Journal of Chemical Health Risks

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JCHR (2025) 15(4), 534-542 | ISSN:2251-6727

Evaluation of Gingival Displacement Achieved by Gingival Retraction Cord Impregnated with Herbal Solution in Prepared Posterior Teeth - a Randomized Parallel Clinical Trial

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(Received: 16 May 2025 Revised: 20 June 2025 Accepted: 02 July 2025)

KEYWORDS

Gingival retraction,

vertical displacement, horizontal displacement, retraction cords.

ABSTRACT:

Introduction: To compare the gingival displacement achieved by the herbal solution, Mocharasa impregnated gingival retraction cord and plain cord in prepared posterior teeth in both the vertical and horizontal directions in patients between 18–55 years of age.

Aim: This study aims to compare the clinical efficacy of mechanical gingival displacement in prepared posterior teeth obtained by impregnated Mocharasa gingival retraction cord with non-impregnated gingival retraction cord as a herbal treatment.

Methods: 40 Subjects with a gingival score from 0.1-1.0 were taken for the study. Gingival displacement was carried out in prepared posterior teeth with the help of a cord soaked in Mocharasa solution and plain cord. A thermoplastic vacuum-formed stent was fabricated on a diagnostic cast to measure post-operative vertical gingival displacement at the gingival margin's deepest point on the mid-buccal surface of the tooth. The thickness of the elastomeric impression material at the finish line, which corresponds to the gingival sulcus' width, was measured under a trinocular microscope with a macro attachment camera (LABO microscope).

Results: The post-retraction readings for vertical displacement, for the cord dipped in Mocharasa solution (Group A) were 0.43 µm and the plain Cord (Group B) was 0.23 µm. The mean horizontal displacement for group A was 558.0 µm at mesio-buccal, 555.28 µm at mid-buccal, and 560.28 µm at disto-buccal, and for group B, it was 344.50.0 µm at mesio-buccal, 349.44 µm at mid-buccal, and 350.83 µm at disto-buccal.

Conclusions: The study concluded that highly significant vertical and horizontal displacement was observed when cord impregnated with Mocharasa herbal solution was used for gingival displacement as compared to plain cord.

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JCHR (2025) 15(4), 534-542 | ISSN:2251-6727

1. Introduction

Building a solid foundation is essential for long-term stability and success. In prosthodontics, fixed prostheses are used to replace lost or decaying teeth or for cosmetic purposes. For this, the surrounding periodontal tissues must be adequate in health and equilibrium [1]. Maintaining gingival health and its aesthetic appeal is one of the trickiest procedures [2]. Gingival displacement is defined as "The deflection of the marginal gingiva away from a tooth" [3] . This process creates the space/room needed for the impression material to reach the apical region and replicate all of the fine details between the gingival tissue and finish lines [4,5,6] . In order to traumatically produce enough space between the gingival tissue and the finish line inject the necessary bulk of the impression material into the widened fissure, and gingival displacement is performed. It is easier to fabricate a prosthesis with proper marginal integrity and a sound emergence profile when there is a clear image of the impression [7] . During retraction, the gingival tissues exhibit several stresses, including displacement, collapsing, and relapsing forces [8,9] .

There are numerous gingival retraction techniques accessible, such as electrosurgery, chemico-mechanical displacement, mechanical displacement, chemical treatments, and rotational gingival curettage [10,11,12] . The mechanical technique of gingival displacement with a retraction cord has been in use for a number of years [13]. However, the dentist finds this method tedious and delicate making it more prone to tissue abrasions, gingival irritation, or uneven margin placement. Recent trends in the market use cordless gel, paste, such as Racegel, 3M Astringent paste, and magic foam. Racegel is one of the hemostatic agents and comprises 25% aluminum chloride, oxyquinol, and excipients. Racegel and Expasyl are two chemical substances that are used for gingival displacement; they cause less trauma to gingival tissue and decrease bleeding [1,14,15] .Thus, a method that controls both bleeding, provides necessary gingival displacement without leading to stress should be preferred [16]. Using chemico-mechanical is the most common that involves retraction cord being soaked or impregnated with chemicals to obtain adequate gingival displacement [17].

