

A Qualitative Analysis of Magic Foam and the Conventional Gingival Retraction Cord System in Dental Impressions

Manoj Shetty¹, Shetty Gaurav², Nivya John³, Umesh Pai⁴, Nitesh Shetty⁵

ABSTRACT

Aim and objective: The present study was designed to clinically evaluate the efficacy of the magic foam retraction system and conventional retraction cords on the basis of the relative ease of working, the time required for placement, and the amount of gingival retraction.

Materials and methods: Thirty-three (anterior and posterior each) abutment teeth were selected requiring full coverage restoration where more than one abutment teeth were to be prepared. After the preparation of the abutment teeth, the area was isolated thoroughly. Two impressions were made, one with the retraction cords being placed and the other with the magic foam retraction technique being used. Subjective ease of placement, the time required for placement, and the amount of gingival retraction by means of margin exposure were assessed.

Results: The mean time taken for the magic foam retraction technique was 48.17 seconds and for the retraction cord technique was 131.5 seconds. In this study, the cord retraction technique was more successful for shoulder and chamfer margin preparations than the magic foam retraction technique. Also, the cord retraction technique was found to be more successful for anterior teeth than the magic foam retraction technique. The magic foam retraction technique was more successful for posterior teeth albeit not significantly.

Conclusion: Within the limitations of the study, the magic foam retraction system appears to be a promising system with regard to reduced time for application and ease of placement. However, the amount of gingival retraction observed with the magic foam retraction system was significantly less than the retraction cord system.

Clinical significance: The conventional retraction cord technique is the most popular tissue retraction system, however, it is technique-sensitive and time-consuming and also known to cause some attachment loss during manipulation. Magic foam retraction provides comparable results in less time without the loss of attachment that could help in maintaining the biological health of the tissue.

Keywords: Gingival retraction, Magic foam cord, Retraction cord, Tissue management.

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INTRODUCTION

It is imperative to attain long-term health and biologically stable periodontium for a successful fixed dental prosthesis.¹

Complete coverage restorations which are usually esthetic in nature mandate subgingival preparations.

Subgingival preparations in itself are a procedure that must be handled with protective biological techniques and thus retraction methods in these preparations should not add to the attachment loss.^{2,3}

In these scenarios, a precise impression must be made to fabricate a well-fitted prosthesis. However, the cervical finish lines recorded by the dentist using no tissue management methods are inaccurate. Tissue displacement procedures help in a gingival shift that would enable the impression material to reach apically into the crevices and also hold the position so that accurate records can be made. Doing this also leads to effortless instrumentation, intelligible visualization, and satisfactory impression, this, in turn, ensures quality crowns and bridges having a marginal fidelity.

It is a cumbersome task for the restorative dentist to expose the gingival margins after tooth preparation. Furthermore, it can be complicated by variations in host tissue, such as sulcus depth, gingival tissue distention, presence and absence of local inflammation.⁴

Glossary of prosthodontic terms defines gingival displacement as the deflection of the marginal gingiva away from the tooth.⁵ There are mechanical ways of retraction that displace the gingival tissue physically, and there are chemical methods that constrict the vessels thereby reducing hemorrhage. With the mechanical ways,

¹Department of Oral Implantology, AB Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangaluru, Karnataka, India

²Department of Prosthodontics, Indian Army, Mumbai, Maharashtra, India

³Department of Prosthodontics and Crown and Bridge, AB Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangaluru, Karnataka, India

⁴Department of Prosthodontics and Crown and Bridge, Manipal College of Dental Sciences, Mangaluru, Karnataka, India

⁵Department of Prosthodontics and Crown and Bridge, Srinivas Institute of Dental Sciences, Mangaluru, Karnataka, India

Corresponding Author: Nivya John, Department of Prosthodontics and Crown and Bridge, AB Shetty Memorial Institute of Dental Sciences, NITTE (Deemed to be University), Mangaluru, Karnataka, India, Phone: +91 9742024358, e-mail: nivyajohn@nitte.edu.in

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there are high chances of tissue tear and with chemical methods, there could be systemic effects.

Magic foam cord (MFC) is a polyvinyl siloxane material that expands the tissue physically. It is designed for easy and fast retraction of the sulcus with neither trauma or tedious procedures

nor contain a hemostatic agent. During the setting, the reaction of this material, there is an enforced side reaction, generates hydrogen gas. The released hydrogen gas creates bubbles and forms the setting material into a sponge-like structure. The material, therefore, has to be syringed towards the margins of the abutment teeth and held under physical pressure during the course of impression making.⁶

The conventional retraction cord uses pressure to displace the gingiva laterally, which may cause some sulcular hemorrhage.⁷

The present study was designed to clinically evaluate the efficacy of the magic foam retraction system and conventional retraction cords on basis of the relative ease of working, the time required for placement, and the amount of gingival retraction.

