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Research Article

Comparative Evaluation Of Three New Gingival Retraction Systems- An In Vivo Study

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ABSTRACT

Context: For fixed prosthodontics, crown or inlay/onlay margins are at or below the free margin of the gingiva and access to them for both preparation, impressioning, and cementation is impossible without additional techniques to displace the gingival tissues and control gingival hemorrhage and sulcular fluids. Among the various gingival retraction systems available in the market, three fairly new retraction systems have been introduced into this field. These three systems were used in these study.

Aim: To determine an appropriate gingival retraction system to achieve an adequate gingival displacement, better exposure of finish line so as to fabricate prosthesis with a clinically acceptable marginal integrity.

Material and Method: 30 subjects were prepared who requires Preparation for full coverage restoration for missing mandibular first molar involving second premolar and second molar as a abutments. Clinically and radiographically healthy gingiva and periodontium were present around the abutments. Abutment teeth were in normal size and contour (no developmental anomaly or regressive age changes).

Statistical analysis used: The stastical analysis were done using Independent t test and ANOVA test. Multiple comparisons were done using Bonferroni's test

Results: There was statistically significant difference found in time taken for placement, hemorrhage control and vertical and horizontal gingival retraction.

Conclusion: Till date no clinical study has demonstrated the superiority of one technique over other, so choice of which retraction system to use finally depends upon the presenting clinical situation and operator preference.

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INTRODUCTION:

The oral cavity is a difficult area to treat in restorative dentistry because of the constraints of the lips, tongue, cheeks, challenges for access to visualize and manipulate instruments, as well as, the position of the teeth that are being treated relative to the gingival tissues, which if improperly managed, bleed. For fixed prosthodontics, crown or inlay/onlay margins are at or below the free margin of the gingiva and access to them for both preparation, impressioning, and cementation is impossible without additional techniques to displace the gingival tissues and control gingival hemorrhage and sulcular fluids.

The concept of biologic width and its relationship to periodontal health and restorative dentistry is explained. The "biologic width" is defined as the dimension of the soft tissues, which is attached to the portion of the tooth coronal to the crest of the alveolar bone. This term was based on the work of Gargiulo et al (1961)[1]**.** The Padbury A (2003**)** et al[2] states that "An adequate understanding of the relationship between periodontal tissues and restorative dentistry is paramount to ensure adequate form, function, esthetics and comfort of the dentition". Shivasakthy M et al (2013)[3]concluded that, Merocel strip produces statistically significant amount of gingival retraction (p=0.001). When compared with the displacement produced by conventional cord, the displacement produced by the Merocel strip is significantly more (p=0.04). Both the materials and methods of displacement have not grossly affected the gingival health in 2 weeks follow-up (p=0.154).

Ankit Gupta et al (2013),[4] evaluated the clinical efficacy of 3 new gingival retraction systems; Stayput, Magic foam cord and Expasyl, on the basis of their relative ease of handling, time taken for placement, hemorrhage control and the amount of gingival retraction. Dr. Ravi Rakesh Dev. J. et al(2017)[5] concluded that the injury associated with the use of gingival retraction cords to the periodontium is only temporary and usually heals within a weeks' time. The use of paste system is more advocated in gingival retraction procedure as it has added advantages over the regular gingival retraction cord system.

MATERIALS AND METHOD:

Among the various gingival retraction systems available in the market, three fairly new retraction systems (Figure-1) have been introduced into this field. The first one is a cordless 'aluminum chloride paste (Traxodent) retraction system' which promises to provide easy, effective haemostasis and retraction . Second is, plain type 'copper wire reinforced retraction cord (Stay-put)' impregnated with 0.05 %oxymetazoline hydrochloride solution (Otrivin). Stay-put is a unique combination of softly braided retraction cord and an ultrafine copper filament, and it claims that it was so pliable that it stays where you put it. Oxymetazoline was α-adrenomimetic decongestants are effective alternative retractioin agents for chemo-mechanical diltation of the gingival groove[6]. It is observed that more effective reversible displacement when retraction cords are pre-soaked in oxymetazoline hydrochloride . Here Otrvin nasal drop is used for 0.05 % Oxymetazoline hydrochloride. Thirdly, medium viscosity vinylpolysiloxane (VPS) gingival retraction paste with 15% ammonium aluminum sulfate (GingiTrac) claims to gently displaces the gingiva from the tooth and stops the bleeding.

Figure 1 : Three new gingival retraction system

Subjects Inclusion Criteria

1. Preparation for full coverage restoration for missing mandibular first molar involving second premolar and second molar as a abutments.
2. Clinically and radiographically healthy gingiva and periodontium around the abutments.
3. Abutment teeth of normal size and contour (no developmental anomaly or regressive age changes).

