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ORIGINAL RESEARCH

Evaluation of Efficacy of Different Gingival Displacement Materials on Gingival Sulcus Width

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ABSTRACT

Aim: The purpose of the present *in vivo* study was to measure the efficacy of different gingival displacement materials in achieving gingival tissue displacement and to compare the efficacy of Expasyl displacement paste (Pierre Rolland, France) and gingival displacement cord for gingival displacement.

Materials and methods: Sixteen subjects were included in the study. Premolars were prepared to receive full veneer crown, gingival displacement was carried using gingival retraction cord and gingival displacement paste. Impression of the gingival sulcus was made. Sulcus width after displacement was measured under magnification.

Results: The mean displacement value of sulcus width was 0.21 ± 0.01 mm for the gingival retraction cord and 0.26 ± 0.02 mm for the gingival displacement paste. 'F' test was used for statistical analysis. Difference among the two test agents was statistically significant ($p < 0.01$).

Conclusion: Gingival displacement paste showed better response in achieving horizontal displacement of the gingival sulcus than gingival retraction cord.

Clinical significance: Gingival displacement helps in recording the unprepared tooth surface adjacent to the finish line in the impression being made, thereby helping a better marginal adaptation and emergence profile in the extracoronal restoration.

Keywords: Gingival displacement, Cord less technique, Horizontal displacement, Crossover study.

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INTRODUCTION

Fixed prosthodontic procedure requiring tooth preparation below the free gingival margin must be accomplished by gingival displacement to accurately record the prepared tooth margin during impression making. An impression, which exactly records the aspects of the prepared tooth including the finish line and sufficient unprepared tooth structure immediately adjacent to the margins, is essential for the marginal adaptation.[1-3] The elastomeric impression materials are popular due to their high degree of accuracy in registering details. However, most of them have an inherent lack of wettability that may prevent adequate registration of soft and hard tissue details. The control of the fluids in the gingival sulcus is mandatory, particularly when hydrophobic impression materials are used, as the sulcular fluid which can cause an incomplete impression of the critical finish line. The marginal integrity of the restoration depends on its close adaptation to the finish line of the preparation. The gingival tissues should be displaced to accurately record the prepared finish line during impression making.

The mechanical method of gingival displacement using retraction cord has been a standard for several years. It acts by physically pushing the gingiva away from finish line, but its effectiveness is limited because of its inability to control the sulcular fluid seepage.[4,5] The mechanochemical method using cords impregnated in hemostatic agents are the most commonly advocated. Enlargement of gingival sulcus as well as control of fluids seeping from the walls of gingival sulcus is readily accomplished by combining chemical action with pressure packing.[6] However, the placement of the cords into the gingival cervice may cause slight trauma to the sulcular epithelium and is also time consuming.[1,4]

The injectable gingival displacement paste (GDP) (Expasyl, Pierre Rolland, France) containing kaolin and aluminum chloride as a hemostatic agent which has been recently introduced, claims improved ability to achieve tissue management with fewer traumas to gingival tissues even under the most difficult clinical situation and is less

time consuming. There are clinical reports regarding the use of this displacement material but the effectiveness of the tissue displacement achieved, is not adequately documented.[7] The purpose of the present study was to measure efficacy of gingival displacement cord (GDC) (#00, knitted cord impregnated with 15.5% ferric sulphate) (Ultradent products, USA) and GDP in achieving gingival tissue displacement and to compare the efficacy of GDC and GDP in achieving gingival tissue displacement.

MATERIALS AND METHODS

A total of 16 patients were included in this randomized crossover study. All patients were recruited through the Department of Prosthodontics. The patients required full veneer crowns in relation to premolars. All the patients had a good oral hygiene and were free of gingival inflammation. A total of 32 assessments were done, 16 assessments for each test agent. Out of 16 assessments, eight assessments were carried by first placing the GDC followed by placement of GDP with a gap of 8 days and for rest of eight assessments were *vice versa*.