AIMS AND OBJECTIVES OF THE PRESENT STUDY

- To evaluate a new gingival retraction system relative to clinical success for fixed dental restorations under various clinical conditions.
- The purpose of the present study was to compare and evaluate the MFC system and retraction cord system in the same patient at different time intervals, with relation to their clinical success.

MATERIALS AND METHODS

A total of 33 (anterior and posterior each) abutment teeth were included in the study. The study was done at The Department of Prosthodontics and Crown and Bridge, AB Shetty Memorial Institute of Dental Sciences. Thirty-three subjects were clinically assessed for the health of the abutment teeth. Written informed consent was obtained from those who agreed to participate voluntarily and ethical clearance was obtained from the ethical committee. The study was done by a single investigator.

Abutments that were included were free of active periodontal inflammation, the probing depth was <3 mm, and dint has no bleeding on probing. Abutment teeth with supragingival preparation margins and implant abutments were excluded from the study.

Methodology

The subjects were seated upright in the dental chair so that proper illumination and visualization were carried out. Abutments were prepared for full coverage prosthesis with subgingival or equigingival margins by preserving the biological architecture.

The retraction cord technique was used on abutment teeth during one appointment and magic foam gingival retraction paste was used during the next appointment or *vice versa*.

Procedure for Application of Conventional Retraction Cord

The selection of the cord was done based on the sulcular depth and gingival biotype. The length was chosen as per the region of interest keeping in mind the cord has to be encircled completely. The packing was done using a serrated cord packer starting from the interproximal side (mesial/distal) with minimal pressure covering the entire circumference. Subjective assessment of the ease of placement was done. Furthermore, the time taken for placement (from the start of packing till completion) of the cord was recorded. The cord was left in the sulcus for 5 minutes, after which it was slowly retrieved. Then, the impression was made with putty and light body of addition silicon structures (Fig. 1).

Magic Foam Impression Procedure

During this procedure, the Comprecap technique was used for single abutment teeth and the putty impression technique was used for if there were several abutment teeth. The system comes with a cartridge and a thin intraoral tip. The material was injected into the site and Comprecap was placed on top of the impression to hold the material in place while making an impression. After 4 minutes, the Comprecap with the set retraction material attached to it was removed from the patient's mouth⁶ (Fig. 2).

Evaluation of the Impression

The impression was first evaluated by visual inspection and then investigated using a laboratory microscope and lenses with 2–6 times magnification. The presence or absence of bubbles and the complete reproduction of the preparation finish lines was examined. Bubbles were defined as globular or half globular spaces caused by air entrapments in the impression material. Irregular defects with glossy surfaces appearing in the impression were classified as voids.

Three Possible Categories were Established

Criteria 1: Accurate impressions with the absence of any voids or bubbles and perfect reproduction of the preparation finish line.

Criteria 2: Minimal defects up to 2 mm in diameter in impression, not involving the preparation finish line.

Criteria 3: If the preparation finish line is not reproduced or the impression shows larger voids, bubbles >2 mm in diameter, and defects involving the preparation finish line, they will be rated unacceptable (Fig. 3).

Statistical Analysis

The results were averaged (mean \pm standard deviation) for each parameter.

Unpaired *t*-test $t = nsX1$ where *X* is the mean difference in each set of paired observations, *s* = SD of the difference, and *n* is the number of observations. Chi-square test was used to compare MFC and retraction cord with different criteria I, II, and III at different positions like anterior and posterior, chamfer, and shoulder margins. In all the above tests, *p* value < 0.05 was taken to be statistically significant. The data were analyzed using SPSS statistical package (PC version 17.0, SPSS Inc., Chicago, IL, USA).



Fig. 1: Application of retraction cord

RESULTS

The mean time taken for the magic foam retraction technique was 48.17 seconds and for the retraction cord technique was 131.5 seconds. The time range for the magic foam retraction technique was 30–65 seconds and for the retraction cord technique was 50–240 seconds (Fig. 4).

Comparison of Mean Time Taken for Application in Each Retraction Technique between Upper and Lower, Anterior and Posterior Teeth (Table 1)

Sixteen upper arches and 16 lower arches were considered. The mean time taken for the application of the magic foam retraction technique in the upper arch was 49.67 seconds and in the lower arch, it was 46.67 seconds and with the retraction cord technique, it was 122.67 seconds in the upper arch and 140.33 seconds for the lower arch.