Subjects Exclusion Criteria

1. Age less than 18 years.
2. Gingival and periodontal disease.
3. Uncontrolled diabetes, hypertension, hyperthyroidism and other cardiovascular disorders, anattachment loss or signs of periodontal disease.
4. Tipped, tilted or rotated abutment teeth.

The three gingival retraction systems were used on the prepared abutments randomly, such that each combination is repeated ten times. For example, in one subject Stay put impregnated with Oxymetazoline hydrochloride & Traxodent retraction system were used for the two prepared abutments (Premolar and Molar), in second subject Traxodent and GingiTrac retraction system were used and in third subject Stay-put impregnated with Oxymetazoline hydrochloride & GingiTrac retraction system were used for gingival retraction. The same order was followed for all the thirty subjects.

Preparation of the Custom trays:

Two layers of base plate wax was softened and adapted on to the diagnostic model to act as a spacer for the impression material. Tissue stops were placed on thenoncentric cusps of the teeth not to be prepared. Stops were made by removing wax at an angle of 45 degrees to theocclusal surfaces of the teeth using a wax-carver. The autopolymerizing resin dough (DPI RR- Cold cure) was adapted to the cast to fabricate custom tray(Figure: 2).

Figure 2: Cast with base plate wax as spacer and Custom tray with tissue stops and tray adhesive application

The subjects were seated comfortably in an upright position on the dental chair and the light was focused to illuminate the area to be recorded. Prior to the application of any retraction technique, Goldman-Fox probe was used to measure the sulcus depth at mesio-buccal, mid-buccal and disto-buccal region on both the abutment teeth. This recording gave the sulcus depth before retraction. After gingival retraction the sulcus depth was again measured with Goldman-Fox probe and vertical gingival retraction was calculated by comparision of sulcus depth before and after gingival retraction (Figure : 3).

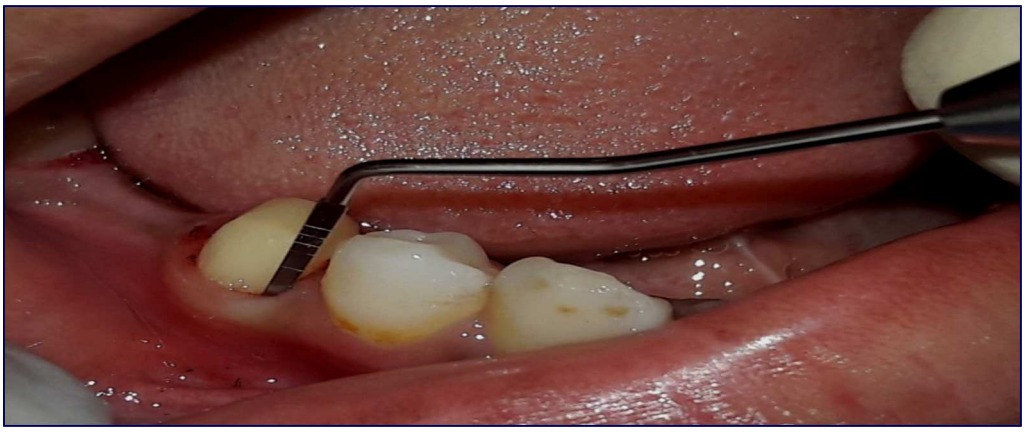


Figure 3: Use of Goldman fox periodontalprobe to measure vertical Gingival retraction.

The horizontal gingival retraction was measured by making impressions of prepared abutments both before and after gingival retraction. The obtained impressions were evaluated using a stereomicroscope and compatible image analysis computer software. The amount of gingival retraction was calculated by taking the difference between the values attained before and after gingival retraction[6].

Traxodent Retraction System :

It consists of dispenser syringes of Traxodent paste and disposable dispensing cannulas. The syringe with the cannula was placed laterally on the applicator tip. Now the piston was advanced so as to let the paste to flow and come out from the tip. Cannula was bent if required. The paste was injected slowly into the closed space between the tooth and marginal edge of the gingiva without pressure on gingiva.

After applying sufficient paste the Retraction cap was placed and asked patient to bite on it and maintain pressure on it. The paste is left in place for 2 minutes and then removed by rinsing (Figure : 4).Hemostasis, time taken and ease of placement, vertical gingival retraction was measured and recorded. The horizontal gingival retraction was measured by making impressions of prepared abutments both before and after gingival retraction. The obtained impressions were evaluated using a stereomicroscope and compatible image analysis computer software. The amount of gingival retraction

was calculated by taking the difference between the values attained before and after gingival retraction.

Figure 4: Traxodent retraction system placement technique and Retraction cap application.

Stay- Put Retraction Cord Impregnated With Oxymetazoline Hydrochloride Retraction System:

The Stay-put retraction cord of adequate width (sizes# 0, 1, 2) was selected on the basis of the clinical situation of gingival sulcus. The cord of adequate length i.e., slightly more than required to encircle the tooth was cut and looped around the tooth. The cord was presoaked into 0.05%oxymetazolinehydrochloride solution (Otrivin Nasal drops). Cord packing was started from the mesial interproximal area by gently pushing the cord into the sulcus. The cord packer was angled toward the tooth so that, the cord was pushed directly into the area. Cord placement was continued all around the tooth(Figure: 5).

