



Effect of Gingival Retraction Method to Lateral Gingival Displacement Width

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Abstract

Objective: To analyze the efficacy of retraction cord with a hemostatic agent in comparison with retraction paste on lateral gingival displacement, to achieve the success of fixed dental prostheses (FDP). **Material and Methods:** Test samples included 32 teeth that required treatment with metal-porcelain FDP at RSKGM FKG Universitas Indonesia. Impressions were taken before the gingival retraction procedure. From the 32 samples, 16 teeth were retracted using a combination of retraction cord and hemostatic agent, whereas the other half were retracted with retraction paste. Impressions were then taken. The sample was made using cutting die. Lateral gingival displacement width was measured on die-cast using an optical microscope. **Results:** The mean value of group A before gingival retraction was 0.1695 mm, and after gingival retraction was 0.4705 mm. The mean value of group B before gingival retraction was 0.1767 mm, and after gingival retraction was 0.3289 mm. Lateral gingival displacement width between a combination of cord retraction and hemostatic agent group in comparison with the retraction paste group showed a significant difference ($p < 0.001$). The combination of cord retraction and hemostatic agent group showed higher mean value. **Conclusion:** Gingival displacement width as a result of cord retraction with the hemostatic agent was larger compared to the retraction paste. Even though both of them are still considered to be effective in providing access for impression material.

Keywords: Prosthodontics; Gingival Retraction Techniques; Dental Impression Technique.

Introduction

Marginal fitness of fixed dental prostheses is affected by a few factors; one of them is determined by the impression's accuracy [1,2]. One of the efforts to obtain an accurate impression is through gingival retraction procedure [1]. Gingival retraction is the lateral displacement of the gingival margin away from the tooth surface [3]. On the gingival retraction procedure, the preparation finish line on the cervical tooth surface, which covered by gingival tissue, is expected to be exposed so that it can be recorded accurately by impression material [1]. A good impression could be obtained if the lateral gingival displacement width is 0.15 – 0.2 mm, which able to provides excellent access for impression material [4-6].

Commonly used gingival retraction method is a combination of retraction cord with hemostatic agent [1,7,8]. Despite such method is widely used due to its relatively low cost, this retraction method has some of disadvantages, among others (1) a fairly difficult application and requires an ample of processing time; (2) has a high risk in damaging gingival epithelial attachment; (3) causing a recession of gingiva 0.2 ± 0.1 mm; (4) lots of hemostatic agent residue were left in the gingival sulcus which may lead to a gingival inflammation if not properly removed; (5) inconvenient to the patient [6,9-13].

Gingival retraction using paste is easier and requires a shorter procedure time. The paste is injected into the gingival sulcus using an injector [1,12,14]. The advantages of using a retraction paste compared to retraction cord are (1) easier application procedure; (2) non-invasive; (3) more convenient to the patient [1,9,15]. However, some literature stated that gingival retraction using paste resulting in a shorter lateral gingival displacement width compared to utilizing a retraction cord, and therefore, the tooth surface would be not exposed thoroughly [12,15]. This technique will produce lower impression accuracy so that the identification and determination of marginal restoration by the dental technician will be affected [1].

Previously there was one study that compared the effect between the combination of retraction cord and hemostatic agent with retraction paste to lateral gingival displacement width. However, this study did not measure the lateral gingival sulcus width before gingival retraction, compare lateral gingival displacement width after both methods, and only measure one point of tooth surface side (buccal). It was stated that the disadvantage of this research was the lack of subject (only ten subjects), and did not establish control over gingival biotype as confounding variable [12]. Therefore, the objective of this study is to elaborate on the previously published research and conduct a more specific examination of the thin gingival biotype that is common in the largest Indonesian race, the Malayan Mongoloid [16,17].

The purpose of this research is to analyze whether the retraction cord and hemostatic agent have a different effect on the lateral gingival displacement width has compared to retraction paste.

