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Original Article

Efficacy of two gingival retraction systems on lateral gingival displacement: A prospective clinical study

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ABSTRACT

Purpose: Gingival management is a substantive procedure in fixed dental prosthesis treatment. Various new retraction cord systems are available and used. This study aimed to compare the efficacy of a new retraction cord (Stay-Put, Coltene Whaledent AG) and a conventional retraction cord (Ultrapak, Ultradent Products Inc., South Jordan, Utah) on lateral gingival displacement in continuation with the treatment protocol of the subjects fixed dental prosthesis for various partial edentulous conditions requiring fixed dental prosthesis.

Method: Thirty subjects were selected who needed bilateral fixed dental restoration. In selected subjects both gingival retraction cords were placed bilaterally buccolingually by simple randomization method. After removing the cords, impressions were made and undamaged definitive casts were retrieved. The abutment teeth were sectioned buccolingually at the buccal ridge followed by decimal measurement of the width (in millimeter) of the retracted gingival sulcus, under a traveling microscope.

Results: Data was analyzed using SPSS version. Paired "t" test was used to compare the difference between the displaced gingival width in two retraction group ($p > 0.05$).

Conclusion: Although mean gingival retraction in Stay-Put system (0.528 ± 0.12 mm) was higher as compared to that in Ultrapak (0.487 ± 0.10 mm), the difference between the two systems (0.041 ± 0.11) was not significant statistically ($p = 0.057$).

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1. Introduction

Horizontal or lateral displacement of the gingival sulcus is a generally recognized prerequisite for making accurate impression to achieve desirable emergence profile of fixed restoration particularly when the finish line is at, or just within, the gingival sulcus.^{1,2} Therefore, it is necessary to displace free gingival margin effectively. This technique also becomes important when the level of the crown margins is in or close to the crevice because of cervical lesion.³ The critical

sulcular width has been reported to be approximately 0.15–0.2 mm at the level of the finish line which is important for good flow of impression material around the finish line.^{4,5} Impressions with less sulcular width have higher incidences of voids, tearing of impression materials, and reduction in marginal accuracy.^{2,4} Various gingival displacement methods, such as mechanical, chemo-mechanical (chemicals embedded in cords or in an injectable matrix), and surgical (lasers, electrosurgery, and rotary curettage) are available to the clinician.⁶ Many cases reported gingival damage

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associated with traditional techniques,^{7,8} but others have documented complete gingival healing after gingival retraction without permanent damage to soft tissues.⁹

Classic techniques can traumatize the delicate epithelial lining and may lead to an average postoperative gingival recession of 0.2 ± 0.1 mm.¹⁰ Nevertheless, retraction cords offer a familiar and inexpensive retraction method.

The use of conventional retraction cords as a mechanical or chemo-mechanical technique is well established in practice due to their relative predictability, effectiveness, and safety compared with rotary gingival curettage and electrosurgery.¹¹

Conventional gingival retraction cords are available unimpregnated or impregnated with the astringent-hemostatic agents, as well as aluminum potassium sulfate, aluminum sulfate, racemic epinephrine and zinc phenolsulfonate/racemic epinephrine, among others. Numerous studies reported conventional mechanical methods of gingival displacement that involved the use of knitted or braided, impregnated or unimpregnated strings or fibers of different types. A new gingival retraction cord, Roeko Stay-Put (Coltene Whaledent), was recently introduced to the dental profession proposed to effectively displace free gingival margin prior to final impression. This wide spectrum of different retraction cord systems encouraged us to investigate Roeko Stay-Put retraction cord on lateral displacement of free gingiva in comparison with conventional Ultrapak retraction cord.

2. Methods and materials

The present study is in conjunction with the treatment protocol of the patient's fixed dental prosthesis, the patients were not subjected to any additional invasive procedure.

2.1. Sample

The study subjects were patients, seeking fixed dental restorations reporting to the Department of Prosthodontics at M.S. Ramaiah Dental College and Hospital, Bangalore, Karnataka, India. The sample was composed of thirty adult patients (totaling seventy two abutment teeth) and in each patient either two or four abutment teeth were present (either one or two missing teeth on either side of same arch). Patients were selected according to the following inclusion and exclusion criteria:

2.2. Inclusion

1. Adults aged 30–35yrs.
2. Absence of periapical or any other intra oral infection.
3. Individual with healthy gingiva and periodontal status including zero plaque index, gingival sulcus depth between 1 and 2 mm and no bleeding on probing.
4. Patients with no relevant medical history; non-smoker or has quit smoking for at least 6 months prior to the study.