Teeth were prepared according to standard prosthodontic principles to receive full veneer crown (uniform occlusal reduction of 1.0 to 1.5 mm and axial reduction of 1.2 to 1.5 mm with shoulder finish line at the level of marginal gingiva) followed by placement of GDC in the gingival sulcus of premolar.

Matrix impression system was performed in the study. At first, polyvinyl siloxane-putty (3M ESPE, Express STD) was hand mixed and an impression of the prepared teeth was made by extending one tooth adjacent on either side using a carrier to obtain a matrix (Fig. 1). The thickness of the matrix was between 1 and 3 mm. The outer portion of the matrix was trimmed to the gingival crest with a Bard Parker blade. The axial walls of the prepared teeth in the matrix were trimmed to provide space for the impression material. The internal, incisal or occlusal aspect was not trimmed. The portions of the matrix contacting the proximal surfaces of adjacent unprepared teeth were relieved. Tray adhesive was applied on the preformed matrix. Then a definitive impression was made using the matrix of the prepared teeth with a heavy body material (3M ESPE, Imprint II garant) which was injected over the abutments with an automatic mixing system.

GDC was packed in the gingival sulcus from distolingual/palatal to the distobuccal using a serrated cord packer with minimal pressure. The excess of the cord was removed leaving about 2 to 3 mm of the displacement cord outside the sulcus for the ease of removal (Figs 2 and 3).

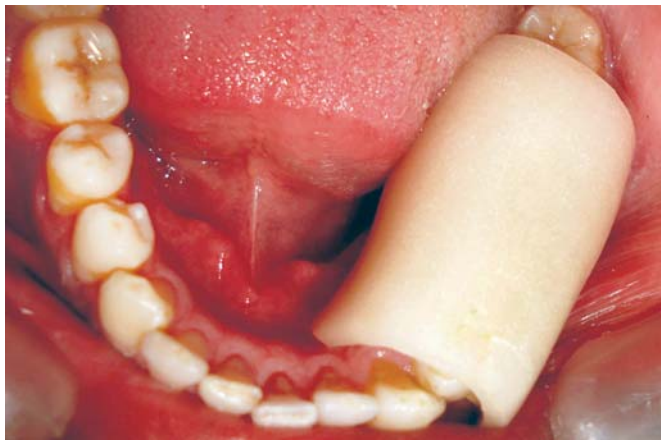

Fig. 1: Carrier for impression

Fig. 2: Impregnated knitted cord in sulcus

Fig. 3: Gingival sulcus after displacement

GDP cartridge with the dispensing tip was attached to the cartridge and loaded in the dispensing gun; material was slowly dispensed into the sulcus resting on the tooth without exerting any pressure with the tip on the gingiva. The paste applied must have a dry and compact appearance; if not a second injection was performed (Figs 4 and 5).

Matrix with the impression of the displaced sulcus (Fig. 6) was sectioned in the mid region and was focused under the optical stereomicroscope (Olympus, Japan) and

