Comparison of gingival displacement using paste technique and combination technique (cord and paste) in digital impressions: A pilot study.

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Abstract

Statement of the problem: Digital impressions require a good amount of gingival displacement to capture finish line precisely. A clinical comparison between the paste and a combination of paste and cord technique of gingival displacement for digital impression is required.

Purpose of the study: The purpose of this pilot study was to evaluate which gingival displacement system would show better gingival retraction in digital intraoral scanners (digital impression).

Materials and methods: A series of four cases and eight teeth were conventionally prepared according to the guideline dimensions for porcelain fused to metal crowns, and allocated at random to two groups: gingival retraction paste system and retraction cord with paste (combination system). Segmental digital impressions were taken before and after gingival displacement. The stereolithography (STL) files were assessed in vertical dimension in the buccal and lingual aspects on a CAD superimposition software, 3D Tool. The differences in the amount of gingival displacement were measured and statistically analysed.

Results: PB (paste only for buccal aspect) and CB (cord and paste for buccal aspect), demonstrated no significant difference in gingival displacement (P= 0.442), whereas PL (paste only for lingual aspect), and CL (cord and paste for the lingual aspect) showed a significant gingival displacement (P= 0.042 or P<0.05), with paste showing better gingival displacement.

Conclusion: Within the limitations of the study, vertical gingival displacement achieved using the paste and the combination technique was equal. Additional use of a cord for gingival displacement did not provide better retraction when the intraoral scanner impression was made.

Keywords: Combination System, Digital Impression, Gingival Displacement, Intraoral Scanner, Retraction Paste, Vertical Displacement.

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Introduction

Impression making is a crucial step in the fabrication of indirect restorations. When obtaining an impression for an indirect restoration, it's critical to effectively manage the soft tissue to accurately capture the fine details along the margins. This holds true even when using digital impression methods. In fact, extra care is often required when using intraoral scanners to ensure that the images are captured without the gingival tissue obstructing the view. Traditionally, practitioners have used retraction cords, sometimes with astringent agents, to create space and reveal the margins. More recently, lasers and retraction gels or pastes are used for

this purpose. Retraction pastes not only assist in controlling bleeding but also aid in gently moving the gingival tissue aside to expose the area needed for accurate impressions.

Marginal integrity is a fundamental principle for durable ceramic restorations. Marginal overhangs can trigger gingival inflammation, and increase the risk of secondary caries, especially in the region of root cementum. Therefore, soft tissue management for indirect restorations require accurate gingival displacement and haemostasis.

Gingival retraction techniques can be classified into mechanical, chemical and surgical or a combination of these. A comparison between two techniques – a chemical paste technique and a combination of mechanical cord and chemical paste was used to carry out this clinical study. The purpose of this current study is to compare the above-mentioned techniques for gingival displacement with digital impression making.

Materials And Methods

A total of four patients participated in the study, in which the method of gingival displacement was considered as the study variable. The intraoral scanner images were analysed using 3D tool superimposition software. This pilot study was approved by the Institutional Ethical Committee of Medical Hospital (Ethics Clearance Number: SRMIEC-ST0323-758)

The selection criteria for the patients included root canal treated teeth requiring single crown prosthesis, good oral hygiene, and patients under ASA I/II. Patients with parafunctional habits, periodontally compromised teeth, congenital abnormalities, teeth which were tender on percussion and patients under ASA III/IV; were all excluded from this study. A patient information sheet was provided to the participants. Subjects willing to participate in the study were enrolled after an informed consent.

Procedure

A series of four cases with a total of eight teeth were chosen for PFM crowns. The teeth were prepared according to the recommended guidelines; 1.5 mm axial reduction and 1.5 to 2 mm occlusal reduction, with rounded line angles and a chamfer finish line margin.[1] The complete crown preparation of each tooth was conducted by the same operator keeping the margin equigingivally. Prior to gingival retraction a segmental digital impression was made. Subsequently, the prepared teeth were randomly allocated to the two experimental groups (gingival displacement with paste only and gingival displacement with combination of cord and paste). [2]

The soft tissue management began by placing a short piece of #000 braided type retraction cord (Ultrapak, manufactured by Ultradent products, USA) along the entire tooth preparation margin in one tooth. Then the paste was extruded into the sulcus, over the cord, in a continuous bead around the tooth to complete the combination technique of gingival displacement. The thin nozzle of the retraction capsule [Figure 1] fit easily into the interproximal spaces of the prepared tooth. Lastly, the paste alone was also applied on the adjacent prepared tooth, into the sulcus directly around the entire circumference of the tooth to achieve paste technique of gingival displacement. The paste and cord were allowed to sit for at least 30 seconds to one minute [Figure 2]. A water spray and high-volume evacuation was used to remove the paste from the sulcus, followed by air drying. The cord was removed using a tweezer. The haemostatic property of the paste left the prepared tooth completely dry and the margins were well inspected, before the final impression was taken. [3]

An online form was filled to generate an electronic file for the optical impression. A digital impression device Vivascan, Ivoclar Vivadent, Switzerland [Figure 3] was used to

record the final impression. The impression was taken for both the teeth using a sectional scan from the canine to second molar, and recorded in the system simultaneously [Figure 4]. The digital STL files were transferred to the 3D Tool CAD software, where the marginal difference before and after the gingival displacement was assessed.

