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COMPARISION AND EVALUATION OF GINGIVAL DISPLACEMENT BY USING DIFFERENT TYPES OF RETRACTION CORD SYTEM- IN VIVO STUDY

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Abstract

Purpose:

The purpose of this in vivo study was to compare the efficacy of three different gingival displacement systems in achieving gingival tissue displacement.

Aim:

To evaluate and compare the amount of gingival displacement using a mechanical system and a chemico-mechanical system.

Key words- gingival retraction, gingival retraction cord, impression making

Materials and method:

For the purpose of the present study adults of both sex who need full coverage restoration on their posterior teeth were drawn out of the department of Prosthodontics of Jaipur dental college and hospital, Jaipur.

A total of 30 subjects were selected according to inclusion and exclusion criteria. Maxillary & mandibular impressions were made with elastomeric impression material for all subjects.

Inclusion criteria

- Patients aged >18 years with healthy gingiva and clinically and radiographically sound posterior segments were included in the study.
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- The tooth may be root canal treated
- A molar tooth is selected for this study irrespective of any upper or lower arch.
- Patient should be ready to give consent to undergo the procedure involved in the study.
- Free from active periodontal inflammation.
- No bleeding on probing

Exclusion criteria

- Subjects history of systemic disease nor were on medication, or tooth fractured more than one-third of the clinical crown or having malocclusion or incompetent lips or para-functional habits.
- Pregnancy and lactation.
- A baseline of gingival health was obtained by initial sealing and polishing and all patients and all patients were free of gingival inflammation prior to the procedure.
- Subjects with Tipped, tilted, or rotated abutment teeth. Any kind of Gingival pathology
- Patients having a history of any periodontal surgery on that tooth.
- All the patients were instructed to follow the same oral hygiene instructions.

Methodology:
A detailed clinical examination and case history were obtained from all the participants.
The study was carried out after obtaining approval from the Institutional Ethics Committee of the institution.

The patients were randomly assigned to three equal groups: -

• Group A- represents the control group, where no retraction procedures were carried out.

• Group B- represents the retraction group, where gingival retraction was carried out with a mechanical method. (using Sure Endo Cord Non-Impregnated Retraction Cord)

Group C- represents the retraction group, where gingival retraction was carried out with the chemico-mechanical method. (using hemostatic astringent 25% aluminum chloride gel.

Preparation of patient

Patients were assessed clinically and radiographically. Finish lines were prepared for a fixed prosthesis with equigivngival margins (fig. 16) taking care to avoid damage to surrounding gingival tissues. After the preparation of teeth, the area was isolated thoroughly.

For Group A (control group)- no retraction system was used in this group of patients, an impression made with silicone impression material was used. Two-step impression with putty and light body with the perforated stock tray.

FOR GROUP B (retraction cord)- In this group of patients, a knitted retraction cord (sure endo retraction cord) was placed with the serrated cord packer around the abutment after tooth preparation and proper isolation were maintained and the final impression was made with the two-step impression technique.

FOR GROUP C (retraction cord with a hemostatic agent)- In this group of patients knitted retraction cord with a hemostatic agent, i.e. 25% aluminum chloride was used. (sure endo retraction cord + smart retract gel)

In these patients, the hemostatic agent was applied around the tooth and kept for 5mins and isolation was done with cotton rolls to maintain the working area dry. The required size of the retraction cord was selected according to the gingival biotype of the subject required length of the cord was cut and placed around the tooth, which was soaked in the hemostatic agent. Cord packing was started from the mesial to the distal by pushing the cord into the labio-gingival sulcus. The cord was left in the sulcus for 5 minutes after which it was slowly retrieved and the impression was made with elastomeric (addition silicone) impression material (polyvinyl siloxane) using the perforated stock tray. The impression was disinfected in 2% Glutaraldehyde and then poured using type IV die stone (ultra rock, kalabhai, India)and the cast was obtained.

Aluminum chloride displacement and impression

Isolation was done on the molar with cotton rolls to maintain dry working area. The required dimension of the retraction cord was selected according to the gingival biotype of the subject. The retraction cord impregnated with aluminum chloride looped around the labial surface of the tooth and gently pushed into the sulcus with the gingival cord packer instrument. The retraction cord was removed after keeping it for 10 min in the gingival sulcus. Impressions were made in a similar way as the baseline impressions.