Fig. 4: Expasyl in sulcus

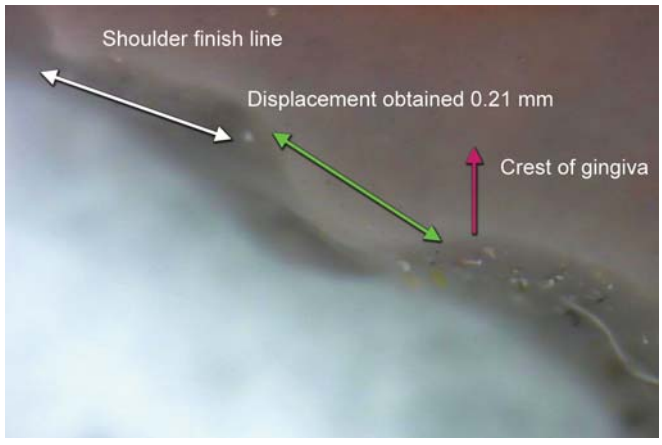

Fig. 7: Impregnated knitted cord impression under magnification

Fig. 5: Gingival sulcus after displacement

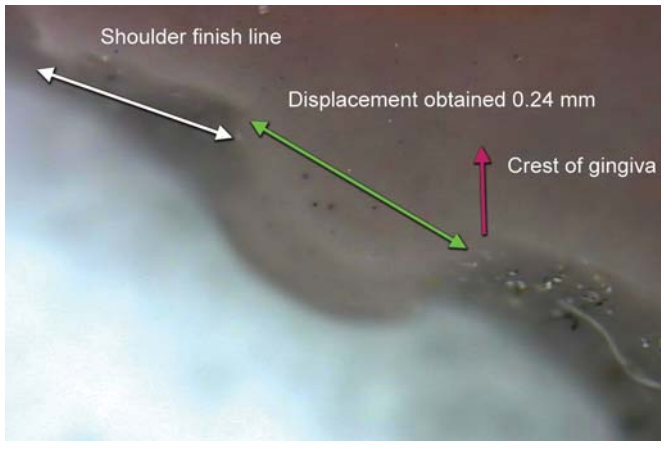

Fig. 8: Expasyl impression under magnification

Fig. 6: Obtained impression

the measurement was made from the unprepared part of the tooth to the crest of the gingiva (Figs 7 and 8). Three measurements were made per section of an impression and the mean was taken as a measurement value. This procedure was repeated for all the 32 impressions.

RESULTS

Table 1 shows the mean sulcus width obtained with gingival displacement agents after placing retraction cord and paste and after placing paste and retraction cord. It was observed that mean horizontal gingival displacement for the GDC was 0.21 mm with ±0.01 and that for the GDP was 0.26 mm ± 0.02 (Table 2). Statistical analysis ($p < 0.01$) resulted in a statistically significant difference for mean displaced sulcus width for two agents. The analysis for gingival displacement obtained in maxillary and mandibular premolars was performed. The mean sulcus width for the retraction cord in maxillary arch was 0.20 mm and for mandibular arch was 0.22 mm and for injectable retraction material mean sulcus width in maxillary arch was 0.27 mm and for mandibular arch was 0.26 mm (Table 3). Statistical analysis ($p < 0.05$) resulted in a statistically significant difference for mean displaced sulcus width for the retraction cord in both the arches.

DISCUSSION

This study was designed to evaluate the clinical success of the GDP material, which is claimed to be a tissue friendly product designed as an alternative to displacement cords,[7] though there are a few clinical reports regarding the use of this material. Research data on the predictability and efficacy of this material is lacking. A mean displaced

Table 1: Mean sulcus width obtained with gingival displacement agents

Displacement agents	*Displacement (mm)*	
	Retraction cord	*Expasyl paste*
Retraction cord-Expasyl paste	*0.20*	*0.27*
	0.18	0.25
	0.21	0.27
	0.20	0.24
	0.22	0.24
	0.21	0.29
	0.21	0.27
	0.20	0.29
Displacement agents	*Displacement (mm)*	
	Expasyl paste	*Retraction cord*
Expasyl paste-retraction cord	0.27	0.22
	0.25	0.20
	0.25	0.23
	0.28	0.23
	0.24	0.22
	0.22	0.23
	0.24	0.20
	0.26	0.19

sulcus width of 0.21 ± 0.01 mm for the GDC and 0.26 ± 0.02 mm for GDP material was obtained in our study. Studies have shown that the retraction cord should be left in the sulcus for approximately 10 minutes for obtaining adequate tissue displacement with very minimal injury to the gingival tissues and leaving it for more than 10 minutes can lead to damage of sulcular epithelium.[3,8,9] Hence in the present study, the test agents (cord impregnated with 15.5% ferric sulfate) were left in the sulcus for a period of 10 minutes.