While evaluating the tooth preparation margins, two factors were taken into consideration – the marginal difference of the buccal aspect and the lingual aspect. The same procedure was repeated for all instances.

The measuring tool in the software was utilized to calculate the distance between a reference point on the occlusal surface of the prepared tooth and the deepest point in the buccal and lingual sulcus respectively [Figure 5]. The distance was first measured for the scan taken before the gingival displacement, then for the scan taken after the gingival displacement, for every tooth. A third tooth adjacent to both the prepared teeth was also measured to use as a reference, and minimise the error during superimposition. Both the buccal and lingual aspects were considered in the vertical axis. Four groups were taken into consideration - PB (paste only for buccal aspect), CB (cord and paste for buccal aspect), PL (paste only for lingual aspect), CL (cord and paste for the lingual aspect). Lastly, the difference between both the distances measured was calculated as the amount of gingival displacement that took place using the paste only and using the combination of paste and cord.

Results

The data thus obtained was subjected to a statistical analysis using SPSS Software (version 21). Two independent T-tests compared if there was a significant difference between the two groups: Paste only and Paste and Cord both.

The p-value for the groups PB and CB were 0.442 which interprets as an insignificant difference in the amount of gingival displacement seen (p-value >0.05). Whereas the p-value for the PL and CL groups was 0.042 which shows a significant difference in the gingival displacement achieved with a higher significant change seen using only the retraction paste rather than using both the retraction cord and paste (p-value <0.05).

Discussion

In previous studies [4,5] a number of gingival displacement systems have been compared to assess which system has achieved maximum marginal accuracy[6], but only a few have compared which system has proved to be better for digital impressions. In recent times, digital impressions are taking over the conventional method of recording prepared teeth. Digital impressions have become more predictable and have their advantages in certain clinical situations as compared to traditional impressions which can shrink and distort with time. It reduces the patient discomfort and provides them a better overall experience without gagging, overhanging impression material and uncomfortable tray positions. The time taken to complete the intraoral scan is also more efficient for a digital impression. Since digital impressions cannot record all the details of oral tissue with extreme accuracy, this study aimed to test which gingival displacement system would work best with digital impressions.

There are various types of gingival displacement systems like mechanical retraction cords, chemico-mechanical retraction cords with paste with or without haemostatic agents, and surgical methods like lasers and gingival curettage. The two systems most commonly used by dental practitioners were compared in this study. The retraction cord used was #000 braided type. The cord usually gives accurate and precise margins, exposing the finish line clearly; but also shows

drawbacks of epithelial attachment injury, requires patient to be given local anaesthesia, lack of adequate bleeding control and also a risk of irreversible gingival displacement. On the other hand, the chemical paste method effectively controls bleeding, it's easy to apply and remove and also does not require a local anaesthetic agent. Its advantages in relation to gingival and periodontal health are also proved in previous studies.

According to the current study, buccally, both the combination system and paste system showed the same amount of marginal displacement. No significant change in gingival retraction was observed ($P>0.05$). Whereas, lingually, the paste system showed a more significant gingival displacement compared to the combination of cord and paste ($P<0.05$). Comparing the groups, there was more significant difference in the lingual aspect statistically, as discussed in the result. One reason could be due to the bleeding that occurred while placing the retraction cord, which in turn could have caused a hinderance in the digital impression. Additionally, the significance only seen on the lingual aspect as compared to the buccal could have been due to the improper management of the bleeding on the lingual aspect due to inadequate vision during digital impression making. However, these results and the fact that the clinical measurements of the crown margins in p-value were, on average, equal or higher in significance while using the paste as compared to combination technique, supports the advantages of the paste system acceptably.

As this study was conducted as a pilot study, the limited number of patients pose to be a limitation. This study measured only vertical gingival displacement and not lateral displacement. Clinically both the techniques are acceptable with a larger sample size. The study could also be done comparing more than just two gingival displacement systems along with digital impressions. These factors can be considered and further research can be conducted with the combination of gingival displacement systems used to create accurate margins for digital impressions.

Conclusion

Based on the findings of this pilot study and within the limitations of the study it can concluded that the gingival displacement achieved in vertical direction using the paste and the combination technique was equal. Additional use of a cord for gingival displacement did not provide better retraction when the intraoral scanner impression was made especially on the buccal aspect.