The following parameters were recorded:

1. The ease of placement (of the Stay-put) was assessed subjectively by the operator.
2. The time taken for placement (from start of packing till completion) of cord was recorded using a stop watch. The cord was left in the sulcus for 4 minutes, after which it was slowly removed.
3. The amount of hemorrhage was then recorded in terms of score 0 to 2.[3]
   a. Score 0: No bleeding on removal.
   b. Score 1: Bleeding controlled with air and water spray within 1 minute.
   c. Score 2: Bleeding not controlled within 1 minute
4. Immediately following the assessment of hemorrhage, amount of vertical gingival retraction was recorded at the same three locations (mesio-buccal, mid-buccal, disto-buccal), using Goldman-Fox probe (Figure: 4).
5. The amount of horizontal gingival retraction i.e. the width of gingival sulcus was measured indirectly by making addition silicone impression of the prepared abutments before retraction and after retraction (Figure: 8). The stereomicroscopic images (10x resolution) of individual abutment teeth, on the addition silicon impressions made before retraction and after retraction were compared using image analysis software (Figure: 9). The width of gingival sulcus was measured and compared at mesio-buccal, mid-buccal and disto-buccal regions of the sulcular extensions, recorded by the impressions of the prepared abutments.

The amount of gingival retraction was calculated by taking the difference between the values attained before retraction and after retraction.

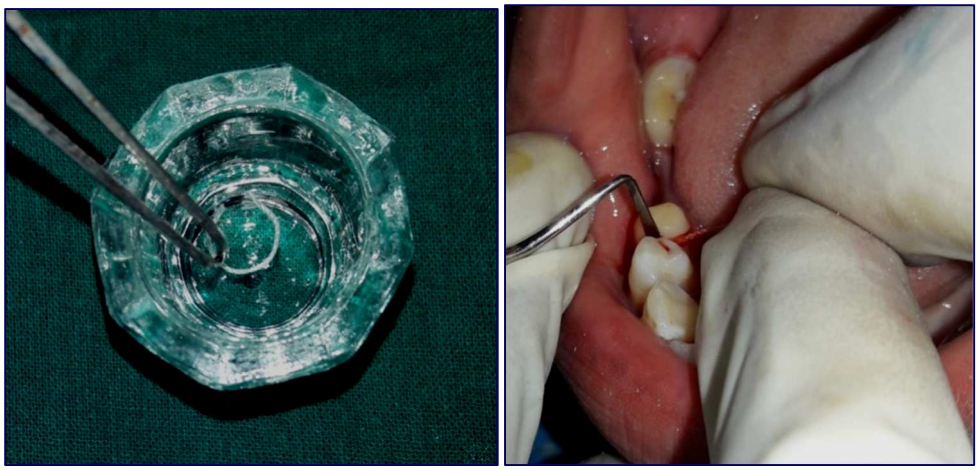


Figure 5: Stay put impregnated with oxymetazoline hydrochloride and placement in gingival sulcus

Gingitrac Retraction System:

It consists of cartridges of medium viscosity polyvinyl siloxane with ammonium aluminium sulfate , auto- mixing gun, mixing tips, intraoral tips and anatomic gingicap. The gingicaps are available in three different sizes for incisors, premolars and for molars.

First, the cartridge was attached to the auto-mixing gun, then the mixing tip and intraoral tips were attached to the cartridge. The intraoral tip was placed in to the gingival sulcus and gingival retraction material was applied in to the sulcus. Care was taken to ensure that the point of intraoral tip created a closed space between the tooth and marginal edge of the gingiva.

After injecting the retraction material, the corresponding gingicap was placed on to the abutment to push the material deep into the gingival sulcus (Figure: 6). The patients were asked to close on to the gingicap to hold it in the position and to apply uniform closing pressure to push the retraction material into the sulcus. After 4 minutes, the gingicap with the set retraction material attached to it, was removed from the patient's mouth. The gingival sulcus was ready for the recordings. Hemostasis, time taken and ease of placement, vertical gingival retraction was measured and recorded.

The horizontal gingival retraction was measured by making impressions of the prepared abutments both before and after gingival retraction. The obtained impressions were evaluated using a stereomicroscope and compatible image analysis computer software (Digimizer). (Figure : 9) The amount of gingival retraction was calculated by taking the difference between the values attained before and after gingival retraction.

