



## **A Comparative *In vivo* Study for Evaluation of the Amount of Gingival Displacement**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JAMMR/2018/42212

#### Editor(s):

- (1) Emad Tawfik Mahmoud Daif, Professor, Department of Oral & Maxillofacial Surgery, Cairo University, Egypt.  
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(2) Luciana de Barros Correia Fontes, Federal University of Pernambuco, Brazil.  
Complete Peer review History: <http://www.sciencedomain.org/review-history/25178>

**Original Research Article**

**Received 5<sup>th</sup> April 2018**  
**Accepted 11<sup>th</sup> June 2018**  
**Published 18<sup>th</sup> June 2018**

### **ABSTRACT**

**Aim and Objective:** This study was done for comparative evaluation of the amount of gingival displacement produced by three different gingival retraction systems (Magic Foam Cord, Racegel & Medicated Retraction Cords) based on gingival displacement, haemorrhage control and ease of placement and finally to suggest the best material for gingival displacement.

**Materials and Methods:** The study involved 30 edentulous patients of 19-25 year age group with healthy periodontium and aligned natural dentition. The custom tray was made on a model from diagnostic alginate impression. The four-time impression was made for each subject on the custom tray. Each impression was taken after interval of one week. First impression was done without gingival displacement; second after gingival displacement with aluminum chloride; third with 'Magic Foam Cord' for tissue displacement; Fourth impression after using 'Racegel' for tissue displacement. Maxillary right central incisor was used for retraction. Mesiodistal width of right central incisor was measured with help of vernier caliper and the center point of the tooth was marked on the cast for making cut. Cast was positioned and stabilized on platform of die cutter, and primary cut was made on the marked central point of incisal edge in the buccolingual direction

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through the entire length of the cast. Evaluation of the amount of displacement: For determining the amount of displacement, samples were studied under a stereomicroscope having magnification of  $\times 20$ .

**Results:** The displacement observed was found to be significantly ( $p=0.0001$ ) higher in Retraction Cord (mean 0.73 mm) than Magic foam cord (mean 0.56 mm) and Racegel (mean 0.37mm). Displacement observed was found to be significantly ( $p=0.0001$ ) higher in Magic foam cord than Racegel. The percentage of no bleeding was higher in Racegel (96.7%) than Magic foam cord (43.3%) and Retraction cord (10%). Among the three retraction systems compared for ease of placement in the present study, the time taken for Racegel retraction technique (mean time 58.53 seconds) was considerably less as compared to the time required for placement of Magic foam cord (65.33 seconds) and Medicated retraction cord technique (119.33 seconds).

**Conclusion:** Magic foam cord can be suggested for use in clinical practice as it is more effective among the three retraction systems used in this study, as it has taken less time and easier in placement, attained good amount of displacement and induced minimal bleeding on removal compared to Aluminum chloride soaked retraction cord.

**Keywords:** *Gingival displacement; retraction; impression in the fixed dental prosthesis; magic foam; racegel; aluminium chloride.*

## 1. INTRODUCTION

During treatment planning for fixed partial denture, margin placement plays a crucial role in maintaining the periodontal health. Design of the finish line is decided on the basis of fixed dental prosthesis material. Accurate finish line and margin is only recorded by gingival retraction and correct impression technique [1,2,3].

The entire impression process for fixed prosthodontics requires careful management of the soft tissue. The inability of impression materials to adequately displace soft tissue, fluids, or debris mandates adequate isolation [4] several clinical methods are available for adequate gingival retraction, including mechanical methods, mechanicochemical methods, rotary gingival curettage and electrosurgery. The various gingival retraction systems available in the market, a cordless system (Magic foam and Racegel) is a fairly new entrant into this field [5]. This system promises to provide good retraction and excellent haemorrhage control. Till date, there are very few studies exclusively done to compare this retraction system with commonly used medicated retraction cords. Therefore the present study was designed with the aim of comparative evaluation of the amount of gingival displacement produced by three different gingival retraction systems. Objectives of the study were to evaluate the efficacy of Magic Foam Cord, Racegel & Medicated Retraction Cords based on gingival displacement, haemorrhage control and ease of placement. Finally to suggest the best material for gingival displacement.