Medicinal plants serve as the foundation for all alternative medical systems and are a source for the development of newer drugs. As a haemostyptic medicine, mocharasa is a reddish-brown herbal substance that is in demand in the pharmaceutical industry for the development of formulations used for bleeding disorders. Because of its astringent, cooling, and binding qualities, it is used to treat bleeding problems such as menorrhagia, bleeding uterine disorders, ulcers, wound healing, etc. Astringents can be used to stop bleeding while creating impressions and packing cords. Many chemicals have been utilized to impregnate the gingival cord, and their application decreases the seepage of gingival fluid. However, the gingival cord has not yet been impregnated with any herbal astringent[18] .

Therefore, this study aims to assess the clinical effectiveness of mechanical gingival displacement in prepared posterior teeth produced by herbal solution—that is, by Mocharasa impregnated gingival retraction cord and non-impregnated gingival retraction cord.

2. Objectives

Primary Objectives

a) To assess the gingival displacement (retraction) in both the vertical and horizontal directions that patients in the 18–55 age range experienced after utilizing a gingival retraction cord impregnated with Mocharasa, a herbal solution, in their prepared posterior teeth and gingival retraction cord non-impregnated with Mocharasa.
b) To compare, in prepared posterior teeth for patients aged 18 to 55, the vertical and horizontal gingival displacement obtained with herbal solution—Mochasa impregnated gingival retraction cord and non-impregnated gingival retraction cord.

OTHER OBJECTIVES

a)To assess the level of pain that patients in the 18–55 age range feel after applying a herbal remedy—Mochas impregnated gingival retraction cord in prepared posterior teeth—using the VAS Scale.
b)To assess patient discomfort using the VAS Scale when non-impregnated gingival retraction cords are used in prepared posterior teeth for patients between the ages of 18 to 55.
c)To compare the amount of pain that patients in the 18–55 age range feel when using a herbal solution—Mochasa impregnated gingival retraction cord and non-impregnated gingival retraction cord—to accomplish gingival displacement in prepared posterior teeth.

3. Methods

Study design – The subjects selected for the study were from the outpatient department of the MGV's KBH dental college and hospital who had come for replacement of teeth with a fixed partial denture. The protocol for the randomized controlled parallel arm

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JCHR (2025) 15(4), 534-542 | ISSN:2251-6727

clinical trial was approved by the Institutional Ethical Committee (MGV/KBHDCH/226/2022). Patients requiring full coverage restoration with maxillary and/or mandibular posterior teeth within the age group of 18-55 years of age with a gingival score between 0.1-1.0 and willing to participate in the study were included in the study. Patients with tipped, tilted, or rotated abutment teeth, gingival pathology, undergone periodontal surgery in the past 6 months, medically compromised patients, and pregnant and lactating women were excluded from the study. The study was conducted abiding by all human ethical principles as per the WMA- Declaration of Helsinki and the Guidelines of Good Clinical Practice (ICMR). Patients were allocated to two different experimental groups by simple randomization procedures (computerized random numbers). Subject randomization was conducted using a computer spreadsheet. On the day of the procedure for tooth preparation, each patient was assigned to the experimental groups according to sealed envelopes containing the type of treatment. In the test group, patients' gingival displacement was done using a cord soaked in Mocharasa herbal solution, while in the control group, gingival displacement was done using plain cord.

