A Clinical Comparison of Dental impression accuracy between One-step and Two-step Dual phase impression technique by using Polyvinyl Siloxane Impression Material.

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ABSTRACT

Objective:: The objective was to assess the number of visible defects within impression made by two different techniques.

Methodology: This was comparative cross-sectional study was conducted between June 2019 to December 2019 at out patient department of Institue of dentistry, LUMHS Jamshoro. Two impressions were made from 53 crown preparation by using one step and two step dual phase impression techniques. Totaling to 106 impressions. Polyvinyl Siloxane impression material was used with each technique. Evaluation of impressions were made for tears, voids and bubbles and impression were compute as acceptable (A or B) and unacceptable (C or D).

Result: There was no significant difference seen in proportion of overall evaluation of two impression technique, as compared by using "Chi-square test".

Conclusion: Insignificant difference was seen b/w one step and two step dual phase impression techniques.

Keywords: One step impression technique, two step dual phase impression technique, dimensional accuracy.

Introduction:

"A dental impression is a negative imprint of the teeth and oral cavity used to produce a positive replica of the structure to be used as permanent record or in production of a dental prosthesis".[1] The aim of Dental impression is to produce an error free negative replica of prepared tooth which is helpful to make a better cast.[2-3]

In dentistry, developing dental impression is considered a challenging procedure, because of inaccuracies during impression making.[4] Consequently both impression material and impression technique are of paramount importance, if final fitting is to be made reliable with successful dental restoration.[5] In Prosthodontics, there is a long list of material that may be use to develop dental impression; these includes polysulfide, condensation silicones, addition silicones and polyether. However polyvinyl siloxane introduced in dentistry in 1970; soon become most acceptable material as it has some best properties like its absence of volatile by-product, low creep, dimensional stability, low polymerization shrinkage than other materials. Currently polyvinyl siloxane is commonly used material for making impression of fixed partial, removable appliance and implant prosthesis.[4,6-8] Polyvinyl siloxane impression material also has better elastic recovery from mouth, manipulation and handling of material is simple and from single impression we can prepare many casts for study purposes. It also provides better result in case of producing fine surface details so polyvinyl siloxane is considered as best material for fixed prosthodontics. Mostly polyvinyl siloxane comes in two paste form, one base another accelerator. Both pastes can be manipulated by simply hand spatulated or by auto dispended from dual cartridge, both pates should be taken in equal amounts.[4]

Accuracy of impression can be affected by so many factors, including impression technique and impression material but some authors stated that impression material should be improved to such level that accuracy of impression can be control by impression technique rather than material itelf.[7-12] Although several techniques are available, however one-step and two step dual phase impression techniques are commonly used for fixed prosthodontics, in one step dual phase impression technique, both materials polymerize at the same time that decrease chair side time and saves impression materials.[5-8-11] In one step impression technique, around prepared teeth light body is injected than tray with putty material inserted in patient mouth and slight pressure applied till material polymerize and get set according to normal mouth tempreture.[11-13] High viscosity material in used as preparatory material. In the two-step technique, first, a putty impression is made to provide space for the light body, and then, the final impression is made using the light body. Several methods can be employed to create space in the two-step technique. One suggested strategy for this purpose is to make a putty impression, relieve (cut out) the putty material at the finish line, and make a final impression with the light body. Selection of stock tray according to jaw size is very important because it reduces chances of wastage of material and seating of tray intra-orally become comfortable for patient. Two step techniques provide better result in complete coverage of prepared teeth but there are many chances of production of occlusal deformity because during placement of putty material intra-orally, can displace some light body material at occlusal surface.[2] But frequently two step impression technique considered as batter option to produce fine details of cast.[13]

Nissan et al, demonstrated that two-step putty wash impression technique by using polyvinyl siloxane produce more precise dental impression than one-step putty wash impression technique.[12-14] But some problems can also be faced with this technique such as dimensional changes, additional chair side time and more material used.[13]

Rationale for the study. Available literature, regarding

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effectiveness of impression making while treating patients, is scanty. It is expected that the results of this study would help us to find the best method that would produce the most accurate impression with least defects and subsequently would come up with the best clinical result.

Objective:

To assess the accuracy of dental impression making by one-step and two-step dual phase impression techniques by using polyvinyl siloxane impression material.