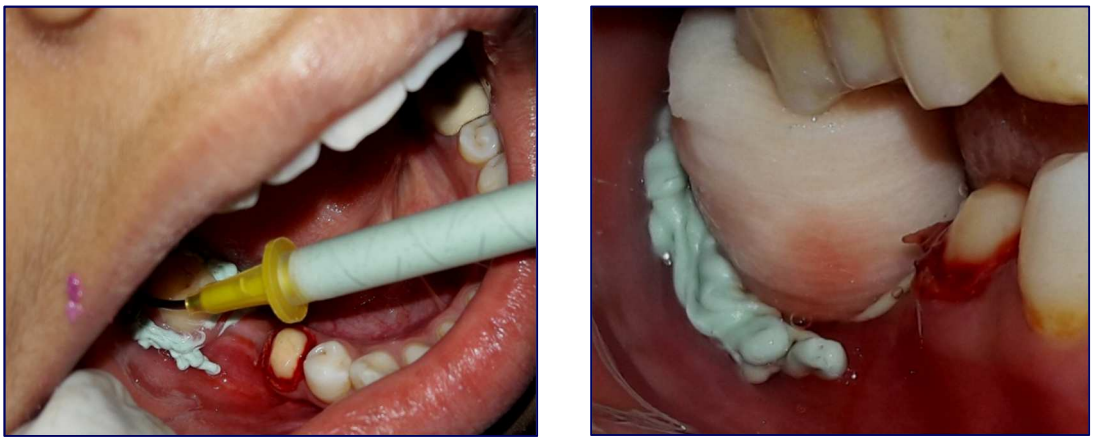


Figure 6: GingiTrac Retraction System application and Gingicap application

Figure 7 : Stereomicroscope was used for measure horizontal retraction in laboratory by analysis of impression made before and after gingival retraction

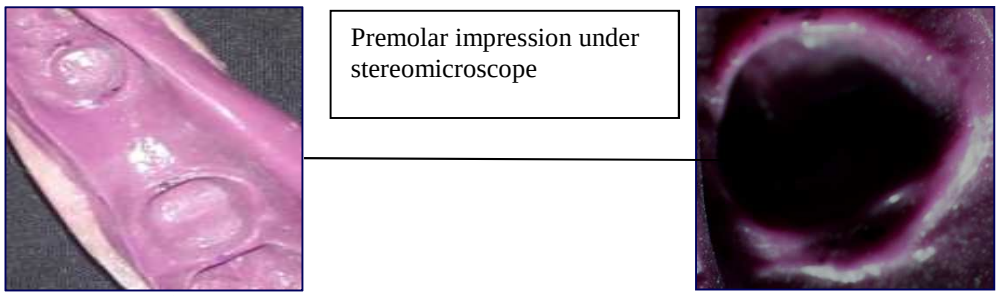


Figure 8: Addition silicone impressions made before retraction and after retraction.

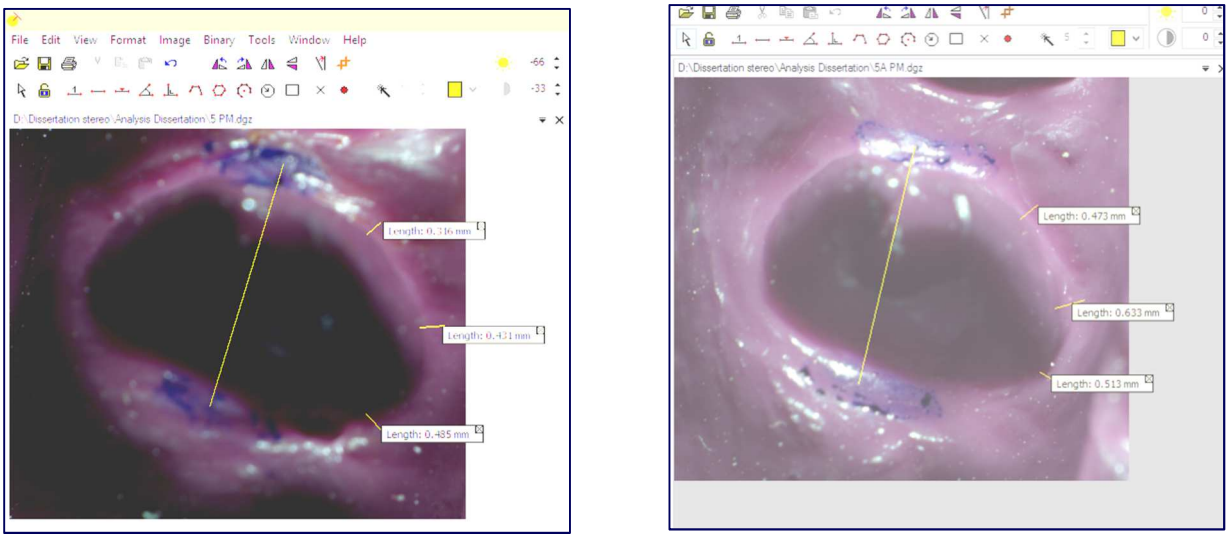


Figure 9: Stereomicroscopic analysis was done impression made before gingival Retraction and after gingival retraction by using Digimizer software