Pouring of impression and sample preparation

Gypsum product (type IV) was immediately poured into each of the impressions. The mesiodistal width of each selected molar was measured on the cast with the help of a Vernier caliper (Digimatic caliper, Mitutoyo, Japan) and the center point of the tooth was marked on the cast. The second marking was done 3mm distal to the center point. The cut was made on the primary point and second point in the labio-palatal direction through the entire length of the cast to obtain a 3mm thick section using a die cutting machine (Vilman, India) Perpendicular line was then drawn from the most prominent point of the crest of the marginal gingiva to the tooth surface at a primary point.

The amount of gingival displacement was then measured as a distance from the tooth to the crest of the gingiva in a horizontal plane.

RESULTS

An optical microscope (AxioCam MRc) with a higher magnification of 50X(fig.15) was used to examine the sample in order to calculate the amount of displacement. The MIC 3.0 image analyzer software received the image after it was captured. From the highest point of the marginal gingival crest to the tooth surface, a perpendicular line was drawn. The area chosen to calculate the displacement measurement was mid-buccal, mesio buccal, and distobuccal of the die.

The values of gingival displacement for all the specimens in μm^2 were tabulated and subjected to statistical analysis.

Control		Lateral displacement(μm^2)	Vertical displacement(μm^2)
	Min	301.12	260.21
	Max.	431.65	413.20
	Mean	382.05	333.03
	SD	39.48	42.12
	P - Value	0.0000	
Mechanical			
	Min	812.40	402.30
	Max.	898.72	487.67
	Mean	850.70	440.59
	SD	22.54	27.51
	P - Value	0.0000	

Chemico-Mechanical			
	Min	901.21	441.13
	Max.	932.04	482.31
	Mean	916.34	453.34
	SD	9.08	10.62
	P - Value	0.0000	

Table I: COMPARISON BETWEEN LATERAL DISPLACEMENT & VERTICAL DISPLACEMENT

By doing student t test, it is a method of testing hypothesis about the mean of a small sample drawn from a population when the population standard deviation is unknown. It shows that the maximum mean of the gingival displacement in chemico-mechanical retraction system i.e. 916.34 μm^2 in lateral displacement and 453.34 μm2 in vertical displacement.

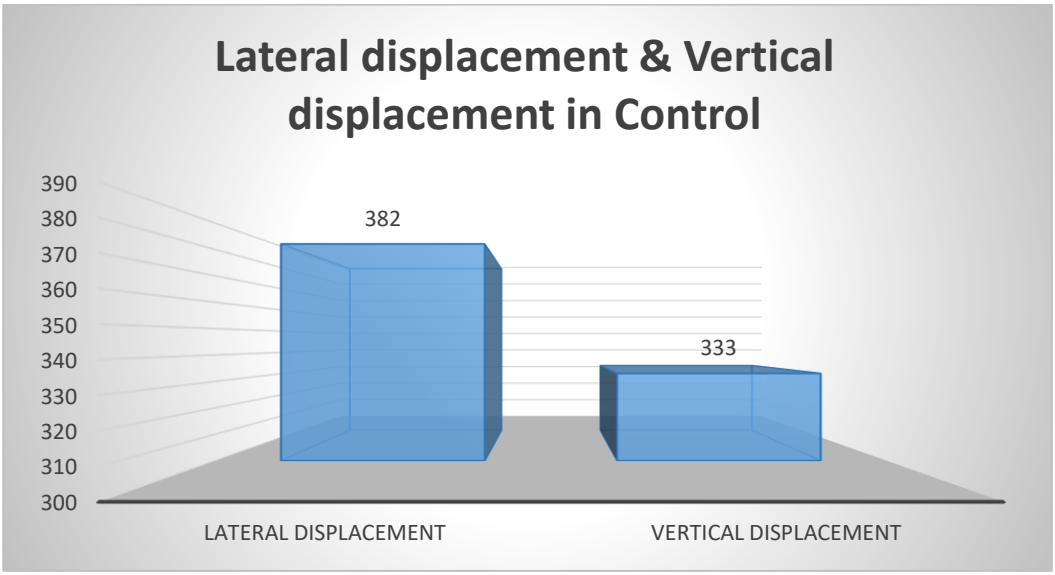
		Lateral displacement	Vertical displacement
Control			
	Min	301.12	260.21
	Max.	431.65	413.20
	Mean	382.05	333.03
	SD	39.48	42.12
	Min	812.40	402.30
	Max.	898.72	487.67
	Mean	850.70	440.59
	SD	22.54	27.51
Chemico-Mechanical			
	Min	901.21	410.13
	Max.	932.04	450.31
	Mean	916.34	452.34
	SD	9.08	10.62
	P - Value(ANOVA)	0.0000	0.0000