Material and Methods

Study Design

This study was held at RSGMP Faculty of Dentistry Universitas Indonesia and Metallurgy Laboratorium Universitas Indonesia. This study used 32 teeth that were indicated to be restored with metal-porcelain fixed dental prostheses. Inclusion criteria of subjects including: (1) patient who required fixed dental prostheses restoration (full veneer crown, dowel crown, and fixed partial denture); (2) healthy gingiva and periodontium, no bleeding on probing (BOP); (3) probing depth 1-2 mm; (4) thin gingival biotype; (5) equigingiva preparation margin; (6) chamfer cervical preparation margin; (7) healthy patient without systemic disease.

The subjects were divided into two separate groups. The first group used a combination of retraction cord (Ultrapak, Ultradent Products, Inc., South Jordan, UT, USA) with a hemostatic agent (15.5% ferric sulfate, astringent). The second group was treated with retraction paste (15% aluminum chloride; 3M ESPE astringent retraction paste, 3M Corporation, St. Paul, MN, USA). Impression prior to gingival retraction (control group) was taken after tooth preparation, using polyvinylsiloxane elastomeric impression material with a two-stage technique. Then, gingival retraction procedures were done to each group.

In the first group, the retraction cord was immersed into the agent hemostatic and applied into gingival sulcus using cord packer; after 4 minutes, it was removed from sulcus gently. In the second group, retraction paste was applied to gingival sulcus by using the injector, the injector tip was directed close to the sulcus, and the paste was injected gently, after 2 minutes it was rinsed by water. Then, the impression after gingival retraction procedures were taken.

The sample was made from the result of the impression, which was already cast using dental stone type IV. The die-cast was cut into four parts in buccal-palatal and mesial-distal direction using a die cutter. Measurement of lateral gingival displacement width was done on die cast before gingival retraction and die cast after gingival retraction, and was measured on 4 points (buccal, palatal or lingual, mesial and distal) using optical microscope Olympus BX43 with 50x magnification (Olympus Corporation, Tokyo, Japan).

The image was measured using a software application image J. Lateral gingival sulcus width before gingival retraction and lateral gingival displacement width after gingival retraction was measured by drawing a perpendicular line extending from the marginal gingiva towards the tooth surface. The delta value was a subtraction result between before and after gingival retraction. Measurements were recorded in microns (μm), which were converted into millimeter (mm) for statistical analysis.

Data Analysis

Statistical analysis of lateral gingival displacement width comparing between before and after gingival retraction, on both group A and group B showed normal distribution data ($p > 0.05$) by Kolmogorov-Smirnov normality test, then were compared by dependent T-Test. The lateral gingival displacement width between group A and group B after gingival retraction was compared by independent T-Test. All statistical analysis was calculated with statistical software (IBM SPSS Statistics, version 22).

Ethical Aspects

This study was approved by the Ethical Committee Faculty of Dentistry Universitas Indonesia (No. 89/Ethical Approval/FKGUI/IX/2017).

Results

There was a significant difference between before and after gingival retraction, on both group A and B ($p < 0.001$). The mean value of group A before gingival retraction was 0.1695 mm, and after gingival retraction was 0.4705 mm. The mean value of group B before gingival retraction was 0.1767 mm, and after gingival retraction was 0.3289 mm (Table 1).

Table 1. Lateral gingival displacement width before and after gingival retraction.

Groups	N	Mean (mm)	Mean Differences	Mean Differences (CI95%)	p-value
Group A (Before)	64	0.1695 ± 0.168	0.3009 ± 0.382	0.2914 – 0.3105	<0.001
Group A (After)	64	0.4705 ± 0.041			
Group B (Before)	64	0.1767 ± 0.016	0.1521 ± 0.024	0.1417 – 0.1580	<0.001
Group B (After)	64	0.3289 ± 0.029			

Lateral gingival displacement width between groups A and B showed a significant difference ($p < 0.001$) after gingival retraction method. The mean value of group A (0.3022 mm) was higher than group B (0.1521 mm) (Table 2).