RESULTS

The mean time taken for placement in the gingival sulcus for; Traxodent was in Premolar 74.90 Seconds and Molar 83.10 Seconds, Stay put impregnated with oxymetazoline hydrochloride was in Premolar 178.8Seconds and Molar 187.1 Seconds and GingiTrac was in Premolar 56.3 Seconds and Molar 71.4 Seconds. According to Independent t test no stastically significanct difference found in Traxodent and Stay put impregnated with oxymetazoline hydrochloride in Premolar and Molar abutments with respect to mean time taken for placement . But GingiTrac retraction system shows stastically significant difference in Premolar and Molar abutments with respect to mean time taken for placement($P<0.001$) .

According to ANOVA test statistically significant difference ($P<0.001$) was found between

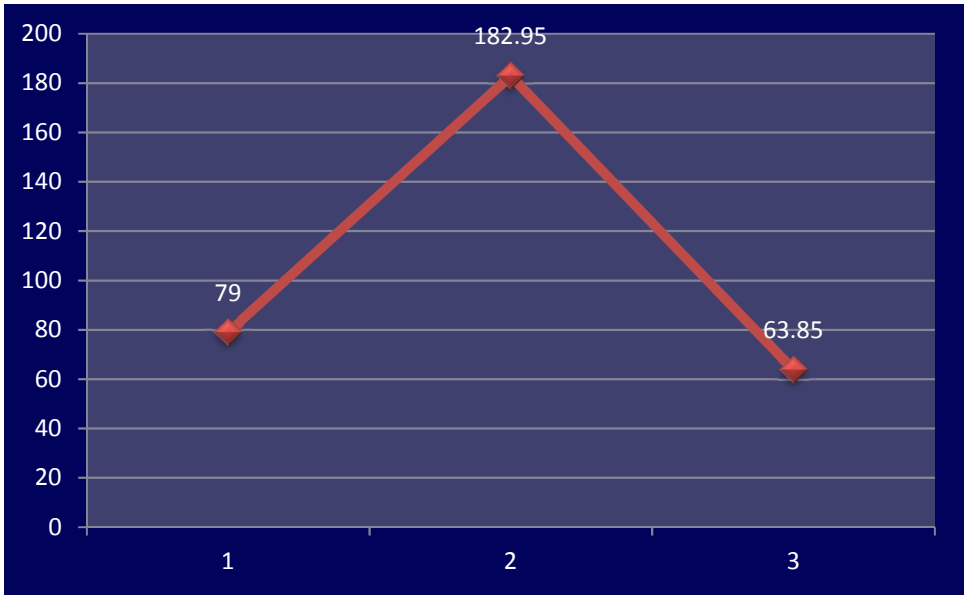
the three systems with respect to mean time taken for placement. The multiple comparisons using Bonferroni's test showed that there is a significant difference between; Stay put impregnated with oxymetazoline hydrochloride and GingiTrac retraction systems with respect to the mean time taken (P<0.001), Traxodent and GingiTrac retraction system with respect to the mean time taken (P<0.001) and also between Traxodent and Stay put impregnated with oxymetazoline hydrochloride retraction system with respect to the mean time taken for placement(P<0.001).

The hemorrhage scores of individual three systems in Premolar and molar abutments were evaluated by using Independent t test. The scores and result for Traxodent , Stay put Impregnated with oxymetazoline and GingiTrac are given in respectively. This result shows no stastically significant difference (P>0.05) with respect to hemorrhage scores.The hemorrhage scores between three retraction systems were evaluated by using ANOVA test. According to ANOVA test statistically significant difference (P<0.001) was found between the three systems with respect to hemorrhage scores.

The multiple comparisons using Bonferroni's test showed that there was a significant difference between; Stay put impregnated with oxymetazoline hydrochloride and GingiTrac,Traxodent and GingiTrac, and Traxodent and Stay put impregnated with oxymetazoline hydrochloride retraction systems with respect to hemorrhage scores (P<0.001). The Vertical and horizontal retraction of individual three systems in Premolar and molar abutments were evaluated by using Independent t test. The result for Traxodent , Stay put Impregnated with oxymetazoline and GingiTrac are given in and respectively. This result shows no stastically significant difference (P>0.05).The mean vertical retraction achieved with Traxodent system was 0.45 mm, Stay put impregnated with oxymetazoline hydrochloride was 1.46 mm and GingiTrac was 0.67 mm and mean horizontal retraction achieved with Traxodent system was 0.19 mm, Stay put impregnated with oxymetazoline hydrochloride was 0.37 mm and GingiTrac was 0.32 mm .The Vertical and horizontal retraction between three systems were evaluated by using ANOVA test. It shown stastically significant difference in respect to mean horizontal and vertical retraction.The multiple comparisons using Bonferroni's test showed that there is a significant difference between; Stay put impregnated with oxymetazoline hydrochloride and GingiTrac retraction systems, Traxodent and GingiTrac retraction system and also between Traxodent and Stay put impregnated with oxymetazoline hydrochloride retraction system with respect to the mean vertical and horizontal retraction(P<0.001).

