

# Efficacy of Different Gingival Displacement Materials in the Management of Gingival Sulcus Width: A Comparative Study

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## ABSTRACT

**Aim:** The aim of this study was to assess the effectiveness of different gingival displacement materials in the management of the width of the gingival sulcus.

**Materials and methods:** Totally, 60 participants who were aged 18 years and more were chosen for this study. The eligible participants were those who required fixed prosthesis with at least one abutment. A modified sectional tray was used to make impressions with elastomeric materials along with additional polysilicon using the double mix single impression technique. All participants were divided randomly into three experimental groups with each group having 20 participants as follows: group I—Expasyl, group II—Magic Foam Cord, and group III—Traxodent. Soon after retraction, impressions were made and assessed in a comparable manner to pre-retraction impressions. Image analysis software was used to measure the quantity of displacement of the gingiva, marked as the distance from the tooth to the gingival crest in the horizontal level under stereomicroscope.

**Results:** The highest mean sulcular gingival width ( $0.644 \pm 0.22$ ) was found in Traxodent group followed by Expasyl group ( $0.590 \pm 0.11$ ) and Magic Foam Cord group ( $0.528 \pm 0.01$ ). A statistically significant difference ( $p < 0.001$ ) was found between the groups. Intergroup comparisons between the gingival displacement materials showed a statistically significant difference ( $p < 0.05$ ) between group II and group III.

**Conclusion:** The present study concluded that all three gingival displacement materials lead to gingival displacement, which is needed for impression making. Slightly more retraction was seen in the Traxodent group when compared to the Expasyl group and Magic Foam Cord group.

**Clinical significance:** The success of fixed prosthodontic treatment depends upon precision and accuracy in every step involved in the procedure. One of the most vital steps making precise impressions in relation to dimensional accuracy, tear strength, etc. It is essential to have an adequate thickness of the impression material along the margins to avoid distortion. This objective can be achieved by acceptable gingival retraction.

**Keywords:** Expasyl, Gingival displacement, Horizontal displacement, Magic Foam Cord, Traxodent.

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## INTRODUCTION

The enduring success of fixed prosthodontic restorations is mainly reliant on the well-being and firmness of the adjacent periodontal structures. Not any single restoration in dentistry is neither reliant on nor influences the periodontal health as much as the complete coverage restoration does. The complete coverage restorations frequently need margins along subgingival areas due to caries, esthetic requirements, restorations that are already present, or as a prerequisite for more retention. In these scenarios, the dentist must make impressions that precisely capture the cervical finish lines prepared intraorally, fabricate exact dies, over which restorations are made.<sup>1</sup>

In order to make an accurate impression, it is vital to have a dry (free of fluid) and clean (free of debris) field intraorally, and the subgingival tissue has to be pushed to record the finish line. The finish lines and prepared abutments can be accurately registered by active gingival retraction, that is, displacement of gingival tissue to expose the cervical part of the tooth surface.<sup>2</sup>

Gingival tissues get displaced reversibly with gingival retraction such that most of the impression material with low viscosity can enter the enlarged sulcus and capture the margins. Both vertical and lateral displacement of gingival tissues can be obtained with gingival retraction. With vertical retraction, the cut part of the tooth apical to the finish line gets exposed. Lateral retraction shifts the tissues and offers acceptable bulk of impression material such that it could be removed intact from the mouth without any tears.<sup>3</sup>

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The market presently has numerous options for gingival tissue retraction, for example, surgical method (rotary curettage, electrosurgery, and lasers), mechanical method (retraction cords),

and chemo-mechanical method (chemicals embedded in cords). The most common being the use of gingival retraction cords.<sup>4</sup>

The cordless methods have now been presented with many claimed benefits, such as negligibly invasive, time-saving, and improved patient comfort. There are clinical reports regarding the use of this displacement material, but the effectiveness of the tissue displacement achieved is not adequately documented. Expasyl is a gingival retraction material with paste-like consistency, which is reliant on the hygroscopic expansion of kaolin on contacting the crevicular fluid and hemostatic properties of aluminum chloride, to provide minor gingival displacement within 2 minutes. Magic Foam Cords is a polyvinyl siloxane material that gradually expands and is fabricated for simple and quick sulcular gingival retraction with no time-consuming and potentially traumatic episodes of packing of retraction cord.<sup>5</sup>

The recently introduced Traxodent Hemodent paste retraction material is made up of 15% aluminum chloride topical paste and cotton caps and has been fabricated to enhance the gingival displacement and aid in hemostasis.<sup>6</sup> Thus, this study was conducted to evaluate the effectiveness of diverse gingival displacement materials in the management of the width of the gingival sulcus.