Displacement by retraction cord caused damage to the sulcular and junctional epithelia and underlying connective tissue. Healing was rapid (8 days).[10] A gap of 8 days was given between the two test materials. Laufer et al reported that the sulcus remained open for longer periods at the mid-buccal point. The midbuccal point was considered suitable for the sulcus width measurement.[11]

Matrix impression system was performed in the present study. It incorporates the attributes of traditional methods and controls the four forces (relapsing, retraction, displacement and collapsing) that impact on the gingiva during the critical phase of making the impression, while attempting to register the subgingival margins.[12,13]

In the present study, number of subjects was obtained for whom full veneer crowns were indicated for premolars. For standardization the buccal sulcus of prepared premolar was selected for the sulcus width measurement.

In the present study, the mean sulcus width for the GDC in maxillary arch was 0.20 ± 0.002 mm and for mandibular arch was 0.22 ± 0.001 mm and for GDP mean sulcus width in maxillary arch was 0.27 ± 0.002 mm and for mandibular arch was 0.26 ± 0.002 mm; the results are consistent with the study conducted by Raja et al.[14]

Though the two test materials used in this study achieved the adequate amount of horizontal displacement. The agent which is least traumatic to the tissues ranks better. Cord packing procedures have a potential to cause detachment of sulcular epithelium and induce bleeding, if adequate care is not exercised. In contrast, placement of the GDP requires only passive syringing of the material into the sulcus. When viewed in this light, the GDP holds promise when compared to the GDC, in achieving adequate horizontal displacement with fewer traumas to the tissues.

Use of all the test agents in the same tooth at different intervals, were taken into consideration in this study. Thus, the effect of these factors is considered in both interpretation

Table 2: Comparison of gingival displacement obtained by the two-test agents

Groups	*Displacement agents*	*Gingival displacement (mm)*		*Expasyl paste vs retraction cord*		
		Range	*Mean ± SD*	*Mean difference*	*Significance*	
					F	*p-value*
1st group	Retraction cord	0.20-0.24	0.22 ± 0.01	0.04	15.6	<0.01 S
	Expasyl paste	0.26-0.29	0.26 ± 0.02			
2nd group	Expasyl paste	0.24-0.29	0.27 ± 0.02	0.06	58.1	<0.01 S
	Retraction cord	0.19-0.23	0.21 ± 0.01			
1st and 2nd groups	Retraction cord	0.19-0.24	0.21 ± 0.01	0.05	59.2	<0.01 S
	Expasyl paste	0.23-0.29	0.26 ± 0.02			

S: Significant

Table 3: Comparison of gingival displacement obtained by maxillary and mandibular premolars

Displacement system	*Maxillary arch*	*Mandibular arch*	*Maxillary vs mandibular arch*	
			t-value	*p-value*
Retraction cord	0.20 ± 0.002	0.22 ± 0.001	2.32	<0.05 S
Expasyl paste	0.27 ± 0.002	0.26 ± 0.002	0.61	0.55 NS

S: Significant; NS: Not Significant

of the results and any of the conclusions drawn from this study.

CONCLUSION

Both the test agents employed in this study achieved adequate sulcus width enlargement. GDP showed 0.26 ± 0.02 mm, a better response in achieving horizontal displacement of the gingival sulcus than GDC 0.21 ± 0.01 mm. Expasyl showed a better ability in achieving horizontal displacement of the gingival sulcus than the knitted impregnated retraction cord. Further studies are required to know the duration of displaced position of gingiva and also the effect of various noncord displacement materials and methods one health of gingival tissue.

CLINICAL SIGNIFICANCE

The marginal integrity of the restoration depends on its close adaptation to the finish line of the preparation. The gingival tissues should be displaced to accurately record the prepared finish line during impression making, which is accomplished by use of gingival displacement material.

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