

ORIGINAL RESEARCH

Comparative Evaluation of Surface Detail Reproduction of Polyvinyl Siloxane Impression Material Using Different Types of Mixing Tips- An *in vitro* Study

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ABSTRACT:

Introduction: Prosthetic dentistry includes impression-making to replicate tooth morphology and oral health. Both the material and the processes are crucial for improved impression accuracy. The purpose of the current study was to validate the automix system's surface detail replication of polyvinyl siloxane impression material using a variety of mixing tips.

Materials and methods: There were 40 samples created in all. Each group consisted of 20 people. Polyvinyl siloxane elastomeric impression material was used, together with MIXPAC Yellow T-Mixer and imitation light body mixing tips, to create an impression. According to ADA requirements, the lines on the impression were graded under a stereomicroscope for surface detail replication.

Results: In accordance with the findings, the yellow T-MIXPAC mixer reproduces surface details better (1.15 0.366). As comparison to the imitation light body mixing tip group, the MIXPAC yellow T- mixer group displayed substantially more clearly defined, sharp, continuous lines on the stereomicroscope. The MIXPAC yellow T-mixer group showed a difference that was highly statistically significant (p0.000*).

Conclusion: This study showed that, in comparison to other tips, T-mixer mixing tips worked significantly better when employed with polyvinyl siloxane impression material.

Keywords: polyvinyl siloxane, Prosthetic dentistry.

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Introduction:

A series of specific stages, including diagnostics, patient management, tooth preparation, impression taking, temporization, and lab procedure, all have an effect on the effective completion of a dental prosthesis. Making an impression constitutes one of the essential processes in creating a prosthetic

replacement that fits perfectly. The traditional imprint procedure is still useful for giving the dental laboratory information about the patient. Many variables, including periodontal health, dental hygiene, saliva, and the position of the prepared finish lines, might impact the precision of the impression.¹ Salivary moisture can obstruct the recording of

impressions and can also have an impact on the precision of dimension and detail reproduction at the borders of the impression. Other elements that affect an impression's precision include the impression process, the impression tray, and the characteristics of the impression material. In order to record an exact imprint, dimensional accuracy and surface detail replication are just two of the crucial requirements.

Four elastomer types are polysulfide, condensation silicone, addition silicone, and polyether, and they are employed as impression materials. Elastomeric impression materials can reproduce features as small as 25 microns. Dimensional variations in elastomeric impression materials can be brought on by hydrophilicity, polymerization shrinkage, resultant evaporation from polymerization reactions, shrinkage from heat modification, insufficient elastic recovery, and time spent pouring the impression.²

Also known as "viny polysiloxane," or VPS, is another name for polyvinyl siloxane, or PVS. It has been described as addition-silicone because of its silicone chemical foundation. In most therapeutic settings, it is the preferred substance. To what extent indirectly generated prostheses and restorations fit properly depends largely on the replication of surface features and dimensional accuracy in polyvinyl siloxane.³

Hand mixing has been replaced by automix devices, such as disposable intraoral syringes, dispenser with linked cartridges, or automatic mixing machines. The imprint material produced by automatic mixing has fewer voids and is more homogeneous than that produced by hand mixing. Automixed alginate has been shown to have enhanced elasticity and reproduction of surface features that are actually on par with elastomeric materials.⁴ Moreover, the rheological characteristics of impression materials are altered by automixing, providing less viscosity and

better-flowing mixtures, a characteristic that is practically applicable and desired in several clinical circumstances.⁵ Automated mixing was found to have superior qualities than manual mixing. However, it should be emphasised that automatic mixers have a significantly shorter working time; they can make fine paste with few air bubbles with ease. It displays exceptional qualities.⁶

There are many different types of mixing tips on the market. The goal of this investigation was to confirm the surface feature replication of polyvinyl siloxane impression material with various types of mixing tips in the automix system. The null hypothesis states that, there would be distinction between the impressions made by the various mixing tips.

Materials and methods:

The research was done at the Panineeya Mahavidyalaya Institute of Dental Sciences and Research Center's prosthodontics department. The Panineeya Institute of Dental Sciences and Research Center's Ethics Committee gave its approval to the study protocol. 40 samples in all were created. They were split up into two groups of twenty. Three horizontal parallel lines, x, y, and z, were scribed to depths of 50, 20, and 75 μ m on a stainless steel die created as specified by ADA standard No. 19, and two vertical cross lines, cd to c' d', were made to intersect the x, y, and z lines.