Table II: COMPARISON FOR LATERAL DISPLACEMENT & VERTICAL DISPLACEMENT

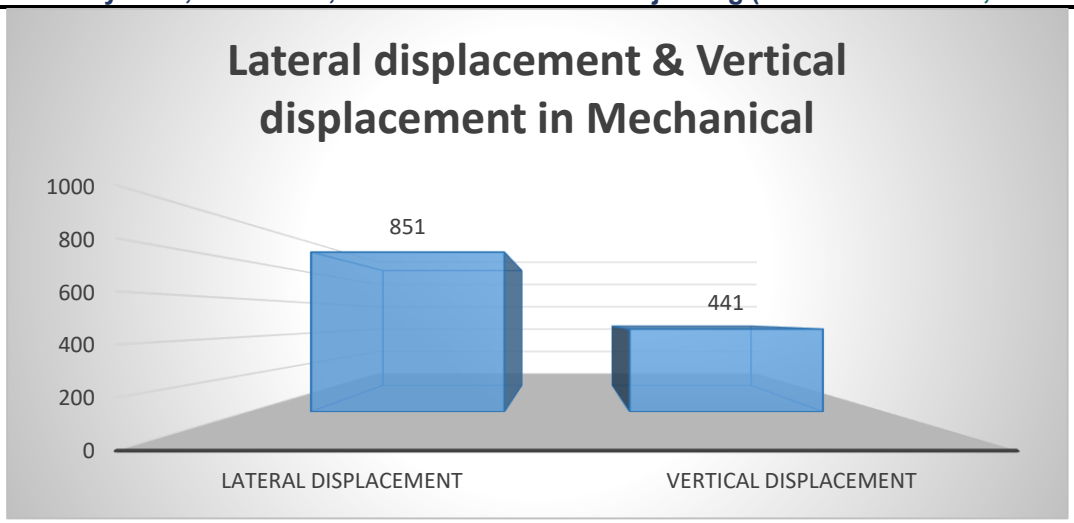
By doing ANOVA test, which stands for Analysis of Variance, is a statiscal test used to analyse the difference between the means of more than two groups. ANOVA, $p<0.05$(highly significance). This shows the max. Displacement in chemico-mechanical system i.e. 916.34 μm^2 in lateral displacement and 452.34 μm^2 in vertical displacement.

Dependent Variable			Mean Difference (I-J)	Sig.
Lateral displacement	Control	Mechanical	-468.65	0.000
		Chemico-Mechanical	-534.29	0.000
	Mechanical	Control	468.65	0.000
		Chemico-Mechanical	-65.64	0.000
	Chemico-Mechanical	Control	534.29	0.000
		Mechanical	65.64	0.000
Vertical displacement	Control	Mechanical	-107.56	0.000
		Chemico-Mechanical	-120.31	0.000
	Mechanical	Control	107.56	0.000
		Chemico-Mechanical	-12.74	0.225
	Chemico-Mechanical	Control	120.31	0.000
		Mechanical	12.74	0.225