The t value between magic foam and cord retraction technique in the upper arch was -12.39 with a p value of 0.00 . So the hypothesis of equality of means is rejected even at a 5% level of significance ($p < 0.05$), which signifies means are statistically significant.

The t value between magic foam and cord retraction technique in the lower arch was -8.46 with a p value of 0.00 . So the hypothesis

of equality of means is rejected even at a 5% level of significance ($p < 0.05$), which signifies means are statistically significant.

The mean time taken for the application of the magic foam retraction technique in the anterior arch was 41.79 seconds and in the posterior arch it was 55.00 seconds and using the retraction cord technique it was 98.57 in the anterior arch and 164.29 seconds for the posterior arch.

The t value between magic foam and cord retraction technique in the anterior arch was -7.26 with a p value of 0.00 . So the hypothesis of equality of means is rejected even at a 5% level of significance ($p < 0.05$), which signifies means are statistically significant.

The t value between magic foam and medicated cord retraction technique in the lower arch was -13.58 with a p value of 0.00 . So the hypothesis of equality of means is rejected even at a 5% level of significance ($p < 0.05$), which signifies means are statistically significant.

Comparison of Quality of Impression for Grading with Magic Foam and Cord for Anterior and Posterior Teeth (Table 2)

Anterior teeth: Of the 33 anterior teeth 83.3% were rated perfect and categorized as category I. 4.5% showed minimal voids or bubbles, but the impressions were still acceptable and categorized as category II. Around 12.1% of impressions were unacceptable and categorized as III.

Posterior teeth: Of the 33 posterior teeth 83.3% were rated perfect and categorized as category I. 7.6% showed minimal voids or bubbles, but the impressions were still acceptable and categorized as category II. Around 9.1% of impressions were unacceptable and categorized as III.

The cord retraction technique is more successful for anterior teeth for acceptable impressions than the magic foam retraction technique. (Criteria I) The magic foam retraction technique is more successful for posterior teeth but not significantly.

Comparison of Quality of Impressions for Grading with Shoulder and Chamfer Margin with Magic Foam and Retraction Cord

Table 3 shows the impressions of 33 teeth with shoulder and chamfer margins that were evaluated.

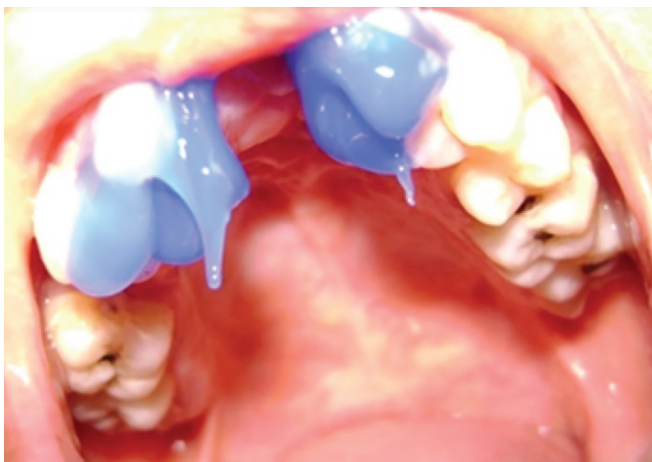
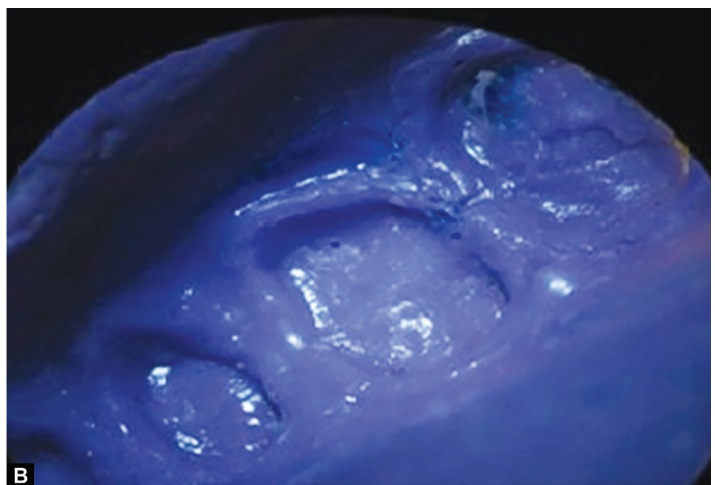
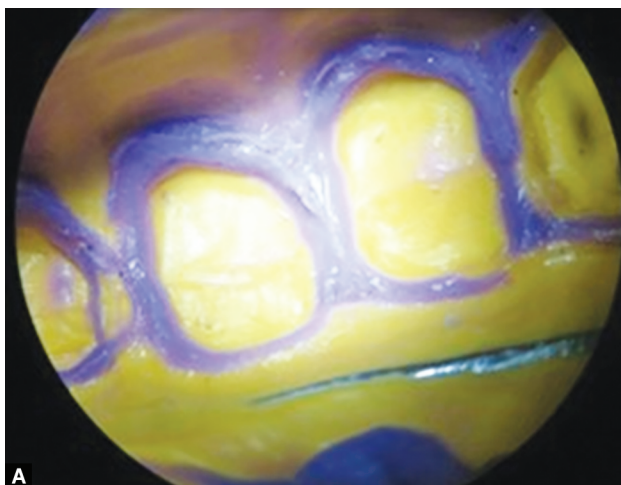