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TABLES

Table I: Comparison of mean values of gingival retraction with paste and combination of cord and paste techniques utilised on Buccal aspect:

Group Statistics					
	VAR00010	N	Mean	Std. Deviation	Std. Error Mean
BUCCAL ASPECT	PB	4	.4400	.09055	.04528
	CB	4	.3725	.05315	.02658

*PB - Paste only for buccal aspect; CB – Cord and paste for buccal aspect

Table II: Independent T test for Buccal aspect:

Independent Samples Test				
	Levene's Test for Equality of Variances		t-test for Equality of Means	
	F	Sig.	t	df
Equal variances assumed	.679	.442	1.286	6
Equal variances not assumed			1.286	4.848

Table III: Comparison of mean values of gingival retraction with paste and combination of cord and paste techniques utilised on Lingual aspect.

Group Statistics					
	VAR00010	N	Mean	Std. Deviation	Std. Error Mean
LINGUAL ASPECT	PL	4	.1775	.20123	.10061
	CL	4	.0400	.00816	.00408

*PL- Paste only for lingual aspect; CL – Cord and paste for lingual aspect

Table IV: Independent T test for Lingual aspect:

Independent Samples Test				
	Levene's Test for Equality of Variances		t-test for Equality of Means	
	F	Sig.	t	df
Equal variances assumed	6.647	.042	1.366	6
Equal variances not assumed			1.366	3.010

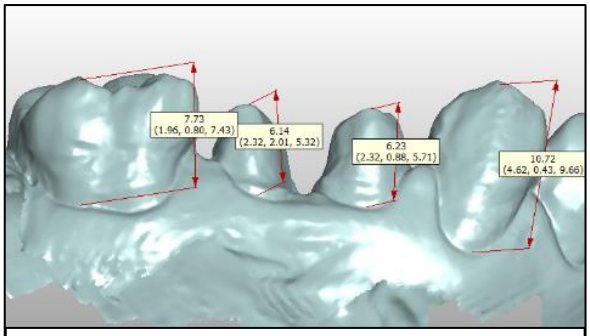
FIGURES

Figure 1

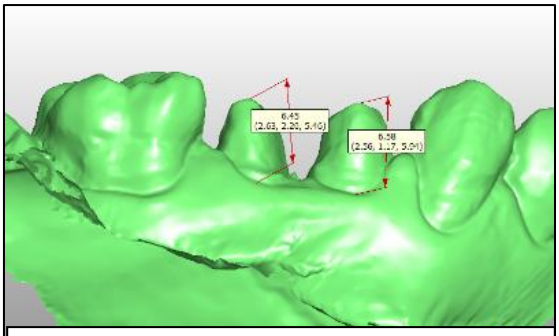
Figure 2

Figure 3

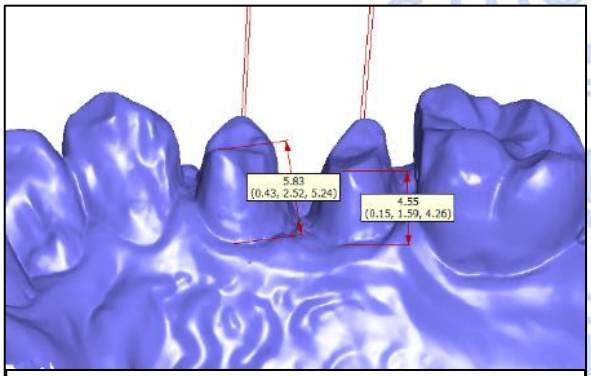
Figure 4



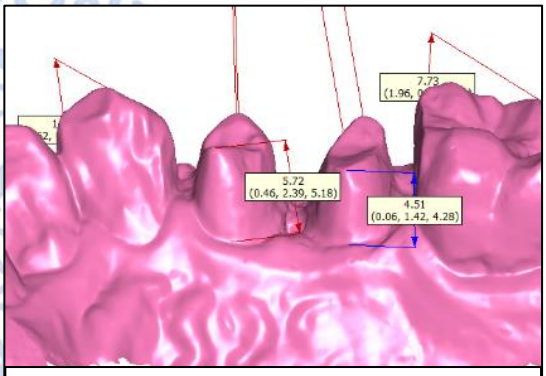
a. Before gingival displacement in buccal aspect



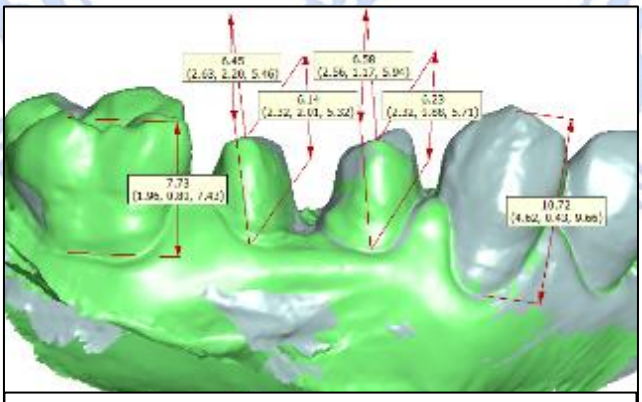
b. After gingival displacement in buccal aspect



c. Before gingival displacement in lingual aspect



d. After gingival displacement in lingual



e. Superimposition in buccal aspect

Figure 5