## MATERIALS AND METHODS

### Selection Criteria

The present study was conducted in the Department of Prosthodontics. Totally, 60 participants aged 18 years and more were chosen for this study. The eligible participants were those who required fixed prosthesis with at least one abutment. Ethical approval was obtained (ADCH/2018/06/0172), and all the participants provided written informed consent.

Participants needing fixed prosthetic treatment with at least one abutment tooth, age at least 18 years, having a healthy abutment tooth clinically and radiographically, with no regressive changes or development anomaly, with a probing depth of <3 mm were included in this study.

Patients aged <18 years with uncontrolled diabetes, hypertension, hyperthyroidism, and other cardiovascular disorders, abutment tooth with signs of attachment loss and clinical mobility, and the presence of exudates were excluded from this study.

### Pre-retraction Impression

Prior to the initiation of crown preparation, alginate impressions were made for the chosen arch to fabricate a customized sectional tray for elastomeric impression making. Post this, the crown was prepared with a finish line positioned equigingivally. After this, an elastomeric impression was made using a double mix single impression technique with a customized sectional tray with the help of additional polysilicon. The impression was verified for the presence of any voids, after which it was boxed and then poured in type IV dental stone.

Later a flexible, smooth measuring strip with gradings of 0.5 mm was used to measure the depth of sulcus at midbuccal, distobuccal, and mesiobuccal regions in the vertical direction prior to retraction. Post this, the gingiva surrounding the abutment tooth was retracted with the help of either of the gingival displacement materials.

### Sample Size Calculation

The formula used to calculate sample size was

$$n = \frac{Z_{1-\alpha/2}^2}{d^2}$$

where

$n$  is the required sample size

$Z_{1-\alpha/2}$  is a constant, and its value for a two-sided test is 1.96 for 95%

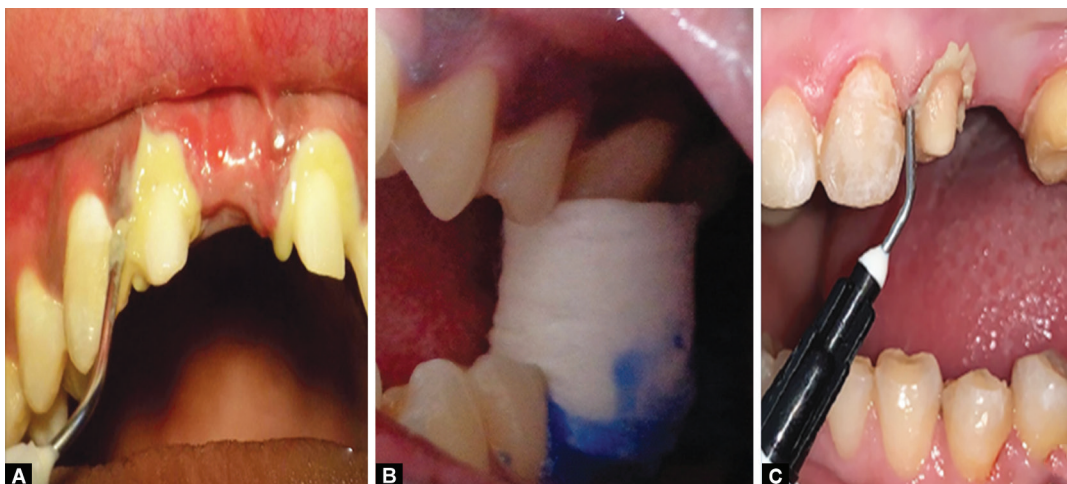
$d$  is absolute precision 20% = 0.2

$\sigma$  is pooled variance

All 60 participants were divided randomly into three investigational groups, that is, 20 participants in each group as follows (Fig. 1).