## 2. MATERIALS AND METHODS

This study was done in the department of prosthodontics, Career Post Graduate Institute of Dental Sciences And Hospital Lucknow on 30 subjects. Each subject selected for the study has the following exclusion criteria; Participants with anterior malocclusion, Gingival recession, Pregnant and lactating women, Participants undergoing orthodontic treatment, Allergic to aluminium chloride will not be included for the study. Inclusion criteria were; Participants having healthy periodontium, Gingival index of score 0, Age limit within the age group of 19–25 years will be included in the study (Figs. 1a, 1b, 1c, 2a, 2b).

### 2.1 Materials & Equipment Used in the Study

Aluminium chloride soaked retraction cord, Magic Foam Cord, Racegel, Tray material, Irreversible hydrocolloid impression material, Diestone, Dicutter, Stereomicroscope( $\times 20$ ).



**Fig. 1a. Retraction cord with aluminium chloride, Fig. 1b. Magic foam**



Fig 1c. Racegel



Fig. 2a. Diecutter, Fig. 2b. Stereomicroscope

## 2.2 Methodology

Impression for custom trays: Maxillary Impressions were made with irreversible hydrocolloid impression material for all participants and cast were made of improved dental stone (Kalabhai). Custom trays were fabricated which were 2 mm short of sulcus. Final impressions were made using custom tray after 24 hr of fabrication.

Gingival displacement and impression making: Each impression is taken after an interval of one week.

First impression: Impressions was made on day 1 for the control group in which no gingival displacement was done. The impressions were made after removing the spacer from the custom tray. Perforations were made in the custom tray with round bur. Impressions were taken with addition silicone Type-2 medium body (Monophase). Impressions were removed from participant's mouth after the material was set. Impressions were disinfected with glutaraldehyde solution and cast was made of Type 4 die-stone.

Second impression after using 'Aluminum chloride' for tissue displacement: Participants were recalled for evaluation of gingiva on day 2. Isolation was done on right central incisor 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. Retraction cord impregnate with aluminum chloride was looped around the maxillary right central incisor and gently pushed into the sulcus with the gingival cord packer. Retraction cord was removed after keeping for 10 min in the gingival sulcus. Impression and cast were made in similar way as previously (Fig. 3a).



Fig. 3a. Retraction with retraction cord soaked in  $AlCl_3$



Fig. 3b. Retraction with magic foam

Third impression after using 'Magic Foam Cord' for tissue displacement: Participants were recalled for evaluation of gingiva after one week (9<sup>th</sup> day) of second impression. The magic foam cord was injected slowly into the sulcus resting on the tooth. The subjects were asked to bite on a com-precap bite block to maintain pressure. At the end of 3-5 mins, magic foam set along with com-precap were removed from the sulcus, followed by impression and making of dental cast (Fig. 3b).

Fourth impression after using 'Racegel' for tissue displacement: Participants were recalled for evaluation of gingiva after one week (16<sup>th</sup> day) of third impression. The racegel was injected slowly into the sulcus resting on the tooth. At the end of 5 mins, racegel was washed away from sulcus, followed by impression and making of dental cast (Fig. 3c).



Fig. 3c. Retraction with racegel

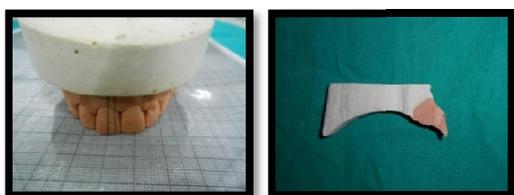


Fig. 4a. Mid line marked on central incisor before sectioning on die cutter machine, Fig. 4b. Sectioned part, ready to be placed in microscope for measuring the displacement

Measurements: Mesiodistal width of right central incisor was measured with help of vernier caliper and the center point of the tooth was marked on the cast for making cut. Cast was positioned and stabilized on platform of die cutter, and primary cut was made on the marked central point of incisal edge in the buccolingual direction through the entire length of the cast (Fig. 4a, 4b).

Evaluation of the amount of displacement: For determining the amount of displacement, samples were studied under a stereomicroscope having magnification of 20X (Fig. 5A, 5B, 5C, 5D).

All readings were tabulated and send for statistical analysis.

### 3. RESULTS

The Table 1 shows the displacement observed was found to be significantly ( $p=0.0001$ ) higher in Retraction Cord than Magic foam cord and Racegel. Displacement observed was found to be significantly ( $p=0.0001$ ) higher in Magic foam cord than Racegel (Table 1, Bar 1).