With the use of two different types of mixing tips, namely MIXPAC Yellow T-Mixer and imitation light body mixing tips, an imprint was created using polyvinyl siloxane elastomeric impression material (figure 1). The lines on the impression were graded in accordance with ADA requirements (figure 2) and examined using stereomicroscope for surface detail replication (figure 3 & 4).



Figure 1: Tips used in the study



Figure 2: ADA model image

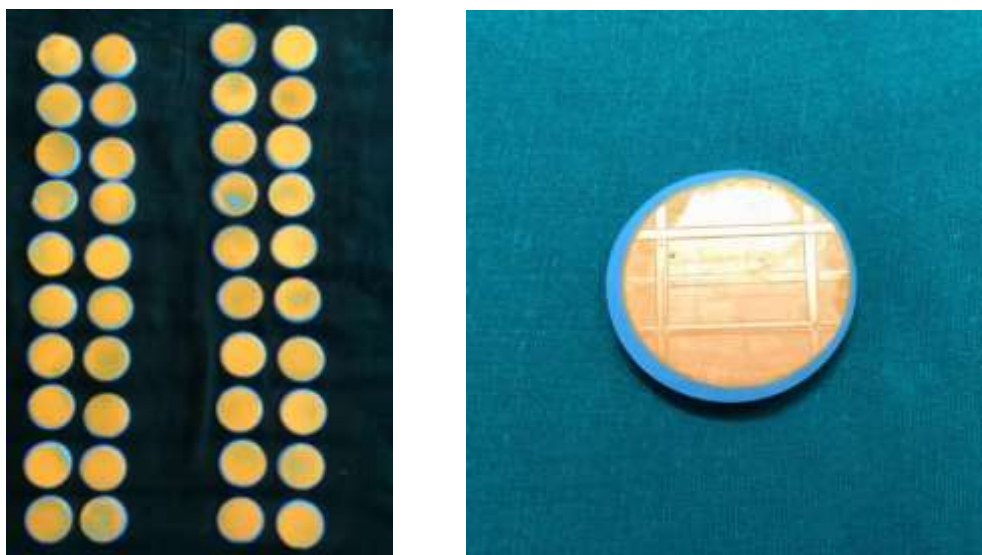


Figure 3 & 4: Surface detail replication images

Statistical analysis:

The Statistical Package for Social Sciences (SPSS) was used to statistically analyse the study. For both groups, descriptive statistics like mean and standard deviation were computed. The two groups were compared using the t test. Statistics were deemed significant at P 0.05.

Results:

Twenty samples in all were examined. The outcomes showed that MIXPAC yellow T- mixer reproduced surface detail better (1.15±0.366). In comparison to the imitation light body mixing tip group, there were noticeably more well defined, sharp continuous lines

on the stereomicroscope for the MIXPAC yellow T-mixer group. The MIXPAC yellow T-mixer group showed a highly statistically significant difference (p<0.000*) (table 1). It has been demonstrated that the MIXPAC yellow T-mixer group produces superior surface detail reproduction than the imitation light body mixing tip group. The MIXPAC yellow T-mixer group (1.15±0.366) shows improved surface reproduction when compared to the imitation light body mixing tip group in the bar graph as well (figure 5).

Groups	Sample size (n)	Mean	SD	P value
Group A	20	1.30	0.470	0.000*
Group B	20	1.15	0.366	