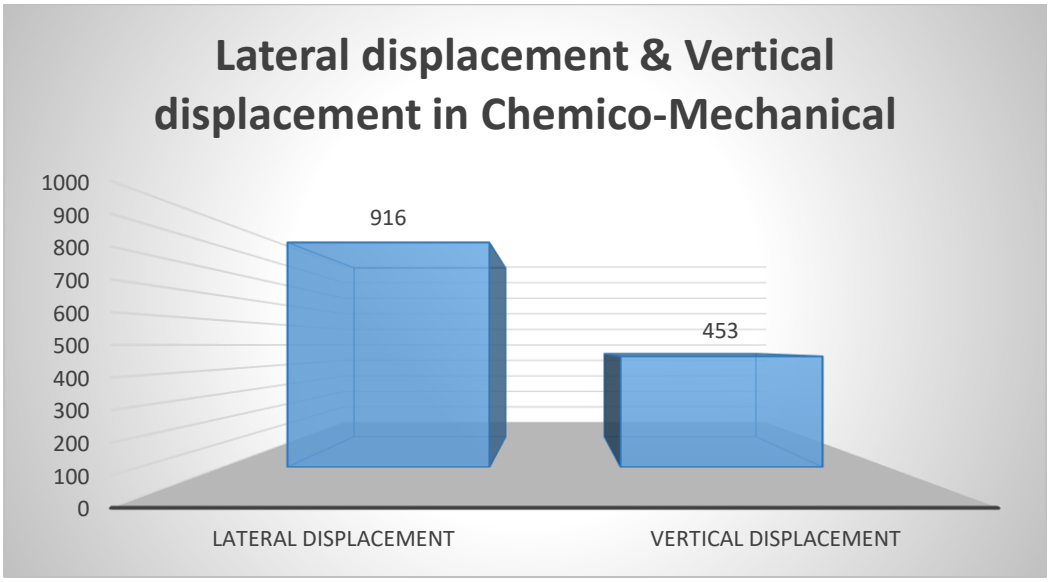
Table III: comparison of intergroup gingival retraction in lateral and vertical displacement by doing post hoc test It is done to identify exactly which group differs from each other, such tests are also called as multiple comparison tests. That shows the maximum displacement by group III in comparison to group I and ground II.



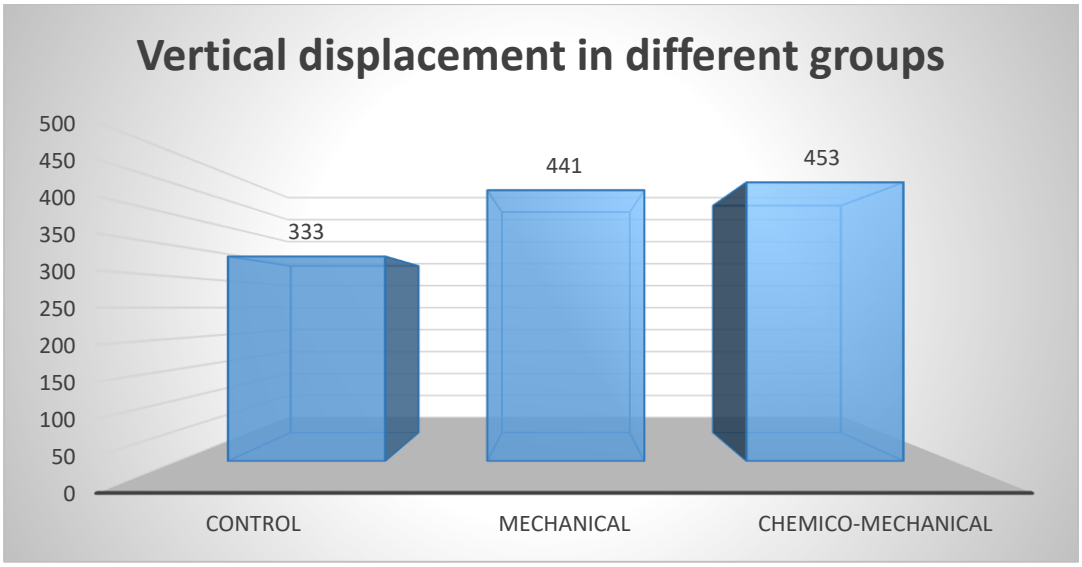
Graph I comparison of lateral and vertical gingival displacement in control group.



Graph II comparison of lateral and vertical displacement gingival displacement in mechanical group.



Graph III comparison of lateral displacement and vertical displacement in a chemico-mechanical group.



Graph V Shows the distribution of the mean value of the amount of vertical gingival displacement by all three groups used in the study.

Discussion

All the measurements in the study were made by single operator to avoid inter-operator variability. The oral cavity is a challenging area for carrying out any restorative treatment because of the constraints of the tongue, cheeks, and lips. It is also challenging to treat the teeth that are located in an inaccessible area, especially when the surrounding gingival tissues bleed if improperly manipulated. In the majority of clinical cases, carious or non-carious cervical lesions, as well as finishing line of various intra- and extra coronal restorations is located at or below the free gingival margin. Access to the subgingival finish line is very difficult during tooth preparation, impression making, and cementation without additional techniques to displace surrounding gingival tissues. One of the most challenging aspects of fixed prosthodontic treatment is the management of gingival tissues when making an impression. Gingival tissue management includes displacement of the gingiva away from the prepared margins so that an impression can be made. Gingival displacement is defined as the deflection of the marginal gingiva away from the tooth. (GPT 9).