Preparation of Mocharasa herbal solution - The preparation of the specimen was carried out at Ayurved Seva Sanchalit, Ayurved Sanshodhan vibhag in Nashik. According to the Ayurveda studies, 1 part of Mocharasa + 16 parts of water on decoction gives 20ml decocted herbal product (Fig. 1). As a result, 100 grams of the herbal product Mocharasa were weighed on a weighing machine in its unprocessed form. It was then roughly ground into a fine powder and allowed to swell in water for a day (Fig. 2). It was then immersed in 100 litres of water. Later,1500 ml more water was added to the previous mixture. To obtain a decoct form of Mocharasa in 500 ml (about 4 L) volume, the swollen herbal solution was heated to 70–80 degrees Celsius(Fig. 3) The product was then filtered and kept for cooling (Fig. 4). To prevent the solution from spoiling and to be used for a long time, preservatives such as sodium benzoate (0.1gm), sodium methyl paraben (1.8gm), and sodium propyl paraben (0.2gm) were added after the mixture had cooled. After that, the liquid was collected and kept at room temperature in plastic containers (Fig. 5).

In order to determine the astringent and hemostatic properties of the solution, Heller's test was carried out. In a test tube, take 3ml conc HNO_3. add Mocharasa herbal solution on the side of the test tube - A White ring was seen at the top of the two layers. Concentrated mineral acids ie HNO_3, H_2SO_4 and HCL, cause denaturation of protein. Since there was denaturation of protein, haemostatic and astringent properties were demonstrated by the Mocharasa solution (Fig 6,7).

Fig. 1: Unprocessed Mocharasa (Herbal Product)

Fig. 2: coarsely ground fine Mocharasa powder

Fig. 3: addition of extra 1500ml of water and Mocharasa herbal solution heated up to 70-80 degrees Celsius.

Fig. 4: Mocharasa herbal solution being filtered and kept cool

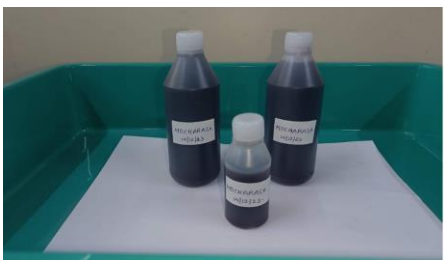

Fig. 5: Final Mocharasa herbal solution in plastic containers ready to be used.

II) TO TEST WHETHER THE SOLUTION HAS ASTRINGENT OR HEMOSTATIC PROPERTIES.

a) **Heller's nitric acid test**.

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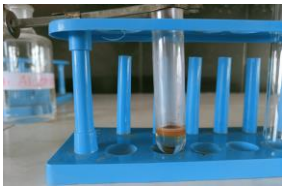

Fig. 6: Bottle of conc HNO_3

Fig. 7 : yellow precipitate at junction of two solutions on addition of Mocharasa herbal solution to conc HNO_3 .

Clinical trial - The patients with a gingival index score from 0.1-1.0 were taken into consideration for the study. Diagnostic impressions were made using heavy body elastomeric impression material. (Fig. 8) .The impression was poured in dental stone and was used as a study model. On the diagnostic cast, a thermoplastic vacuum-formed stent was fabricated. Preoperative vertical distance was measured from the stent to the gingival margin's deepest point on the mid buccal surface of the tooth to be prepared with the help of a divider.

The tooth selected for the study was prepared for complete veneer restoration with an equi-gingival margin. The options in the complete coverage restorations were full metal, all ceramic and porcelain fused to metal (PFM) crowns. After the tooth preparation was complete impression was made by the putty wash technique using an addition silicone impression material. The gingival cord was cut to the necessary length and was placed in the Mocharasa herbal solution 15 minutes before its use . With the help of a cord packer the cord was packed in the sulcus from mesio-buccal, mesial, lingual, distal and ended at mesio-buccal(Fig. 9). The putty impression was made first with the cord in the sulcus. Then, space for light body impression material was made. The tray was loaded with light body impression material, and before placing it in the mouth, the cord was removed with a tweezer. The cord was placed in the sulcus for 5 min. The final impression obtained was examined under a stereomicroscope to check for any tears or voids (Fig. 10).