### Group I: Expasyl

A gun at even pressure was used to inject the Expasyl (Kerr Corp., Orange, California, USA) retraction paste slowly into the gingival sulcus. The tip of the gun was perpendicular to the tooth axis, and then it was pressed toward the tooth and positioned until it touched the sulcus lining of the gingival margin. Expasyl was retained in position for 2 minutes. The tooth was then profusely irrigated with water until all remnants of materials are washed away.<sup>7</sup>



Figs 1A to C: Application of gingival displacement materials (A) Expasyl; (B) Magic Foam Cord; (C) Traxodent

### Group II: Magic Foam Cord

Magic Foam Cord (ColteneWaldent AG, Altstätten, Switzerland) is a mechanical method of gingival retraction with no medicaments. The Magic Foam Cord was held in position during the retraction technique with the help of Comprecap, which was manufacturer-provided. The suitable size of Comprecap was chosen and altered. Magic Foam Cord was injected into the sulcus of the gingiva. The chosen Comprecap was held on to the abutment to push the material deep into the sulcus of the gingiva, and the participants were informed to bite over it for a period of 3 to 5 minutes.<sup>3</sup>

### Group III: Traxodent

The margins of prepared teeth were held dry by air-drying. A syringe was used to dispense the Traxodent (Premier Dental, Pennsylvania, USA) paste into the sulcus of gingiva. The paste was then gradually applied all around the sulcus of the teeth. The gingival had to turn white to indicate that the paste was applied well. As per the manufacturer's suggestions, the paste was left there for 2 minutes and then rinsed off with water. After this, the tooth was air-dried.<sup>6</sup>

Soon after this, post-retraction impressions were made and assessed in a comparable manner to pre-retraction impressions. The impressions were made to a cast with type IV dental stone using a vacuum mixer and vibrator. Once the material was set, the casts were regained and trimmed to get a flat base.

### Measurement of Gingival Displacement

An image analysis software was used to measure the quantity of displacement of gingiva, marked as the distance from the tooth to the gingival crest in the horizontal level under a stereomicroscope (SZMCTV1/2 Spectro). The image analysis measurements were recorded in a micrometer scale, which was then converted into grading in millimeters. The amount of retraction was considered by subtracting the measured width prior to the retraction from the one which was obtained post-retraction.

### Statistical Analysis

The mean and standard deviation was calculated using SPSS software (version 20.0). The comparison between different groups of gingival displacement materials was done using one-way analysis of variance. A *p*-value of less than 0.05 was measured statistically significant.

## RESULTS

The comparison of mean sulcular gingival width prior to placement of gingival displacement materials is as shown in Table 1. The highest mean sulcular gingival width  $0.184 \pm 0.12$  was in Magic Foam Cord group, followed by Expasyl group ( $0.180 \pm 0.20$ ) and Traxodent group ( $0.178 \pm 0.14$ ). But no statistically significant difference was found between the groups ( $p > 0.05$ ).

The comparison of mean sulcular gingival width after placement of gingival displacement materials is as demonstrated in Table 2. The highest mean sulcular gingival width was  $0.644 \pm 0.22$  in Traxodent group, followed by Expasyl group ( $0.590 \pm 0.11$ ) and Magic Foam Cord group ( $0.528 \pm 0.01$ ). A statistically significant difference ( $p < 0.001$ ) was found between the groups.

Table 3 shows multiple comparisons between the different gingival displacement material groups. A statistically significant difference ( $p < 0.05$ ) was found between groups II and III.

**Table 1:** Comparison of mean gingival sulcus width before placement of gingival displacement materials

<i>Gingival displacement materials</i>			
<i>Groups</i>	<i>Mean ± SD</i>	<i>F value</i>	<i>p value</i>
Group I: Expasyl	$0.180 \pm 0.20$		
Group II: Magic Foam Cord	$0.184 \pm 0.12$	19.084	0.860
Group III: Traxodent	$0.178 \pm 0.14$		

**Table 2:** Comparison of mean gingival sulcus width after placement of gingival displacement materials

<i>Gingival displacement materials</i>			
<i>Groups</i>	<i>Mean ± SD</i>	<i>F value</i>	<i>p value</i>
Group I: Expasyl	$0.590 \pm 0.11$		
Group II: Magic Foam Cord	$0.528 \pm 0.01$	22.408	0.001
Group III: Traxodent	$0.644 \pm 0.22$		