In the present study, we analyzed different gingival retraction systems that are mechanical by using a retraction cord and chemico-mechanical by using a 25% aluminum chloride hemostatic agent with a retraction cord, which brings physical as well as chemical displacement of the tissue. Gingival tissue displacement should be chosen such that the gingival sulcus is properly retracted and that hemostatic action and elimination of tissue fluid (crevicular fluid) is ensured. We use the single cord technique in this study as it is relatively simple and efficient and is probably the most commonly used method of achieving gingival displacement. It is also known that better sulcus enlargement can be achieved with a chemically treated cord, which causes transient ischemia and shrinks the gingival tissue.

In the present study, the amount of gingival displacement was measured on the 3 mm sectioned part of the cast under an optical microscope with image analysis software. This method was similar in some ways to that used by Bowles et al.[20] and Chaudhari J et al.[21.] All the measurements done in the present study were made by a single operator to avoid inter-operator variability. The findings of our study were consistent with the findings of Chaudhari J et al[24]. He compared aluminum chloride, tetrahydrozoline, and Expasyl gingival retraction paste to the cord impregnate. In which the Expasyl showed the least amount of gingival displacement and the cord impregnated with aluminum chloride showed the maximum amount of gingival displacement The results obtained in our study were in accordance with the study conducted by Kriti Jajo Shrivastava et al.[25] in which they compared the clinical efficacy of three gingival displacement systems to accurately record intra-crevicular margins of tooth preparation. One mechanical (magic foam cord) and two chemico-mechanical (expasyl paste and retraction cord impregnated with 15% aluminum chloride) gingival displacement systems were used. The casts were sectioned and viewed under an optical microscope, followed by quantitative measurements of the width of the pre-and post-retracted sulci. In the result they obtained, all three displacement systems produced highly significant horizontal gingival displacement. The retraction cord soaked in 15% aluminum chloride produced the maximum displacement (0.74 mm), followed by expasyl paste (0.48 mm), whereas the magic foam cord produced the least displacement (0.41 mm). According to Shaw DH et al.[27], the mechanical effect of the cord itself will be considered equal for all materials. However, the action of the medicament is different according to its mechanism of action. Chemically impregnated cords are the most commonly used technique for gingival tissue displacement. The use of a cord impregnated with aluminum chloride (5–25%) is referred to as the safest and most effective method of gingival displacement. Aluminum chloride solution (15%) acts as a hemostatic agent and astringent. It has the ability to precipitate protein, constrict blood vessels, and extract fluid from tissues. However, utmost care was taken to minimize these errors. In all cases, the single retraction cord technique was used; other retraction cord techniques, such as the double cord technique, were not considered.

From the results and the clinical point of view, the chemico-mechanical retraction system was effective in almost all the variables considered in the present study. Finally, the choice of which gingival retraction system or technique to use still depends on the clinical condition and the operator's preference.

CONCLUSION

Within the limitations of this in vivo study, the following conclusions were drawn: the gingival retraction cord helps in displacing the gingiva both in a vertical and lateral direction, but using a chemical, i.e., aluminum chloride, in an appropriate concentration (25%) produces the maximum retraction in both lateral and vertical displacement. And it causes minimal tissue damage in terms of inflammation, recession, and change in contour. The removal of the retraction material revealed that the retraction cord was difficult to place but that the removal was easy.

The time taken for the application of the chemico-mechanical retraction system (retraction cord plus retraction paste) was significantly ($p < 0.05$) more than the time taken for the mechanical retraction system (retraction cord).

The amount of vertical gingival displacement attained by using chemico-mechanical retraction systems was significantly ($p < 0.05$) higher than mechanical retraction systems.

The amount of lateral gingival displacement attained by using a chemico-mechanical retraction system was significantly higher than that achieved by a mechanical retraction system.

Gingival displacement was more effective when using a retraction cord with a 25% aluminum chloride hemostatic agent in both vertical and lateral displacement.

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