Using a trinocular microscope with a macro attachment camera, the thickness of the impression material at the finish line—which corresponds to the gingival sulcus width—was measured (LABO microscope) at the mesiobuccal, distobuccal, and mid-buccal areas.(Fig. 11) After that, the impression was poured with a die stone to create a study model. The same procedure was carried out for control group patients for non-impregnated gingival retraction cord in prepared posterior teeth. This corresponded with the measurement of the horizontal gingival displacement.

The pre-operative thermoplastic vacuum formed stent made on the diagnostic cast was positioned on the final impression cast in order to quantify the sulcus depth, or the vertical displacement(Fig. 12). The stent's distance from the gingiva's deepest point is determined using a divider. A comparison is made between the gingival margin's preoperative and postoperative distances from the stent. This value obtained corresponds to the vertical displacement achieved by the retraction cords of the test group and control group (Fig. 13).

I) PREPARATION OF TOOTH SURFACE

Fig.8: preoperative impressions for 46 crown preparations.

Fig. 9: crown preparation for 46 tooth and gingival retraction cord ♯000 impregnated in Mocharasa herbal solution.

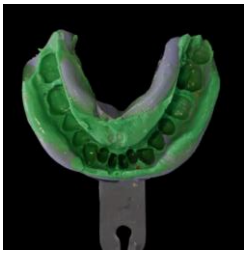

Fig. 10- Final impression using an elastomeric impression and post-operative mandibular cast after crown preparation.

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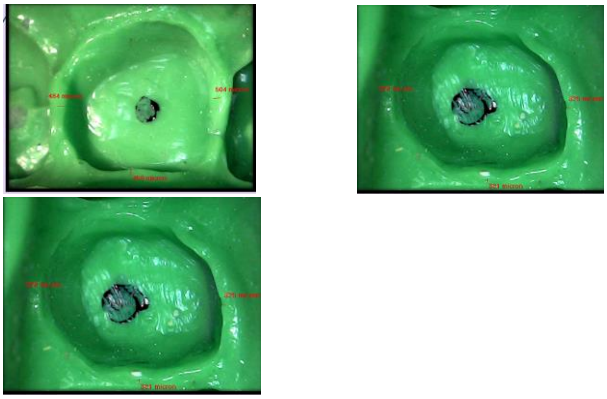

Fig. 11 : Readings when the cord is impregnated in Mocharasa solution (46 sample).

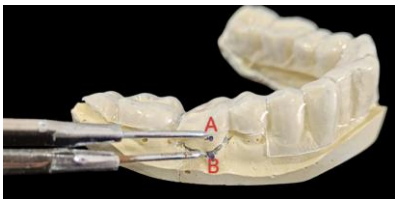

Fig. 12: Reference point marked on the cast with the help of thermoplastic stent (A– lower margin of the splint and B-crest of the gingival margin in the mid buccal region) on preoperative cast.

Fig. 13: Reference point marked on the cast with the help of thermoplastic stent (A– lower margin of the splint and B-crest of the gingival margin in the mid buccal region) on post-operative cast for vertical displacement.

4. Results :

Statistical analysis was done by using tools of descriptive statistics, such as Mean and SD for representing quantitative data. Unpaired t'test used to compare between means of two groups independent of each other. The mean difference in the position of the gingiva before gingival displacement and after gingival displacement in the test group (group A) was 0.43±0.1 µm. The mean difference in the position of the gingiva before gingival displacement and after gingival displacement in the control group (group B) was 0.29±0.08 µm. The mean difference of the test group was more than that of the control group, and it was statistically significant with $p \leq 0.001$.

Table 1- Intragroup comparison of vertical displacement in Group A (Cord dipped in Mocharasa solution) and Group B (Control) respectively .