Methodology:

This comparative cross-sectional study conducted at outpatient department of Institute of dentistry Jamshoro during June 2019 to Dec 2019. Sample size was calculated using Raosoft sample size calculator and it was found n=53 for each technique. Sample size achieved through non-probability consecutive sampling technique. During period of study patients of either gender aged between 16 -60 years requiring fixed partial denture or crown in upper or lower jaw were included. These patients were medically fit. However, patient with known history of allergy to the silicones, whose tooth preparation finish lines located at supra-gingival, has severe gag reflex and problem with temporomandibular joint were excluded from the study. Written informed consent was obtained from all participants. The data was collected on a specially constructed proforma. SPSS® version 17 was used for data analysis. Once the skilled dentist had finished preparing the teeth An acceptable operator for a fixed partial denture or crown In each instance, a metallic perforated stock tray was chosen for the impression of the maxillary and mandibular arches. For each patient, the two master impressions were created using two different methods employing polyvinyl siloxane impression material. The abutment tooth was carefully cleaned and dried before being used as an impression material. After syringing a wash solution around the prepared tooth or teeth, putty is immediately filled into the tray and inserted to create the first impression utilizing the one-step impression procedure. Before beginning the preparation, putty is used to take a second impression, which is then formed utilizing a two-step impression procedure. Putty is then allowed to solidify before being removed from the mouth. The putty is reinserted into the mouth when the tooth preparation process is finished. Then, using a Heine binocular magnifying loupe, two skilled prosthodontists graded both imprints obtained using either procedure visually. Each impression technique's overall score was recorded and graded as either acceptable (A or B) or undesirable (C or D).

Results:

Overall. the minimum age of patient was 17 years and maximum 60 years with mean and standard deviation of the age was 39.25 ± 12.19 years. Males were 27/53 (50.9%) while females were 26/53 (49.0%). Accuracy of One-Step Dual Phase Impression Technique was found as “A” in 64.2% while defects as B, C and D were 15.1%, 5.7% respectively. Accuracy of Two-Step Dual Phase Impression Technique was found as “A” in 45.3% while defects “B”, “C” and “D” were 24.5%, 20.8% and was 9.4% resp. as shown in table 1.

Defects in impression were noted in B, C and D category for both techniques. In One-Step Dual Phase Impression Technique, defects identified are shown in table 2. These defects include void, tear, bubbles and pulls. Bubble was the most frequent (n=10, 18.8%) defect noticed in B, C and D categories, followed next in frequency by tears (n=5, 0.4%), while void and pull were noticed less frequently.

Table No 1: Accuracy with respect to One-Step Dual Phase Impression Technique and Two-Step Dual Phase Impression Technique (each n=53)

Accuracy		
	One-Step Dual Phase Impression Technique. n (%)	Two-Step Dual Phase Impression Technique number. n (%)
A (No defects. Impression is useful)	34 (64.2%)	24 (45.3%)
B (Small defects)	8 (15.1%)	13 (24.5%)
C (Good reproduction of preparation finish line)	8 (15.1%)	11 (20.8%)
D (Defects at preparation finish line)	3(5.7%)	5 (9.5%)
Total	53 (100%)	53 (100%)

Table No 2: Frequency and Percentage of Defects Observed in One-Step Dual Phase Impression Technique.

	Category B (n=7)	Category C (n=9)	Category D (n=3)
Voids	1 (14.3%)	0 (0%)	1 (33.3%)
Tear	1 (14.3%)	4 (44.4%)	0 (0%)
Bubbles	5 (71.4%)	3 (33.4%)	2 (66.7%)
Pulls	0 (0%)	2 (22.2%)	0 (0%)
Total	7 (100%)	9 (100%)	3 (100%)

Table No 3: Frequency and Percentage of Defects Observed in Two-Step Dual Phase Impression Technique.

	Category B (n=14)	Category C (n=12)	Category D (n=3)
Voids	0	1 (8.33)	0
Tear	6 (42.8%)	8 (66.66)	0
Bubbles	6 (42.8%)	1 (8.3)	3 (100)
Pulls	2 (14.3%)	2 (16.6)	0
Total	14 (100%)	12	3

Table No 4: Cross tabulation for ACCURACY of One -Step and Two -Step Dual Phase (n = 106)

Techniques	Accuracy					
	A	B	C	D	Total	p value
One-Step Dual Phase Impression Technique	34	8	8	3	53	0.274
Two-Step Dual Phase Impression Technique	24	13	11	5	53	
Total	58	21	19	8	106	

A (No defects, Useful impression), B (Small defects), C (good reproduction of preparation finish line) D (Defects at preparation finish line)

Defects of Category B with respect to One-Step Dual Phase Impression observed includes 1 Voids, 1 Tear and 5 bubbles. Defects of Category C observed includes 4 Tear, 3 Bubbles and 2 Pulls while defects of Category D observed includes 1 void and 2 bubbles.