Table 2. Lateral gingival displacement width between group A and group B.

Groups	N	Mean (mm)	SD	p-value
Group A	64	0.3022	0.0381	0.000
Group B	64	0.1521	0.0225	

Discussion

Lateral gingival displacement width that produced by gingival retraction affected impression's quality, and this determined the marginal fitness of fixed dental prostheses [1,2]. A lateral gingival displacement width of 0.08-0.18 mm it difficult to obtain a good impression. It has also been shown that 50-90% of impressions with a lateral gingival width of 0.08-0.13 mm had defects. According to the findings reported previously, an accurate impression free of the defect was observed at lateral gingival displacement width of 0.22 mm [18]. In this study, lateral gingival displacement width after gingival retraction on both groups reached above 0.22 mm; this showed that both of those retraction materials were effective in providing good access for impression material.

Lateral gingival displacement width between group A and group B after gingival retraction showed a significant difference. The mean value of group A showed a higher value, 0.3022 mm, whereas the mean value of group B showed a lower value, 0.1521 mm. Result of this study supported the previous research [12], which compared lateral gingival displacement width between retraction cord with hemostatic agent and retraction paste, however different brand was used in this study. The

result showed that the retraction cord with a hemostatic agent (0.46 mm) produced a significantly greater width compared to the retraction paste (0.34 mm) [12]. However, that study only used the mean value of lateral gingival displacement width from each group, not the alteration of lateral gingival displacement width (delta value) for the statistical analysis.

Previous authors reported a gingival sulcus simulation model for evaluating the penetration characteristics of elastomeric impression material. The study stated that a larger lateral gingival displacement width gave better penetration accessibility of the impression material [19]. This conduct showed that gingival retraction using a retraction cord with a hemostatic agent might produce a better quality of impression rather than retraction paste.

Another study showed that pressure generated by retraction cord (KnitTrax®) was 5396 kPa, while pressure caused by retraction paste was 143 kPa (Expansyl®), it showed that the pressure generated by retraction cord was higher than retraction paste [20]. Furthermore, another study that compared pressures generated by several retraction pastes showed that 3M Espe astringent retraction paste had lower pressure (38.8 kPa), compared to Expansyl® retraction paste (142.2 kPa) [21]. This result could be the explanation of why retraction paste had a shorter lateral gingival displacement width compared to the retraction cord was. Lower pressure generated by retraction paste caused a shorter lateral gingival displacement width.

Epithelial attachment sustained to injury when it received the force of 1 N/mm², and ruptured when it received the force of 2.5 N/mm², while gingival retraction using retraction cord on average reached force of 2.5 N/mm² [11,22]. Some other studies also showed that gingival retraction using a retraction cord posed a greater risk of epithelial attachment damage compared to retraction paste [11,23]. A few other studies also showed that gingival retraction using retraction cord posed a greater risk of damaging the epithelial attachment compared to the retraction paste. This fact suggests that the force generated by the retraction cord is higher than retraction paste. Although the lateral gingival displacement width was better for impression with the retraction cord method, the retraction cord had a greater risk of causing periodontium tissue damage.

However, this study had limitations, the variation of the gingival anatomy between patients maybe could affect the gingival displacement width, although the gingival sulcus and gingival biotype were controlled specifically into inclusion criteria. Lack of subject also became a limitation for the statistical power analysis.

Conclusion

Lateral gingival displacement width using a retraction cord and hemostatic agent was found greater than gingival retraction using retraction paste. Both of these methods produced the minimal width, which was effective to obtain good access for impression material. The retraction cord and hemostatic agent produced a larger width, but a retraction paste method is still a good option because it provides good access for impression material. In this study, some factors that could affect lateral gingival displacement width, such as sulcus depth, gingival biotype, preparation margin type,

were not conducted. Further research is needed to investigate those factors and the effects of gingival displacement width.

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