Mirror 3 Extrude putty.

The same findings were also published in a research by Giuseppe Varvara and colleagues. With the novel 3-phase, 2-step impression injection process, they demonstrated a reduction in defect frequency from 100% of monophasic impressions to 5%. Although fewer impressions had faults with the 2-step method (45% vs. 55%), no statistically significant changes were found between the 1-step and 2-step 2-phase imprint approaches. Although the differences between the 3-phase and 2-phase impression injection procedures did not achieve statistical significance, the 3-phase, 2-step impression injection technique had the highest accuracy, with fewer defective specimens (5%)¹.

Table No.1: Comparison of defect frequency and type of defect classification in Study Groups

		Study Groups		P-value
		Group-A (n=309)	Group-B (n=309)	
Frequency of Defect	Yes	185(59.9%)	152(49.2%)	0.008
	No	124(40.1%)	157(50.8%)	
Classification	Type-I	138(74.6%)	135(88.8%)	0.001

CONCLUSION

This present study showed that 2 phase two step impression techniques showed significantly lower defect rate than to 2 phase one step technique in evaluation of defects in surface.

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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