Comparison of time taken for placement by different Systems

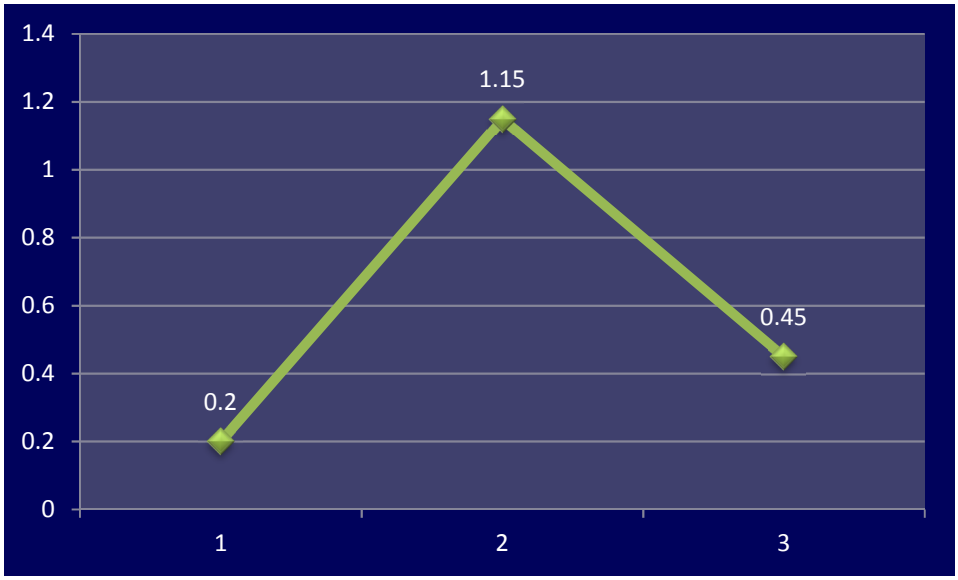
System	Mean	SD	Minimum	Maximum	P value
Traxodent	79.00	19.437	45	114	0.001 (S)
Stay Put Oxy. hcl	182.95	60.403	54	252	
GingiTrac	63.85	16.359	45	110	
Total	108.60	65.058	45	252	



1.Traxodent 2. Stay put impregnated with Oxymetazoline hydrochloride 3.GingiTrac

Comparison of Hemorrhage score in different Systems

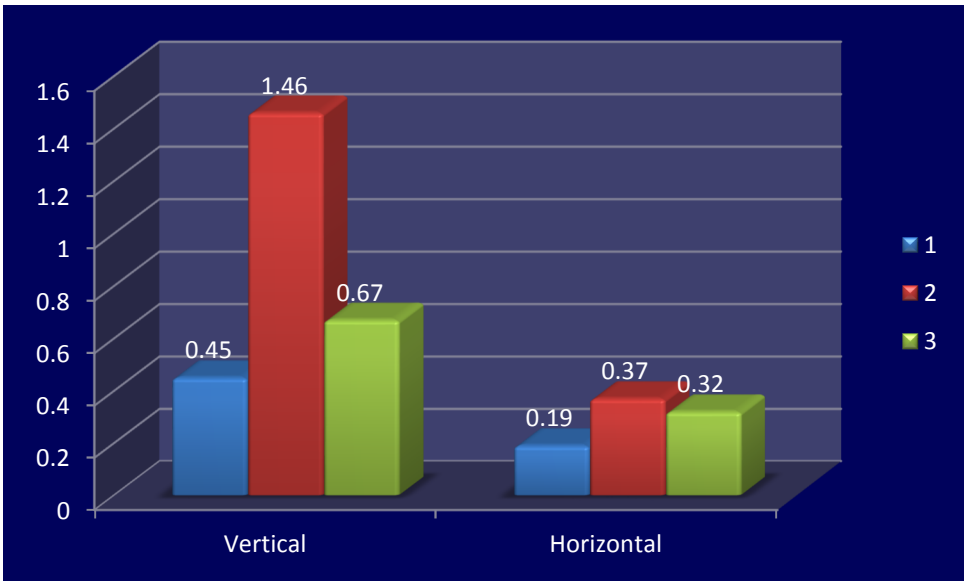
System	Mean	SD	Minimum	Maximum	P value
Traxodent	0.2	0.41	0.00	1.00	0.001 (S)
Stayput Oxy. hcl	1.15	0.67	0.00	2.00	
GingiTrac	0.45	0.51	0.00	1.00	
Total	0.6	0.66	0.00	2.00	