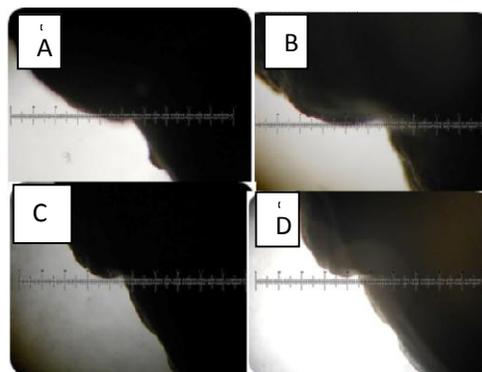


Fig. 5. Stereomicroscopic view under 20X magnification, Fig. 5A. Control group before gingival displacement, Fig 5B. GD using chemical Retraction cord, Fig 5C. GD using Magic foam cord, Fig. 5d. GD using Racegel (GD= Gingival Displacement)

The Table 2 shows the comparison of haemorrhage control among the groups. The percentage of no bleeding was higher in Racegel (96.7%) than Magic foam cord (43.3%) and Retraction cord (10%). The association was found to be statistically significant ( $p=0.0001$ ) (Table 2, Bar 2).

The Table 3 shows that the comparison of ease of placement (in seconds) among the groups. There was significant ( $p=0.0001$ ) difference in ease of placement (in seconds) among the groups (Table 3 and Bar 3).

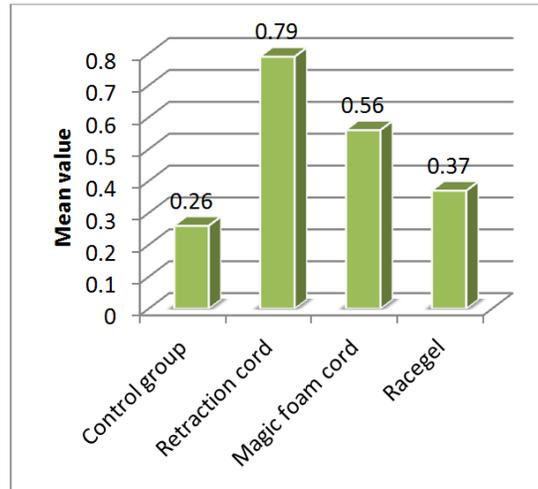
Table 1. Comparison of displacement observed (in mm) among the groups

Groups	Displacement caused (in mm) (Mean±SD)
Control group	0.26±0.04
Retraction cord	0.79±0.14
Magic foam cord	0.56±0.09
Racegel	0.37±0.06
p-value <sup>1</sup>	0.0001*

<sup>1</sup>Friedman test, \*Significant

### 4. DISCUSSION

The long-term success of fixed prosthodontic restorations is greatly dependent upon the health and stability of the surrounding periodontal structures [1].