	Pre-op Mean (SD)	Post –op Mean (SD)	Difference Mean (SD)	Paired t test	P value
Group A	0.927 (0.17)	1.37 (0.2)	0.43 (0.1)	t=-7.12	p<0.001**
Group B	0.877 (0.18)	1.17 (0.18)	0.29 (0.08)	t= -4.89	p<0.001**

p>0.05- no significance *p<0.05- significant **p<0.001-highly significant

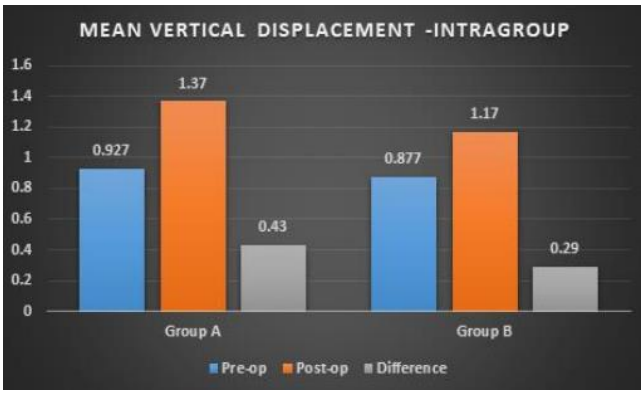

Table 2- Vertical displacement – Intergroup comparison of vertical displacement between Group A (Cord dipped in Mocharasa solution) and Group B (Control) respectively.

	Pre-op Mean (SD)	**Post-op Mean (SD)**	**Difference Mean (SD)**
Group A	0.927(0.17) µm	1.37(0.2) µm	0.43(0.1)
Group B	0.877(0.18) µm	1.17(0.18) µm	0.29(0.08)
Unpaired t test	t=0.855	t=3.126	T=4.257
P value , Significance	p=0.399	P=0.004*	p<0.001*

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p>0.05- no significance *p<0.05- significant **p<0.001-highly significant

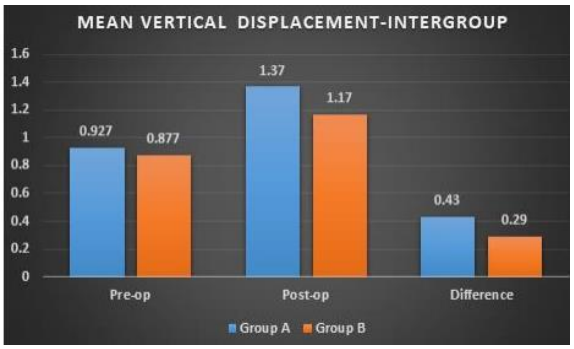
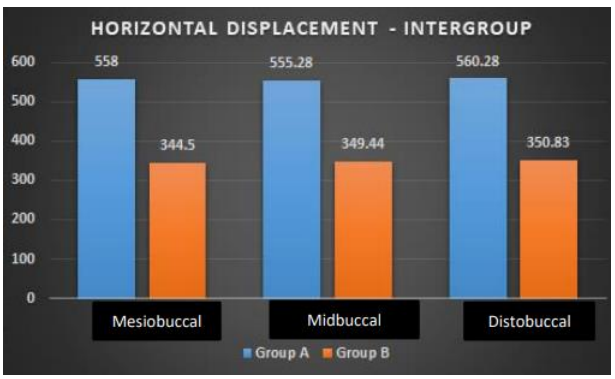


Table 3 – Horizontal Displacement – Intergroup comparison of horizontal displacement between Group A (Cord dipped in Mocharasa solution) and Group B (Control) respectively .

