

Original Article

Clinical Comparison of Polyvinyl Siloxane Impression for Fixed Partial Dentures using three Different Techniques

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ABSTRACT:

Aim: To compare the defects present in impressions between three different techniques using hand mixing elastomers. **Materials and methods:** Three master impressions were made from each 64 crown preparations with three different techniques totalling to 168 master impressions. PVS impression material, putty (Aquasil) and light-body (Reprosil) viscosity combinations were used for every patient with the three techniques i) single stage double mix technique ii) two stage technique with using a spacer and iii) two stage technique without using a spacer. The impressions were rated by two evaluators using Heine binocular magnifying loupe (2.3×) and the results tabulated. The results were presented as percentages. Kappa test was done to compare the obtained results. **Results:** Out of three techniques the least number of defects were shown by the single stage double mix technique with useable impressions of 96.42% and the two stage technique with using a spacer being the least favorable with usable impression of 86.25%. The two stage technique without using a spacer also had a result of 82.60%. Kappa test was used to compare the individual results. Between technique 1 and 2, there was fair significant agreement between the two methods ($p < 0.001$). But when comparing between techniques 1 and 3 ($p = 0.5$) and techniques 2 and 3 ($p = 0.881$), there was insignificant weak agreement signifying that technique 2 impressions were not comparable with technique 1 and 3. Among the defects there was presence of 58 void (60.5%), 26 bubbles (27%) and 12 pulls (12.5%) and absence of any tears. The number of defects located at the margins were 68% and 32% were located at others areas beside the margins. All the pulls were present at the lingual/ palatal aspect of margins while 78% and 56% if voids and bubbles were present at the margins respectively. **Conclusion:** The single stage double mix technique and two stage technique without using a spacer had a more favorable outcome in comparison to the two stage technique using a spacer using hand mixing technique.

Key words: bubbles, impression material, polyvinyl siloxane, tears, voids.

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INTRODUCTION

Making impressions to replicate oral conditions and tooth morphology is an integral part of prosthetic dentistry. Over the past four decades tremendous progress has been made in procedures for making impressions for fixed prosthodontics. The quality of fit of dental restorations is mainly influenced by the accuracy of the dental impressions. There are various techniques for making fixed partial denture (FPD) impressions. These include the following: (1) The single copper band technique, (2) the mono phase technique (in which an impression material of only 1 viscosity is used), (3) the single-step technique (in which impression materials of 2 viscosities are applied at the same time), or (4) the double-step technique (in which the impression is made

in two steps, using material of different viscosity in each step).¹⁻⁴

Dental impression making remains a challenging procedure due to the potential for voids and tears, which may adversely affect the precise fabrication of indirect restorations. Poly vinyl siloxane impression materials (PVS) were successfully introduced in the 1970s.⁴ Since that time and especially in past decade, these materials have gained in their acceptance and account for a larger share of the impression material market and used as impression materials in fabricating fixed partial dentures, removable appliances, and implant prostheses.^{2,3} Vinyl polysiloxane silicones (also called addition silicones, polyvinyls, vinyls, and polyvinyl siloxane) are considered “state-of-the-art” for fixed partial denture impressions. They constitute the most widespread use of impression

materials for fixed prosthetics.⁴ The materials are presented in the form of two pastes (a base and an accelerator) which can be hand spatulated or autodispensed from a dual cartridge, and mixed in equal quantities for use.³ Polyvinyl siloxane impression materials have the best fine detail reproduction and elastic recovery of all available materials. Because there is no by-product, they possess remarkable dimensional stability and are odorless, tasteless and pleasant for patients. They are provided in wide range of viscosities, rigidities, and working and setting times.^{4,5}

Several techniques have been described in literature but the number of clinical studies evaluating the clinical success of impression making is limited. So, present study was conducted to compare the defects present in impressions between three different techniques using hand mixing elastomers.