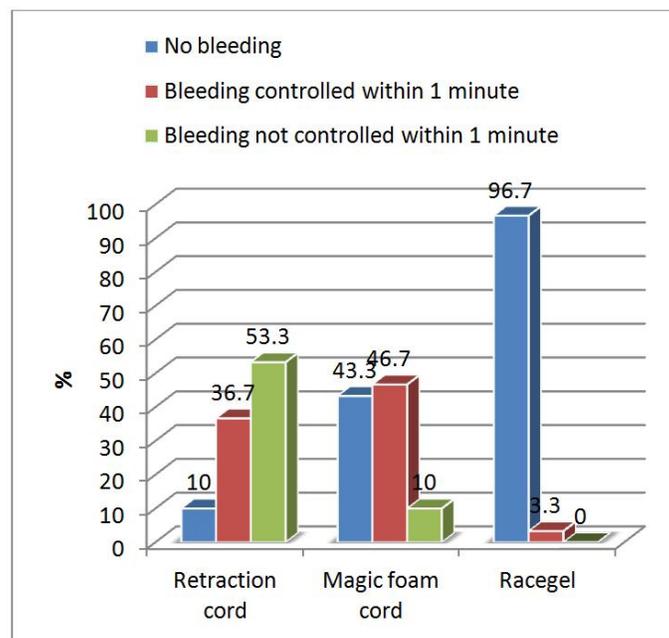


Bar 1. Comparison of displacement observed (in mm) among the groups

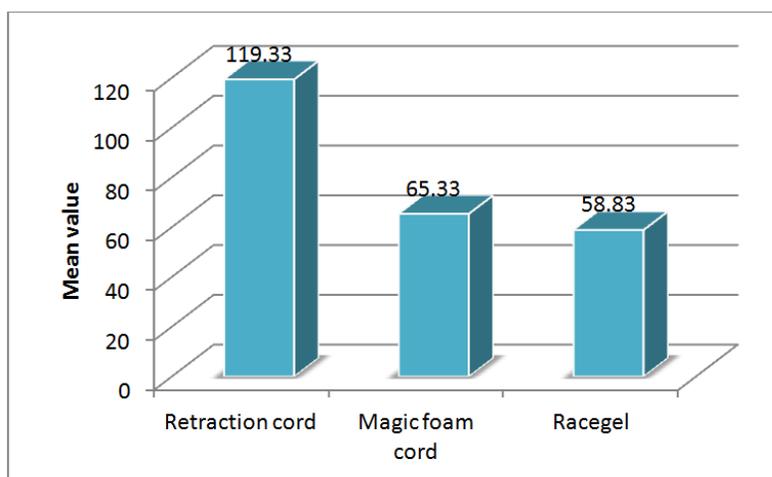
Table 2. Comparison of haemorrhage control among the groups

Groups	Haemorrhage control						p-value <sup>1</sup>
	No bleeding		Bleeding controlled within 1 minute		Bleeding not controlled within 1 minute		
	No.	%	No.	%	No.	%	
Retraction cord	03	10.0	11	36.7	16	53.3	0.0001*
Magic foam cord	13	43.3	14	46.7	03	10.0	
Racegel	29	96.7	01	3.3	00	0.0	

<sup>1</sup>Kendall's test, \*Significant



Bar 2. Comparison of hemorrhage control among the groups



**Bar. 3. Comparison of ease of placement (In seconds) among the groups**

**Table 3. Comparison of ease of placement (in seconds) among the groups**

Groups	Ease of placement (in seconds) (Mean±SD)
Retraction cord	119.33±30.84
Magic foam cord	65.33±12.10
Racegel	58.83±10.56
p-value <sup>1</sup>	0.0001*

<sup>1</sup>Friedman test, \*Significant

This is achieved by accurate impression making after proper gingival tissue displacement.

Chemically impregnated cords are the most commonly used technique for gingival tissue displacement. Pelzner and associates [6] have found that the use of plain cotton cord is contraindicated, as it did not adequately control hemorrhage and therefore created the necessity of retaking approximately 60% of the impressions.

Use of cord impregnated with aluminium chloride (5 to 10%) is referred to be the safest and most effective method of gingival retraction [7].

Csempez et al. (2003) conducted an *in-vitro* study to determine the optimal soaking time for 03 retraction cords of different thickness to ensure adequate uptake of the hemostatic solution. In the present study retraction cord was soaked for 20 minutes in aluminium chloride solution which is in accordance to study done by

Csempez (2003). Their results indicated that 20 minutes of soaking time was necessary for saturation of the cords before use, provided that air trapped within the cords was removed. In addition to the soaking time, the saturation of the cords with the solutions largely depended on the wetting of the cords [8].

It has been found that impregnated cord soaked with aluminium chloride causes necrosis of the gingival tissue instead of gingival displacement and necrosed tissue healed approximately into 2 weeks. So the researcher tried for better material for gingival tissue displacement.

In the study were made by single operator to avoid inter-operator variability and bias. The results can be concluded as; the displacement observed was found to be significantly (p=0.0001) higher in Retraction Cord (mean 0.73mm) than Magic foam cord (mean 0.56 mm) and Racegel (mean 0.37 mm). Displacement observed was found to be significantly (p=0.0001) higher in Magic foam cord than Racegel. The Magic foam cord is a “mechanical” gingival retraction system consisting of expanding type polyvinyl siloxane material. Hence, it might be the reason for getting better retraction from magic foam cord compared to Racegel retraction system. But the retraction was lesser than that from Aluminum chloride soaked retraction cord where the cord was pushed mechanically into the gingival sulcus. Findings of the present study in reference to retraction through Retraction Cord soaked in aluminum chloride was more than other retraction system.