Table 1: Comparison between groups

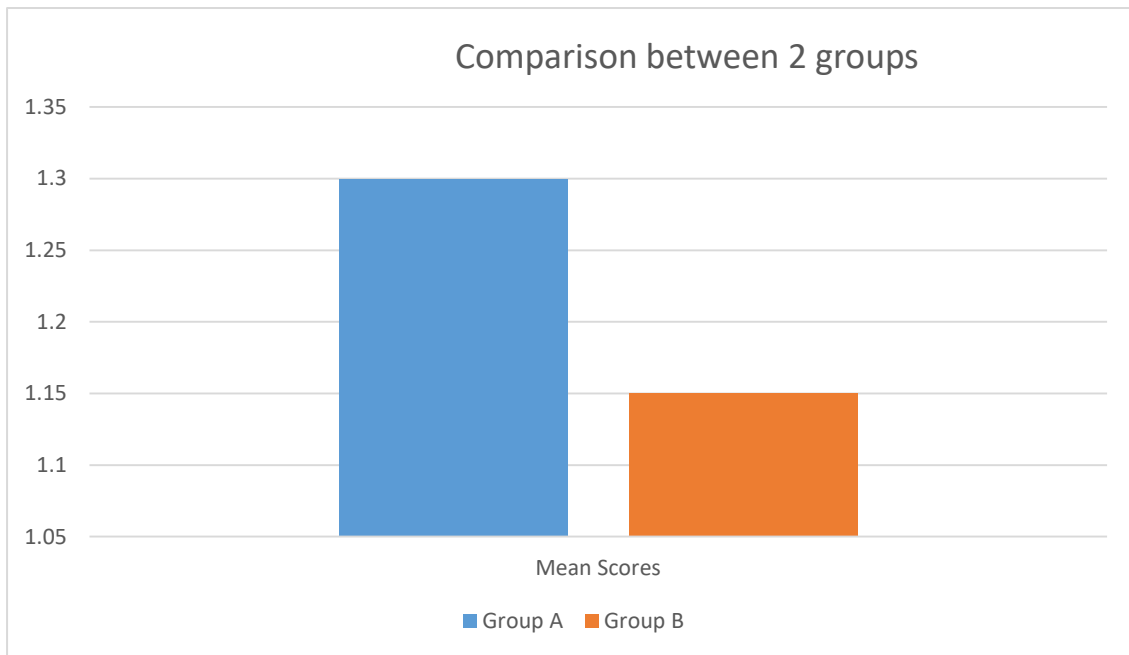


Figure 5: Graph showing differences between 2 tips used

Discussion:

There are four key areas from which to approach a debate on the fundamental standards of impression materials. It deals with aspects that affect the dimensional stability on the one arm, and elements that have an impact on the impression's volumetric correctness on the other. Also, factors like cost, taste, and colour are taken into consideration, as well as the manipulation and setting properties of the impression material.³

Polyvinyl siloxane impression materials are exceptionally accurate when utilised in clinical dentistry practise, according to Shilling Burg et al.⁷ In some cases, dentists will wait up to 72 hours before pouring impressions. The material should maintain its dimensional accuracy during this period of time. Dimensional stability of a substance was often time dependent. When compared to other elastomeric materials, polyvinyl siloxane impression materials have shown finer dimensional stability, primarily since they do not emit any by-products.⁸ According to Goncalves et al, polyvinyl siloxane was more durable than polyether, which only had a 24-hour window of dimensional stability.⁹ When compared to polyether, polyvinyl siloxane has higher surface detail reproduction.³ Hence, polyvinyl siloxane was selected as the impression material of choice in the present study. The surface feature replication of polyvinyl siloxane impression material was evaluated using two mixing tips in the present study.

Due to their simplicity, ease of price, lack of spatulation, uniformity of the mixture, and ease of use, Craig et al. concluded that the adoption of automixing tips was crucial.¹⁰ According to Chee et al., using an automixing system decreased the amount of bubbles that were mixed into the mixture for all impression materials.¹¹

To improve material utilisation while generating impressions, there are shorter impression mixing tips, such the T-Mixer. The current study's findings demonstrated that the T-Mixer mixing tip enhanced material mixing capabilities in comparison to the traditional helical mixing tip and that surface detail replication was more appreciated in samples created using the T mixer mixing tip. As a result, the initial null hypothesis was rejected.

Due to the internal architecture design of the mixing tips, surface detail replication of samples made using T-mixer mixing tips was noticeably better than that made using standard mixing tips. The group-B samples' lines underwent stereomicroscopic examination and were found to be crisp and continuous. According to the ADA Standards of Grading, each tested sample in the study group and control group received a grade.

Conclusion:

Due to their potential to reproduce surface detail more accurately, newer mixing tips on the market required consideration and hence the current study was conducted. This was an initial study to evaluate the reproduction of surface detail in polyvinyl siloxane using various mixing tips. The findings of this investigation demonstrated that T-mixer mixing tips greatly outperformed conventional mixing tips when used with polyvinyl siloxane impression material in comparison to other tips.

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