MATERIALS AND METHODS

Sixty eight subjects with age range between 25 and 45 years who required fixed partial denture (FPD) as a part of their dental treatment were included in the study, after obtaining their informed consent as approved by the Institutional Research Board of College Of Dentistry, Najran University, Najran, KSA. Three master impressions were made of each patient using three different techniques with polyvinyl siloxane (PVS) putty-wash impression technique. PVS impression material, putty (very high consistency) and light-body (LB) viscosity combinations were used for every patient with three different impression techniques; i) Technique 1- single stage double mix technique ii) Technique 2- two stage technique with using spacer iii) Technique 3- two stage technique without using a spacer.

After tooth preparation was completed, a knitted gingival retraction cord was used. An appropriate metallic perforated stock tray was selected for both the maxillary and mandibular arch in every case. The abutment tooth was thoroughly rinsed with water and dried to clean and eliminate any moisture. For group 1, impressions were subjected to the 1-step technique. Putty and wash impression materials were used simultaneously. The wash material was manually mixed and dispensed with a 3ml syringe around the prepared tooth with simultaneous removal of the retraction cord. The putty was mixed manually, loaded on the impression tray and placed over the whole arch.

The impression was allowed to set in the mouth for 12 minutes. For group 2, the 2-step technique was used with a polyethylene spacer. A polyethylene sheet was placed over the teeth. The preliminary putty impression was made and allowed to set for 10 minutes. Wash material was then added in the putty impression and the tray reseated after removal of the gingival retraction cord and allowed to set for 12 minutes. For group 3, the 2-step technique was used without a spacer. A preliminary putty impression was made and allowed to set for 10 minutes. Wash material was then added over the putty impression and the tray reseated after removal of the gingival retraction cord. It was allowed to set for 12 minutes.

Every impression was visually examined by two prosthodontist using a Heine binocular magnifying loupe (2.3x) and the results tabulated. The overall score of each impression material (A to D rating) was described by frequency and percentage for each material. According to a rating scale for the readability of the abutment teeth, impressions were rated as acceptable (A or B) and unacceptable (C or D). The defects were observed in the impression, and were documented as bubbles, voids, tears, or pulls defects, and their location was documented as well. Tears, voids, and bubbles were observed, which were also described by the frequency and percentage of each impression with any tear, void, or bubble for each material.

Kappa test was used to compare the results obtained by three different techniques.

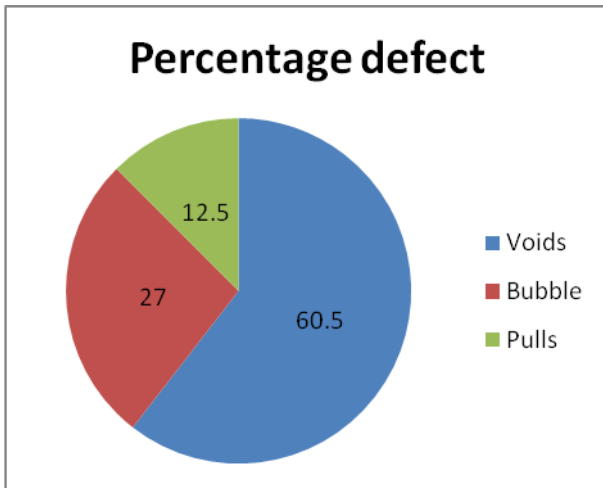
RESULT

Among the three techniques the least number of defects were shown by the single stage double mix technique with useable impressions of 96.42% and the two stage technique with using a spacer being the least favorable with usable impression of 86.25%. The two stage technique without using a spacer also had a result of 82.60%. Kappa test was used to compare the individual results. Between technique 1 and 2, there was fair significant agreement between the two methods (p<0.001). But when comparing between techniques 1 and 3 (p= 0.5) and techniques 2 and 3 (p= 0.881), there was insignificant weak agreement signifying that technique 2 impressions were not comparable with technique 1 and 3.