2.3. Exclusion

1. Pregnancy
2. Individuals with uncontrolled diabetes and other systemic diseases which could influence clinical outcome of study.

2.4. Group establishment

In all thirty patients seventy two abutment teeth were allocated to two groups (group A and group B) by simple randomization. In group A and group B, Ultrapak (Ultradent Products Inc., South Jordan, Utah) and Roeko Stay-Put (Coltene Whaledent AG) retraction cords were used respectively.

2.5. Clinical procedure

Clinical parameters of gingival and periodontal status were recorded periodically during maintenance appointments prior to preparation. If patients met these selection criteria, the abutment teeth were randomly divided into either group for fixed dental restoration.

During the investigation period, a principal investigator and an auxiliary personal assisting the clinician performed all mandatory clinical steps. A total of seventy two preparations for indirect fixed restorations were performed (thirty six each for group A and group B) according to universal guidelines.¹² After tooth preparation, the allotted gingival retraction cord (Ultrapak or Roeko Stay-Put) (Fig. 1) was used for each abutment. Cords were placed in the gingival sulcus with use of a cord packer, and left in situ for 10 min before making the impression. None of the retraction cords were immersed in any solution or medicaments prior to insertion.

Fig. 1 – Gingival retraction systems (left: Ultrapak, Ultradent Products Inc., South Jordan, Utah; right: Stay-Put, Coltene Whaledent AG). Ultrapak gingival retraction system considered as conventional system and Roeko Stay-Put is a new system of retraction consists of ultrathin copper wire.

The cords were removed from both side of the same arch was followed by impression making. A standardized protocol was followed for impression making.¹³ Custom tray was fabricated using autopolymerizing acrylic tray material (DPI-RR; Wallace Street, Mumbai, India).

A double mix putty wash technique of impression making was followed. The manufacturers' recommendations on working and polymerization times were strictly followed. A close visual inspection of final impression was performed with the help of a magnifying glass followed by fabrication of definitive type IV gypsum (Ultrarock, type IV dental stone; Kalabhai Karson Ltd, Vikhroli (W), Mumbai, India) cast.

Undamaged retrieved casts were sawed out, buccolin- gually from buccal to lingual at the buccal ridge with the help of die cutter (Aveyron, France) followed by vicenary mea- surement of the width (mm) of the retracted gingival sulcus (Figs. 2 and 3), under a traveling microscope (National Scien- tific Industries, Ambala Cantt, India). The width was measured as the distance from the abutment tooth to the crest of the free gingiva.¹⁴

2.6. Data analysis

Data was analyzed using Statistical Package for Social Sci- ences (SPSS) version 15.0. Paired "t" test was used to compare the difference between two groups. Confidence level of the study was kept at 95%, hence a "p" value less than 0.05 indi- cated a statistically significant difference.

3. Results

A total of seventy two sectioned dies were examined under a traveling microscope for quantitative measurement of retracted gingival sulcus. Of those, two missing teeth (one tooth on either side of same arch) were present in twenty four patients and in remaining six patient four missing teeth (two

Fig. 3 – Traveling microscopic view of sectioned die of retracted gingival sulcus (Stay-Put). Retracted gingival sulcus was viewed under traveling microscope, distance from the abutment tooth to the crest of the free gingiva.

teeth on either side of same arch) were present. In patients where two missing teeth were present on either side of same arch, average mean of retraction in width (mm) by two different retraction systems are presented in Table 1.

Results according to retraction of gingival sulcus by two different retraction systems are presented in Table 2. Both groups were compared and statistically evaluated.

Mean gingival retraction in group B (0.528 ± 0.12 mm) was higher as compared to that in group A (0.487 ± 0.10 mm) yet the difference between two groups (0.041 ± 0.11) was not significant statistically ($p = 0.057$), (Table 2).

Qualitative comparison (Chart 1) between group A (Ultra- pak) and group B (Stay-Put) was also not found to be signifi- cant statistically ($p = 0.057$).