1.Traxodent 2. Stay put impregnated with Oxymetazoline hydrochloride 3.GingiTrac

Comparison of retraction (in mm) among different Systems (MB+mB+DB)

Retraction	System	Mean	SD	S error	P value
Vertical	Traxodent	0.45	0.175	0.02	0.001 (S)
	Stay put Oxy. hcl	1.46	0.519	0.06	
	GingiTrac	0.67	0.192	0.02	
	Total	0.86	0.549	0.04	
Horizontal	Traxodent	0.19	0.09	0.011	0.001 (S)
	Stay put Oxy. Hcl	0.37	0.177	0.022	
	GingiTrac	0.32	0.143	0.018	
	Total	0.29	0.161	0.012	



1.Traxodent 2. Stay put impregnated with Oxymetazoline hydrochloride 3.GingiTrac

DISCUSSION

Traxodent is a non-cord "mechanico-chemical" method of gingival displacement where the material is placed into the gingival sulcus. Which promises to provide easy, effective haemostasis and retraction .The GingiTrac consisting of medium type vinyl polysiloxane and ammonium aluminium sulphate material. According to manufacturers, it is potentially less traumatic to gingival tissue, as the GingiTrac material is syringed around the crown preparation margins and a comprecap is placed to maintain pressure which causes physical displacement of the gingival tissues. The Stay-put impregnated with oxymetazoline hydrochloride is a unique combination of softly braided retraction cord and an ultra-fine copper filament boundedwith nylon. The manufacturer claims that Stay-put retraction cord is effective and easier to place compared to conventional retraction cord, as the copper filament maintain its

shape and position once it is placed into the gingival sulcus.

Therefore, the present study was designed and conducted with the purpose of both clinical and laboratory analysis of the efficacies of these recently introduced Stay-put retraction cord impregnated with oxymetazoline hydrochloride, Traxodent retraction system and GingiTrac retraction system. The subjects in the study were assessed clinically and radiographically for the sound condition of both the abutments. Subsequently, these abutments were prepared for full coverage restoration with subgingival margins. Care is taken to avoid damage to surrounding gingival tissues. The three gingival retraction systems were used on the prepared abutments randomly, such that each combination is repeated ten times. For example, in first subject Stay-put impregnated with oxymetazoline hydrochloride &Traxodent retraction system were used for two prepared abutments, in second subject Traxodent and GingiTrac were used and in third subject Stay-put impregnated with oxymetazoline hydrochloride & GingiTrac were used for gingival retraction. The same order was followed for all thirty subjects, so that all three retraction systems were compared with each other in group of two for ten times. The parameters used in this study to compare the three retraction systems were; amount of vertical and horizontal gingival retraction, hemorrhage control, time taken and ease of placement.

The amount of mean vertical gingival retraction attained using; Stay-put impregnated with oxymetazoline hydrochloride was 1.46mm, Traxodent was 0.45 mm and GingiTrac was 0.67mm. The amount of mean horizontal gingival retraction attained using; Stay-put impregnated Oxymetazoline hydrochloride with was 0.37 mm, Traxodent was 0.19 mm and GingiTrac was 0.32 mm. Based on data collected, stay-put retraction cord impregnated showed maximum amount of vertical and horizontal retraction among the three materials used in this study. The retraction obtained from GingiTrac was found greater than that of Traxodent retraction system.

Statistical analysis using ANOVA test showed significant difference between the groups with respect to the mean vertical and horizontal gingival retraction ($P<0.001$). The multiple comparisons were made using Bonferroni's test. The test results revealed that, there was a significant difference between Stay-put impregnated with oxymetazoline hydrochloride and Traxodent retraction system, Stay-put impregnated with oxymetazoline hydrochloride and GingiTrac and also between Traxodent and GingiTrac retraction systems with respect to the mean vertical and horizontal gingival retraction ($P<0.001$).

The above mentioned results can be attributed to the following factors; Stay-put cord impregnated with oxymetazoline hydrochloride is a "chemicomechanical method" of gingival displacement, which involves physical displacement of the gingival tissue by placement of materials within the sulcus to obtain maximal gingival retraction. Whereas, Traxodent is a non-cord "mechanico-chemical" method of gingival displacement where the material is placed into the gingival sulcus. Retraction cap wass placed to maintain pressure which causes physical displacement of the gingival tissues. It might be more effective under specific, limited conditions--when the sulcus is flexible and of sufficient depth. The GingiTrac is also "chemicomechanical" gingival retraction system consisting of medium bodied vinyl polysiloxane material and ammonium aluminum sulfate.The material issyringed around the crown preparation margins and a Gingicap is placed to maintain pressure which causes physical displacement of the gingival tissues. Here, GingiTrac is more viscous in consistency as compare to Traxodent, it might be the reason for getting better retraction from Gingitrac compared to Traxodent retraction system but the retraction was lesser than that from Stay-put impregnated with oxymetazoline hydrochloride retraction cord where the cord was pushed mechanically into the gingival sulcus.