The findings of this study are supported by the study of Gupta et al and Sushma et al.

Weir and Williams considered amount of bleeding on removal of the retraction cords as criterion for success. They categorized hemorrhage into following scores -No bleeding - score 0, Bleeding controlled with air and water spray within 1 minute - score 1, Bleeding not controlled in 1 minute- score 2. The percentage of no bleeding was higher in Racegel (96.7%) than Magic foam cord (43.3%) and Retraction cord (10%). The association was found to be statistically significant ( $p=0.0001$ ) [2,3,9].

The Magic foam cord was potentially less traumatic as controlled pressure through comprecap was used, whereas Racegel was least traumatic and induced no bleeding as it contains aluminum chloride an astringent paste in its composition. Finding of the present study in reference to bleeding during retraction through Retraction Cord was more than other retraction system. The findings of this study are supported by the study of Weir and Williams [2].

Among the three retraction systems compared for placement in the present study, the time taken for Racegel retraction technique (mean time 58.53 seconds) was considerably less as compared to the time required for placement of Magic foam cord (65.33 seconds) and Medicated retraction cord technique (119.33 seconds). Racegel was relatively clinician-friendly and easy to place, as it was applied directly into the gingival sulcus. The Magic foam cord was also found easier to place and less time consuming than Aluminum chloride soaked retraction cord as it is injected with an automixing gun around the sulcus. Finding of the present study in reference to time taken for placement during retraction was more with Aluminum chloride soaked retraction cord than other retraction system. The observations of this study are approved by the study of Gupta et al.

Gingival displacement holds the key for success of a fixed dental prosthesis. Till date no gingival displacement material can be considered as ideal. Many gingival displacement materials are there in the dental world being used by practitioners. Hence, more comparative studies in near future is the need of hour [9,10].

## 5. CONCLUSION

1. The amount of gingival displacement attained by using Aluminium chloride

soaked retraction cord and Magic foam cord retraction system was significantly higher than Racegel.

2. Time taken for the application of Racegel retraction system was significantly less compared to the time taken for Aluminum chloride soaked retraction cord and Magic foam cord retraction systems.
3. The haemorrhage control with the Racegel retraction system was found better than haemorrhage control with the other two retractions system used in the study.
4. Magic foam cord and Racegel were found easier in placement compared to Aluminum chloride soaked retraction cord.
5. Magic foam cord can be suggested for use in clinical practice as it is more effective among the three retraction systems used in this study, as it has taken less time and easier in placement attained a good amount of displacement and induced minimal bleeding on removal compared to Aluminum chloride soaked retraction cord.

## CONSENT

It has been taken individually from all the patients.

## ETHICAL APPROVAL

Ethical approval was taken from institutional ethical research cell committee.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Ferencz JL. Maintaining and enhancing gingival architecture in fixed prosthodontics. *J Prosthet Dent.* 1991;65: 650-7.
2. Weir DJ, Williams BH. Clinical effectiveness of mechanical-chemical tissue displacement methods. *J Prosthet Dent.* 1984;51:326-9.
3. Bishop K, Briggs P, Kelleher M. Margin design for porcelain fused to metal restorations which extend onto the root. *Br Dent J.* 1996;180:177-84.
4. Trivedi SC, Talim ST. The response of human gingiva to restorative materials. *J Prosthet Dent.* 1973;29:73-80.
5. Nemetz H, Donovan T, Landesman H. Exposing the gingival margin: A systematic

- approach for the control of hemorrhage. J Prosthet Dent. 1984;51:647-51.
6. La Forgia A. Mechanical – chemical and electrosurgical tissue retraction for fixed prosthesis. J Prosthet Dent. 1964;14:1107-14.
  7. Benson BW, Bomberg TJ, Hatch RA, Hoffman W Jr. Tissue displacement methods in fixed prosthodontics. J Prosthet Dent. 1986;55:175-81.
  8. Donovan TE, Gandara BK, Nemetz H. Review and survey of medicaments used with gingival retraction cords. J Prosthet Dent. 1985;53:525-31.
  9. Gardner FM, Walton JN. Gingival retraction techniques. In: Clinical aspects of dental materials. Washington, DC: United States Army Institute of Dental Research. 1986.
  10. Donovan TE, Chee WWL. Current concepts in gingival displacement. Dent Clin North Am. 2004;48:433-70.

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