Defects identified in Two-Step Dual Phase Impression Technique other than type "A" are shown in table 3. The most frequent defect observed was tear (n=14, 26.41%) followed next in frequency by bubbles (n=10, 18.8%) while pulls and void were less frequently noticed. Defects of Category B with respect to Two-Step Dual Phase Impression Technique were 6 Tear, 6 Bubbles and 2 Pulls, defects of Category C with respect to Two-Step Dual Phase Impression Technique were observed as 1 Voids, 8 Tear, 1 Bubbles and 2 Pulls, while for category D, these defects were bubbles in 3 cases as shown in table 3.

The term accuracy is used to denote when restoration with suitable marginal adaptation and minimum gap is achieved.

Accuracy between two techniques was compared using chi -square test, we observed that statistical difference between two technique is insignificant in (p-value = 0.274)

The accuracy of impression techniques is revealed when restoration with suitable marginal adaptation and minimum gap is obtained.[2] The mechanical and bonding characteristics[3] are also significantly influenced by the marginal fit.[4-12]

Discussion:

Because of its surface reproduction and dimensional stability, polyvinyl siloxane has been considered to be the most accurate impression material for dental impressions.[14] There were no discernible differences between the two impression techniques used in the current study—a one-step and a two-phase dual phase—regarding the frequency of defects. There were some other studies that concords with this conclusion, Tjan AHL Whang et al [15], who found that all techniques produce almost identical results. Bomber and Hatch also concurred and added that with either technique small flaws may be fixed by doing an overall rewash impression.[16] Another earlier study[17] discovered that by just controlling the bulk of the impression material, the heavy body and light body two step impression technique exhibited somewhat more accurate results when compared to other impression procedures. According to another study[18], a two-step putty wash procedure with minor modifications, such as 1- and 2-mm spacer thickness, is a more palatable and practical alternative to take a precise impression in cases involving permanent partial dentures that cover a significant distance. While several studies supported the idea that the accuracy of an impression is independent of the impression technique used, a study by hung et al.19 and Idris et al.20 examined the significance of impression techniques and found no evidence that the accuracy of an impression was technique-dependent. According to a further explanation of the study by Idris et al, the use of a two-stage procedure can limit sources of mistake by reducing the potential for more bubbles to be created and incorporated in the set impression using putty wash one step impression techniques. John Purk and Shirley H. hung21 preferred the application of the two-step technique above the one step impression technique. They did so because they saw that the putty wash imprint one-step technique had far more distortion than other techniques. While a study conducted by Pardeep K. Bansal5 found that the final imprint technique utilized had little to no impact on the dimension accuracy of the dental impression. The current study revealed a lower rate of open voids, bubbles, and pulls in impressions.

This is because the majority of defects, including voids, bubbles, and tears, were brought on by operator mixing techniques, which can be easily controlled by using automixing machines.[22,27] Tear resistance demonstrated the material's capacity to withstand tearing in gingival sulcus depth and inter-proximal regions.[23] According to the current study, both one step and two step dual phase impression techniques had fewer tears. When possible, the supragingival margin should be utilized, but there are several situations where we have to use the sub-gingival margin.[24] Although in this current investigation finish lines were typically set above 1mm or slightly below 1mm so as to not violate the original biological width,25 a greater impression failure rate was seen when finish lines were placed 2mm sub-gingivally and below. Due to these measures, the accuracy of one step and two step dual phase approaches varied very little in the results of this investigation. While several authors came to the conclusion that the mono phase technique was the simplest to use, numerous vitro experiments indicated that the one step technique was the worst at providing accurate surface details.[25] Study conducted in North Carolina, United states of America showed that 86% of the evaluated impressions had at least 1 visible error, and 55% of the detectable errors were critical errors affecting the preparation finish line.[26]

Conclusion:

Statistically we did not find much difference between accuracy of two techniques and therefore unable to warrant recommendation of one technique over other. The bubbles and tear were the majority of defects that were present. Marginal area is more prone to defects.

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