**Table 3:** Comparisons of the mean difference between the groups using Tukey Honestly Significant Difference

<i>Group</i>	<i>Compared with</i>	<i>Mean difference (I-J)</i>	<i>Sig.</i>
Group I	Group II	0.062	0.18
	Group III	-0.054	0.06
Group II	Group I	-0.062	0.18
	Group III	-0.116	0.001*
Group III	Group I	0.054	0.06
	Group II	0.116	0.001*

\*Significant,  $p < 0.05$

## DISCUSSION

Fixed prosthodontic treatment includes the use of artificial substitutes for the restoration and replacement of teeth so as to enhance patients' masticatory efficiency and comfort, preserve integrity and health of the dental arches, and elevate the patients' self-identity. The utmost basic measure of the tooth preparation principles is marginal integrity.<sup>8</sup>

The restoration's success and healthiness of the prepared abutment tooth's periodontium critically depend on an agreeable association between the finish line and gingival margins. It is desirable to position the restoration's gingival finish lines either equigingival or supragingival after consideration of periodontium's health. It becomes inevitable to place the margins subgingivally due to various reasons, such as esthetics, caries, prevailing restorations, and a necessity for extra retention. Because of these, some type of gingival displacement is required to record the finish line.<sup>9</sup>

Gingival displacement or tissue management is defined as "the retraction of marginal gingiva away from the tooth prior to recording the impressions is a critical stage for ideal replication of marginal details in fixed restorations."<sup>10</sup> Displacement of gingiva enables efficient impression making, management of fluid, finishing and positioning of prepared tooth margins, elimination of extra cement, etc. Impressions made with the width of sulcus lesser than the ideal value, that is, 0.15 to 0.2 mm, have increased frequencies of voids in the marginal area and reduced tear strength of impression material.<sup>11</sup>

In this study, the extreme increase in mean width of sulcular gingiva was found in Traxodent group followed by Expasyl group and Magic Foam Cord group. As per Phatale et al.,<sup>12</sup> it is safe and easy to use newly improved material, the retraction pastes like Expasyl or Magic Foam Cord for gingival retraction. The slightest pressure applied by Magic Foam paste on the gingiva led to hemostasis. They were found to be better than the cord histologically, with regards to the periodontium. The tolerance by the patient was noted to be very good. The material demonstrated complete biocompatibility without the requirement of anesthesia. It was also reinforced by Kazemi et al.<sup>13</sup> that retraction paste causes reduced gingival inflammation.

It was reported by Raghav et al.<sup>14</sup> that MagicFoam was an expanding polyvinyl siloxane material designed for fast, easy, and atraumatic sulcular gingival displacement. However, it was found to be less efficient when compared to the other two groups. The effectiveness of three nontraumatic gingival displacement systems was evaluated by Thimmappa et al.<sup>15</sup> and Singh et al.,<sup>16</sup> and they reported minimum gingival displacement with Magic Foam Cord. These results are in accordance with the results obtained by our study.

A single operator recorded all the measurements in this study so as to avoid the inconsistency in measurements that could arise by multiple operators. The present study results are not similar to the results obtained by Kohli and Hegde<sup>6</sup> who reported Traxodent as a chemical method that did not generate physical pressure when placed in the gingival sulcus. Thus, Traxodent attained less amount of retraction. One more study by Gupta et al.<sup>10</sup> found statistically significant differences between vertical and horizontal retraction achieved by Traxodent, and this was less.

As per the results obtained by this study, all the three retraction systems are judiciously satisfactory, because all three offer more retraction than the least amount of retraction (0.22 mm) needed for any fixed partial denture impressions.<sup>17</sup> After considering the limitations of this study, it was demonstrated that the use of the paste system was quick, easy, and painless, thus minimizing chairside time.

Many more studies have to be performed in the future to analyze various retraction systems that are commercially available and made explicitly for fixed partial impressions. Digital techniques could be used to make measurements than manual measurements. The limitations of this study are the impact of gingival distensibility, the thickness of the gingiva, diverse sulcular depth, and failure to consider the accessibility and visibility on the gingival displacement.

## CONCLUSION

The present study concluded that all three gingival displacement materials lead to gingival displacement that is needed for impression making. Slightly more retraction was seen in Traxodent group when compared to the Expasyl group and Magic Foam Cord group.

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