Fig. 2: Application of magic foam



Figs 3A and B: (A) (right): Grade I impression under a stereomicroscope with 6–8 \times magnification; (B) (left): Grade II and III impression under a stereomicroscope with 6–8 \times magnification

Shoulder margin: Of these 80.3% were rated perfect and categorized as category I.

4.5% showed minimal voids or bubbles, but the impressions were still acceptable and categorized as category II. Around 15.2% of impressions were unacceptable and categorized as III.

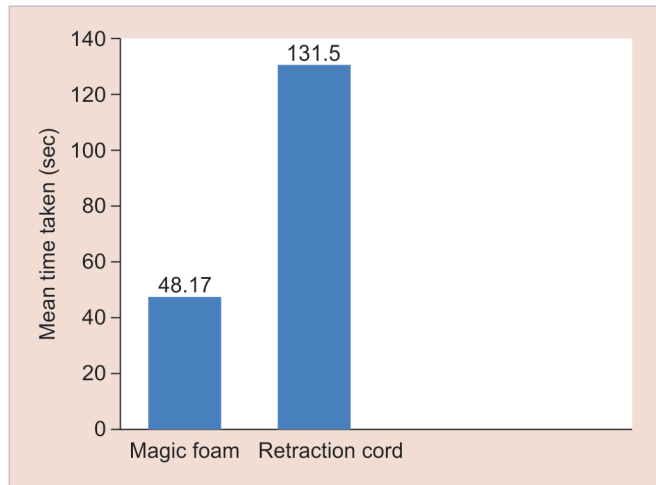


Fig. 4: Mean time taken for retraction

Chamfer margin: Of these 78.8% were rated perfect and categorized as category I.

9.1% showed minimal voids or bubbles, but the impressions were still acceptable and categorized as category II. Around 12.1% of impressions were unacceptable and categorized as III.

The cord retraction technique is more successful for shoulder and chamfer margin preparations for acceptable impressions than the magic foam retraction technique. (Criteria I) The magic foam retraction technique shows category III impressions in 18.2% of cases when compared with 9% for shoulder and chamfer margins.

DISCUSSION

Fixed prosthodontics require an impression of the teeth and the supporting area so that the laboratory can replicate the oral conditions and fabricate a perfectly fitting prosthesis. To achieve such success, the marginal adaptation plays a vital role. Although when we think of periodontal health supragingival margins are better, when it comes to esthetics, or deep-seated caries, or other factors, placing a subgingival margin is inevitable.⁸ The reproduction of margins, especially subgingival or equigingival margins can be challenging without an adequate tissue management method. Currently, there are various methods to deliver the same. The most popular one is the retraction cords. Use of cord impregnated with aluminum chloride (5–10%) was concluded to be the most effective

Table 1: Comparison of mean time taken for application in each retraction technique between upper and lower, anterior and posterior teeth

Region	Technique	Mean \pm SD	t value	p value	Inference
Upper	Magic foam	49.67 \pm 0.15	-12.39	<0.001	Highly significant
	Retraction cord	122.67 \pm 0.18			
Lower	Magic foam	46.67 \pm 0.14	-8.46	<0.001	Highly significant
	Retraction cord	140.33 \pm 0.23			
Anterior	Magic foam	41.79 \pm 0.13	-7.26	<0.001	Highly significant
	Retraction cord	98.57 \pm 0.20			
Posterior	Magic foam	55.00 \pm 0.17	-13.58	<0.001	Highly significant
	Retraction cord	164.29 \pm 0.21			

Table 2: Comparison of quality of impression for grading with magic foam and cord for anterior and posterior teeth