The hemorrhage scores between the three groups were evaluated by using ANNOVA test. A significant difference was found between the three groups with respect to hemorrhage scores ($P<0.001$). Based on data collected, Stay-put impregnated with oxymetazoline hydrochloride showed maximum bleeding on removal, followed by minimal bleeding on removal by GingiTrac, here it may be due to presence of ammonium aluminiumsulphate in the GingiTrac. The Traxodent retraction system induced

no bleeding on removal. A study conducted by Weir DJ and Williams BH, to compare the clinical effectiveness of mechanico-chemical tissue displacement methods showed that the maximum bleeding on removal was caused by dry retraction cords. Also the placement of retraction cord into the gingival sulcus may cause injury to sulcular epithelium and may induce bleeding on removal.

In GingiTrac retraction system the material was syringed around the crown preparation margins and a cap (Gingicap) was placed to maintain pressure, it was found potentially less traumatic to the tissues as compared to Stay-put retraction cord impregnated with oxymetazoline hydrochloride. In Traxodent retraction system hemostasis was produced by the aluminum chloride present in the retraction paste, while tissue retraction was achieved by its semi-rigid consistency. Further, as it was placed with little or no pressure, damage to the epithelial attachment and gingival tissues was minimal.

The mean time taken recorded for placement in the gingival sulcus for; Stay-put impregnated with oxymetazoline hydrochloride was 182.95 seconds, Traxodent was79 seconds and GingiTrac was 63.85 seconds. Among the three retraction systems compared in the present study, GingiTrac was relatively clinician friendly and easy to place, as it was applied with an applicator gun directly into the gingival sulcus. The Traxodent retraction system was also found user friendly and easier to place compared to Stay-put retraction cord, as it was applied with an automixing gun directly into the sulcus and a retractioncap was placed over it. However, the Stay-Put impregnated with oxymetazoline hydrochloride retraction cord placement requires more skill, experience and time similar to conventional retraction cords. This analysis was more of subjective in nature where the skill and experience of the operator was not considered.

Similar type of study was done by Ankit Gupta et al (2013)[6],and evaluated the clinical efficacy of 3 new gingival retraction systems; Stayput, Magic foam cord and expasyl, on the basis of their relative ease of handling, time taken for placement, hemorrhage control and the amount of gingival retraction and concluded that,

1. Time taken for application of expasyl retraction system was significantly ($P<0.05$) less compared to time taken for stay-put retraction cord.
2. The amount of vertical gingival retraction attained by using stay-put and magic foam cord retraction systems was significantly ($P<0.05$) higher than expasyl.
3. The hemorrhage control with the expasyl retraction system was found better than hemorrhage control with the other two retraction system used in the study.
4. Expasyl and magic foam cord retraction system were found easier in placement compared to stay-put retraction cord.
5. Magic foam cord can be considered more effective among the three retraction systems used in this study, as it has taken less time and was easier in placement, attained good amount of retraction and induced minimal bleeding on removal compared to stay-put retraction cord.

CONCLUSIONS

- Ease of placement and hemorrhage scores were assessed subjectively. Time taken for application for each retraction system was recorded.

Within limitations of this study, after analyzing the results following conclusions can be made:

- The amount of mean vertical gingival retraction attained using; Stay-put impregnated with oxymetazoline hydrochloride was 1.46 mm, Traxodent was 0.45 mm and GingiTrac was 0.67 mm. The amount of mean horizontal gingival retraction attained using; Stay-put was 0.37 mm, Traxodent was 0.19 mm and GingiTrac was 0.32 mm. Based on data collected, Stay-put retraction cord impregnated with oxymetazoline hydrochloride showed maximum amount of vertical and horizontal retraction among the three materials used in this study. The retraction obtained from GingiTrac was found greater than that of Traxodent retraction system.
- There was a significant difference between Stay-put impregnated with oxymetazoline hydrochloride and Traxodent retraction system, Stay-put impregnated with oxymetazoline

hydrochloride and GingiTrac and also between Traxodent and GingiTrac retraction systems with respect to the mean vertical and horizontal gingival retraction (P<0.001)..

- Based on data collected, Stay-put impregnated with oxymetazoline hydrochloride showed maximum bleeding on removal, followed by minimal bleeding on removal by GingiTrac. The Traxodent retraction system induced no bleeding on removal.
- The mean time taken recorded for placement in the gingival sulcus for; Stay-put impregnated with oxymetazoline hydrochloride was 182.95 seconds, Traxodent was 79 seconds and GingiTrac was 63.85 seconds.
- Within the limitations of the present study, GingiTrac retraction system appears to be a promising system for the control of hemorrhage, reduced clinical time for application and ease of placement.

However, till date no clinical study has demonstrated the superiority of one technique over other, so choice of which retraction system to use finally depends upon the presenting clinical situation and operator preference.

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