Table 1: Comparison of three different techniques

	Name of Technique	Results	P value
Technique 1	Single stage double mix technique	96.42%	Technique 1 and 2 (p<0.001)
Technique 2	Two stage technique with using spacer	86.25%.	
Technique 3	Two stage technique without using a spacer	82.60%	Technique 2 and 3 (p> 0.05)
			Techniques 1 and 3 (p= 0.5)

Among the defects there was presence of 58 void (60.5%), 26 bubbles (27%) and 12 pulls (12.5%) and absence of any tears (figure 1). The number of defects located at the margins were 68% and 32% were located at others areas beside the margins. All the pulls were present at the lingual/ palatal aspect of margins while 78% and 56% if voids and bubbles were present at the margins respectively.



Graph 1: Graph showing percentage defect

Table II: Rating criteria for visual assessment of defects of impression by clinical evaluator

- A = No defects. Impression is useable.
- B= Small defects such as tears, voids, bubbles which do not affect finish line to prevent use of impressions. Impression is useable.
- C= Good reproduction of preparation finish line. Other defects require impression to be remade.
- D= Defects at preparation finish line, impression needs to be remade.
- T 1= Tears at the margin,
- T2= Tears present in areas beside the margins
- V1= voids present at the margin,
- V2= voids present in areas beside the margin
- B1= bubbles present at the margin,
- B2= bubbles present in areas beside the margin
- P1= pulls present on the lingual/ palatal aspect of the impression
- P2= pulls present in the labial / buccal aspect of the impression
- P3= pulls present in the proximal aspect of the impression

DISCUSSION

In the present study, the accuracy of 4 different impression techniques was investigated. Some authors found that there was no difference in accuracy between one step and two step techniques while others criticized the one step technique. Disadvantages include lack of control of the bulk of wash material and the high risk of

capturing portions of the prepared margin in putty material rather than lower viscosity material. Putty is inadequate for fine detail reproduction.

Present study was conducted to compare the defects present in impressions between three different techniques using hand mixing elastomers.

Among the impression materials available in the market, selection of material is left to the discretion of the dentist, who makes choices based on personal preference, experience, impression philosophy and the material used.²⁻⁴

Idris B et al stated that there is tendency for more bubbles to be produced and included in the set impression with the putty/ wash one step impression technique, and with the use of two step technique this source of error can be minimized.⁵ Our study contradicted with this result as the least defects were noted in the single stage putty wash technique. This may be due to the fact that bubbles in the impression can occur when spatulated and entrap air into the mix, less amount of wash material is used in the single step resulting in less chance of voids but in techniques using spacers, the operator had to manipulate a large amount to light body which might have incorporated air and may have caused the increased number of voids. These defects are caused by the operators mixing technique, which could be prevented by using automixing techniques. Automixing cartridges tend to create fewer bubbles than hand spatulation.² Tear resistance indicates the ability of a material to withstand tearing in thin interproximal areas and in the depth of the gingival sulcus.^{6,7}

There was absence of tears in the impression which might be due to the good tear resistant nature of material.^{7,8}

Most addition silicone materials provide higher tear strengths than polyether and hybrid materials.⁸ The adequacy of the impression is also affected by the clinician's experience level and skills and the material's handling properties here clinically experienced prosthodontist had taken the impression which would elevate this question of adequacy. Whenever possible, the margin of the preparation should be located supragingivally¹⁶; however, certain conditions may require the placement of subgingival margins.⁹ A higher impression failure rate was also shown when the finish lines were placed 2 mm subgingivally and below.¹⁰ In the present study, none of the finish lines were placed more than 1 mm or below the free gingival margins so as not to violate the biologic width.

Craig stated that impression materials have improved to such an extent that accuracy may be controlled more with technique than by material itself.¹¹

Further research with different consistencies of polyvinyl siloxanes is needed. The outcome of this study can suggest the use of single stage double mix technique to make an impression free from visual defects.

CONCLUSION

The single stage double mix technique and two stage technique without using a spacer had a more favorable outcome in comparison to the two stage technique using a spacer for hand mixing techniques. The voids and bubbles were the majority of defect that were present. However, the selection of a specific technique depends on evaluation of an individual patient and experience of the dentist.

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