				Technique		
Region	Criteria			MFC	Retraction cord	Total
Anterior	1.00	Count		23	32	55
		%		69.7	97.0	83.3
	2.00	Count		1	2	3
		%		3.0	6.1	4.5
	3.00	Count		3	5	8
		%		9.1	15.2	12.1
	Total	Count		33	33	66
		%		100.0	100.0	100.0
Posterior	1.00	Count		29	26	55
		%		87.9	78.8	83.3
	2.00	Count		4	1	5
		%		12.1	3.0	7.6
	3.00	Count		6	0	6
		%		18.2	0.0	9.1
	Total	Count		33	33	66
		%		100.0	100.0	100.0

Table 3: Comparison of quality of impressions for grading with shoulder and chamfer margin with magic foam and retraction cord

Margin			Technique		Total
			MFC	Retraction cord	
Shoulder	1.00	Count	24	29	53
		%	72.7	87.9	80.3
	2.00	Count	3	0	3
		%	9.1	0.0	4.5
	3.00	Count	6	4	10
		%	18.2	12.1	15.2
	Total	Count	33	33	66
		%	100.0	100.0	100.0
Chamfer	1.00	Count	24	28	52
		%	72.7	84.8	78.8
	2.00	Count	3	3	6
		%	9.1	9.1	9.1
	3.00	Count	6	2	8
		%	18.2	6.1	12.1
	Total	Count	33	33	66
		%	100.0	100.0	100.0

form of gingival retraction.^{9–11} However, there are shortcomings such as bleeding, time consumption, gingival attachment loss, etc. The magic foam retraction technique is relatively user-friendly and easy to master. In both the MFC and retraction cord technique, the time required for placement was significantly less in anterior teeth than the time taken for posterior teeth. However, this variation was more in the retraction cord system, i.e., the difference in time taken for placement in the anterior region was much less compared to the posterior region in the retraction cord system, though there was a difference even in the MFC system. This can be easily attributed to the difficulty in accessibility and visibility in the oral cavity as we move from the anterior to the posterior segment.

In 1978, Van der Velden and De Vries observed as soon as a pressure of 1 N/mm² was applied to the marginal gingiva tearing of the epithelial attachment was evidenced. Total destruction of the attachment was noted when the pressure exceeded 2.5 N/mm². Unfortunately, the pressure applied by the retraction cord lies in this region that is between 5 and 10 N/mm². Thus, to avoid any damage to the epithelial attachment, gingival retraction should be accomplished under a pressure between 0.1 and 1 N/mm² which is highly challenging.¹² The operator would have no means to assess this. With magic foam, the operator need not worry about the retraction technique since it is possible to achieve atraumatic and adequate extension of the sulcus. The MFC technique emphasized the importance of gentle tissue management because there is no traumatic packing of the retraction cord but the application was limited to equigingival margins. A significant influence on the quality of impressions was found when the margins were subgingival. Studies, however, were done that showed comparable results of retraction and these materials also respected the periodontium. Phatale et al. in their study also encouraged its use as it was also a biocompatible material.¹³

Singh et al. in their study concluded that among the three systems they used, i.e., retraction cord, magic foam, and expasyl, they preferred magic foam as it caused less trauma. Even though the retraction achieved was higher in the conventional retraction cord, it was not statistically significant.¹⁴

A comparison was made in a study conducted by Gupta et al., among the three retraction systems, which were stay put, expasyl, and magic foam. Among the three their results showed the MFC retraction system to be a more effective gingival retraction system.¹⁵

Within the limitations of the study, comparing the two techniques the cording technique was more sufficient in all categories especially in cases of subgingival margins. Magic foam retraction system appeared to be a promising system where reduced clinical time for application and ease of placement is concerned. However, the amount of gingival retraction observed with the magic foam retraction system was significantly less than the retraction cord system.

These findings indicate that a magic foam retraction system may be considered when ease of placement is of prime importance and the amount of gingival retraction required is minimal. Medicated retraction cord should be considered when gingival retraction is of utmost importance. In a review done by Veitz-Keenan and Keenan, it was inferred that impregnated gingival cords were more precise on gingival tissue which was of thick biotype whereas paste was more effective when minimal retraction was required.¹⁶ Future studies must be carried out to see the efficacy of the combination techniques that would bring forth effective retraction without any trauma to the tissues.

Limitations of the Study

Larger sample size and measurement of the pressure levels for each type of impression procedure can be recorded for future studies as these were not recorded in the current study.

CONCLUSION

Within the limitations of the study, it was found that the time taken for the application of the magic foam retraction system is significantly less compared with the time taken for medicated retraction cord. The use of a magic foam retraction system is also easier. However, the hemorrhage control and lateral displacement are better with medicated retraction cord.

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