	Mesio Buccal Mean (SD)	Mid Buccal Mean (SD)	Disto Buccal Mean (SD)
Group A	558.0 (25.99) µm	555.28 (24.75) µm	560.28 (29.09) µm
Group B	344.50 (18.1) µm	349.44 (16.15) µm	350.83 (15.6) µm
Unpaired t test	t=28.593	t=29.541	t=26.916
P value , Significance	P<0.001**	P<0.001*	p<0.001**

p>0.05- no significance *p<0.05- significant **p<0.001-highly significant



The thickness of the impression material corresponding to the width of the gingival sulcus, i.e showing horizontal displacement in the mesio-buccal, was 558.0±25.99 µm, mid-buccal was 555.28±24.75 µm, and disto buccal was 560.28±29.09 µm for group A, and for group B was 344.50±18.1 µm at mesio-buccal, 349.44±16.15 µm at mid-buccal, and 350.83±15.6 µm at disto buccal. The difference between the two groups was highly significant, with p-value of p ≤0.001.

4. Discussions

The study aims to reversibly shift the gingival tissues laterally and vertically using an herbal mechanical method, ie, gingival retraction cord dipped in herbal solution - Mocharasa in order to capture the marginal tissues and introduce a large amount of low-viscosity impression material into the expanded sulcus. A study was done on 40 subjects who required preparation on posterior teeth to receive FPD. The study design was a parallel-arm randomised clinical trial. To minimize the bias, random allotment was done with the help of a sealed envelope.

Ayurveda, the ancient Indian system of medicine, offers several herbal and natural remedies that are sometimes considered as alternatives or supplements in modern dental practice. These alternatives are typically used in specific contexts where they are believed to provide therapeutic benefits - cloves have analgesic and antibacterial properties, neem is used in toothpastes, mouthwashes, and babul for mouth rinses.

Mocharasa, also known as Shalmali (Salmaliamalabarica), is a plant commonly used in Ayurvedic medicine to treat bleeding disorders and to promote clotting in wounds. It is a fact that it possesses haemostatic properties, which means it can stop bleeding. The specific haemostatic properties are attributed to phytochemicals that help in blood coagulation and wound healing processes[18] . It was never used in dentistry before. As it is a haemostatic agent, it can be used after tooth extraction to stop bleeding, for bleeding gums, during surgery to reduce bleeding, and make the field clear for proper visualization of Impression margins.

In the present study, we have used Mocharasa (Salmaliamalabarica) for soaking the gingival retraction cord. Gingival retraction is a technique used in dentistry to expose tooth structure below the gingiva to give a restoration in alignment with the unprepared tooth. During the procedure, bleeding is encountered. Mocharasa is used in the form of a liquid to achieve gingival displacement by impregnating the retraction cord with mocharasa, primarily due to its astringent and hemostatic properties[18]. Astringents cause temporary shrinkage or constriction of tissues, which in this case helps in pulling back the gingival tissue to expose the tooth more effectively[18]. The astringent property of the mocharasa was proved by the use of Heller's test.

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However, measurements of the sulcular width were made on dies or casts in the past. It may have distortions brought on by the pouring and setting of the stone die, not leading to reliable results of gingival retraction.

Marwa Beleidy [19] compared horizontal gingival displacement in Ultrapak, GingiTrac, Traxodent or NoCord technique by measuring post-retraction with polyether impressions utilizing a stereomicroscope.

Gupta A[20] et al compared two retraction systems (Expasyl and magic foam), and horizontal gingival displacement was examined with Image analysis software on stereomicroscopic pictures of individual abutment teeth on the polyether impressions taken both before and after retraction. At the mesio-buccal, mid-buccal, and disto-buccal locations of the sulcular extensions, the gingival sulcus width was measured and compared. The micrometer scale measurements used in the picture analysis were subsequently translated to millimeter grading.

However, in our study, we used a LABO stereo-microscope to measure horizontal gingival displacement post-retraction with the addition silicone impression material. By using a trinocular stereo-microscope, 10x image resolution is obtained, giving precise results for horizontal gingival displacement. The mean values after the use of gingival retraction cords dipped in mocharasa solution (Group A) is 1.37 (0.2) µm and mean values after the use of gingival retraction Group B (Cord not in dipped in Mocharasa solution) was 1.17 ± (0.18) µm in our study However according to Gupta A et al study, the mean values for vertical gingival retraction post- op for stay put was found to be ±1.0655 ± 0.3851 mm. The readings obtained in the present study were almost similar to the study of Gupta et al.