4. Discussion

Various studies investigated the effects of different retraction techniques on the gingival and periodontal health^{7,15,16} but did not test the effectiveness of gingival displacement. This study focused on lateral displacement of free gingiva with the use of a new retraction system Stay-Put (Coltene Whaledent) compared to a conventional retraction system. Stay-Put is an unimpregnated, braided retraction cord. Stay-Put retraction cord was selected for its unique property of cord being wrapped around an ultrathin copper wire. The presence of ultrathin copper wire in retraction cord seems to provide more stability in the sulcus after placement than other conven- tional retraction cord. Thus, Stay-Put could provide better retraction than conventional retraction cord and encouraged us to compare the efficacy of Stay-Put retraction system with Ultrapak conventional retraction cord in lateral displacement of marginal gingiva. The ability of retraction cord to displace gingiva was indirectly measured by the width of retracted gingival sulcus.¹⁴ Clinical parameters included evaluation of gingival index¹⁰ to assess gingival inflammation and it was

Fig. 2 – Traveling microscopic view of sectioned die of retracted gingival sulcus (Ultrapak). Retracted gingival sulcus was viewed under traveling microscope, distance from the abutment tooth to the crest of the free gingiva.

Table 1 – Gingival retraction width by two different retraction systems.

Subjects	Ultrapak (in millimeter)	Stay-Put (in millimeter)
1	0.4	0.44
2	0.6	0.74
3	0.4	0.4
4	0.39	0.73
5	0.36	0.51
6	0.4	0.39
7	0.68	0.54
8	0.41	0.48
9	0.68	0.4
10	0.58	0.7
11	0.4	0.45
12	0.54	0.71
13	0.56	0.6
14	0.4	0.48
15	0.39	0.64
16	0.6	0.7
17	0.5	0.4
18	0.6	0.68
19	0.49	0.54
20	0.41	0.52
21	0.42	0.4
22	0.39	0.36
23	0.6	0.58
24	0.58	0.60
25	0.45 (average mean of retraction in two abutment teeth)	0.46 (average mean of retraction in two abutment teeth)
26	0.43 (average mean of retraction in two abutment teeth)	0.44 (average mean of retraction in two abutment teeth)
27	0.47 (average mean of retraction in two abutment teeth)	0.48 (average mean of retraction in two abutment teeth)
28	0.56 (average mean of retraction in two abutment teeth)	0.55 (average mean of retraction in two abutment teeth)
29	0.51 (average mean of retraction in two abutment teeth)	0.52 (average mean of retraction in two abutment teeth)
30	0.42 (average mean of retraction in two abutment teeth)	0.41 (average mean of retraction in two abutment teeth)

ensured that plaque index was zero, gingival sulcus depth was between 1 and 2 mm and no bleeding on probing was seen before preparation of teeth.

The present study analyzed the effectiveness of a new retraction system compared to conventional retraction system. In our study, the selected patients were all in the same age group and abutment teeth were uniformly distributed in same arch, which ensured similar gingival biotype present around abutment teeth and the negligible influence of age. The same sizes of different retraction cords were placed in both quadrants by the same prosthodontist to minimize operator variability. Moreover, this investigation used healthy teeth which required fixed dental restoration, for various short span partially edentulous situations thereby simulating realistic clinical conditions. The recommended technique of retraction cord application was strictly followed according to

manufacturers' instructions. After preparation of abutments double mix putty-and-wash impression technique was used. In the present study both retraction cords have demonstrated significant retraction of gingival sulcus which is more than critical sulcular width. The Stay-Put system or group B showed 0.528 ± 0.12 mm of retracted sulcus width whereas Ultrapak or group A demonstrated 0.487 ± 0.10 mm. Both retraction system were effective, yet the difference between two groups (0.041 ± 0.11 mm) was not significant statistically ($p = 0.057$). Mean gingival retraction in Stay-Put system was

Chart 1 – Qualitative comparison between group A (Ultrapak) and group B (Stay-Put).**Table 2 – Comparison of mean gingival retraction between two groups.**

	N	Mean	Standard deviation
Group A (Ultrapak)	36	0.487	0.10
Group B (Stay-put)	36	0.528	0.12
Difference (A–B)		0.041	0.11
"t" value (Paired "t" test)		1.983	
"p"		0.057	

higher as compared to that in Ultrapak system. This could be due to provision of thin copper wire within Stay-Put retraction cord which rendered retentive ability in sulcus, consistency, ease of packing and less cord fraying.

This study did not compare the efficacy of both retraction systems in vertical displacement of free gingiva, physical properties and mechanical gingival injury after the first day of placement of both cords. These fields warrant further research to provide clinicians with valuable clinical information.

5. Conclusion

Within the limitations of this study, the following conclusions were drawn:

1. Both retraction systems demonstrated significant retraction of gingival sulcular width to achieve fine details of margins in the impression.
2. Roeko Stay-Put showed slightly higher retraction than Ultrapak due to presence of ultrathin copper wire in the center of the cord.
3. Finally, the choice of retraction technique depends on various clinical conditions, ease of packing and clinician's preference.

Conflicts of interest

All authors have none to declare.

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