Madaan R, Paliwal J, Sharma V, et al [21] studied the effectiveness of retraction paste against retraction cord. The impregnated cord caused a wider gingival displacement than the retraction paste. It was stated that the miminum requirement for horizontal displacement is 200µm. The maximum value for gingival displacement was found in polyvinyl acetate strips (Merocel), followed by impregnated retraction cord (SURE-Cord), and retraction capsule (3M ESPE), and the lowest value was found in retraction paste (Traxodent).

All the results of the present study showed horizontal gingival displacement up to 500µm. So, mocharasa can be used effectively as a herbal solution for impregnating the gingival retraction cord before being used for the displacement of the gingiva.

ShamsuzzamanM et al[22] concluded paste retraction system appears to be a promising system for control of hemorrhage and ease of placement. However, the amount of vertical gingival retraction observed with paste retraction was significantly less than retraction cord system.

Anupam et al[23] studied the efficiency of two gingival retraction systems on lateral displacement using stay put and Ultra Pack cord . Data was analyzed and a Paired "t" test was used to compare the difference between the displaced gingival width in the two retraction groups ($p > 0.05$). Although mean gingival retraction in the Stay-Put system (0.528 ± 0.12 mm) was higher as compared to that in Ultrapak (0.487 ± 0.10 mm). And concluded that the stay–put system and Ultapack demonstrated significant retraction of the gingival sulcular width to achieve details of the margins in impressions. The mean values obtained for stayput were almost similar to the horizontal gingival displacement readings of mocharasa impregnated cord ie, 0.540±0.10 mm, comparing the mean from all locations. It was found that the mean values for horizontal gingival displacement for Group A (cord dipped in Mocharasa solution) at mesio-buccal, mid-buccal, disto-buccal appeared to be 558.0(±25.99) mm, 555.28(±24.75) mm, 560.28(±29.09) mm. The mean values for horizontal gingival displacement for Group B (cord not dipped in mocharas solution) at mesio-buccal, mid-buccal, disto-buccal appeared to be ±344.50(18.1) mm, ±394.44 (16.15) mm, ±350.83(15.6) mm.

5. Limitations of the study.

a) Only patients with a gingival score between 01-1.0 were included in the study.
b) Different gingival biotypes may affect the gingival displacement, and it may impose limitations on this study.

6. Conclusion

The longevity and clinical success of tooth-borne fixed dental prosthesis depend on careful and accurate application of biological, mechanical, and esthetic principles. One of the important biological principles involves the use of gingival retraction.

Advancements in gingival retraction cords have made diverse options available for clinicians today. In the present study thus we have thus attempted to use a herbal solution in conjunction with a gingival retraction cord that has similar hemostatic and astringent properties. It was shown that both cord impregnated in Mocharasa solution (group A) and cord not impregnated in Mocharasa solution (group B) showed reversible vertical and lateral displacement of gingival tissues. It was shown

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that post-operative mean values for Cord dipped in Mocharasa (group A) appeared to be greater than Cord not dipped in Mocharasa solution (group B) ie, Mocharasa herbal solution retraction cord showed significantly higher gingival vertical displacement of tissues than cord not dipped in Mocharasa solution.It also showed that on post-operative retraction, the Cord dipped in Mocharasa (group A) showed more amount of horizontal sulcus displacement at mid-buccal, mesio-buccal, disto-buccal than the cord not dipped in Mocharasa solution (Group B). We can summarize that Mocharasa can be used as a herbal alternative to the chemicals used conventionally with retraction cords.

7. **Financial support and sponsorship** – Nil

8. **Conflicts of Interest** – There are no conflicts of interest.

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