

Comparative Evaluation of Clinical Efficacy of Two New Gingival Retraction Systems - An In Vivo Research

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Abstract: ***Background:** Making an impression for fixed prosthesis require the gingival tissue to be displaced to expose the finish lines on the prepared teeth. Therefore, effectively managing the gingiva prior to making an impression is a critical preliminary step in the process of fabricating restorations. Because of enormous variability of clinical cases, it is not possible to use a single method or impression material for fixed prosthesis. **Aims:** The aim of this study was to evaluate and compare the amount of lateral displacement by laser and magicfoam retraction systems. **Methods and Material:** Study was conducted on prepared right or left maxillary central incisor for 30 subjects. The pre and post displacement impressions were made with addition silicone material using two stage double mix technique. Final cast were sectioned longitudinally into equal halves. The sectioned halves were assessed under stereomicroscope. The measurements were made from crest of gingival margin to midbuccal surface of the tooth. The amount of gingival displacement in each group was calculated by subtracting the pre displacement values from post displacement values. From the observations obtained statistical analysis was performed using independent sample t test. **Results:** Group A showed more amount of lateral displacement than group B. However, amount of gingival displacement between group A and group B showed statistically significant difference. **Conclusion:** Laser retraction system produced more lateral displacement of gingival compared to magicfoam retraction system.*

Keywords: Gingival retraction, lateral displacement, magicfoam, laser, stereomicroscope

1. Introduction

In a present era of high esthetic demands with improved patients awareness have led fixed prosthodontics to play a crucial role.^{1, 2} Making an impression for fixed prosthesis require the gingival tissue to be displaced to expose the finish lines on the prepared teeth. Therefore, effectively managing the gingiva prior to making an impression is a critical preliminary step in the process of fabricating restorations³.

Contemporary techniques used for gingival retraction may include mechanical, mechano-chemical, electrosurgical, rotary, gingival curettage or combination of these.⁴ Apart from conventional methods, new techniques and materials have also been developed in search of better efficiency, lesser side effects and comfort of the patient.¹

Because of enormous variability of clinical cases, it is not possible to use a single method or impression material for fixed prosthesis.⁵ Soft tissue lasers can be used as a substitute to conventional retraction techniques, because they provide adequate retraction along with hemostasis with less working time and good patient comfort.⁶

Magicfoam, an another atraumatic gingival displacement method, is the first expanding polyvinyl siloxane material designed for easy and fast retraction of the sulcus without the potentially traumatic and time consuming packing of retraction cord. It can be used along with comprecap anatomic or soft putty to bring about adequate gingival

displacement. There is no haemostatic chemical added to it which prevents contamination of impression materials.^{1,7}

Various studies have done so far on various retraction methods and on various chemicals. However evidence in respect to a single method or material to attain this objective is inconspicuous. This absence when coupled with claim of supremacy made by recently introduced methods and materials creates a dilemma in the minds of clinicians. Moreover there is no conclusive evidence regarding efficacy of newer materials. Till date, no studies are exclusively done to compare clinical efficacy of Laser and magic foam retraction system.

Therefore a need was felt to design a study to assess and compare the amount of lateral displacement by these two different gingival retraction system i.e. laser and magic foam.

1.1 Aim

Evaluation of clinical efficacy of two different gingival retraction systems

1.2 Objectives

- 1) To evaluate the amount of lateral displacement by laser gingival retraction system.
- 2) To evaluate the amount of lateral displacement by magicfoam retraction system.
- 3) Comparative evaluation of lateral displacement by laser and magicfoam retraction system.

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1.3 Materials and Methods

The patients to be undertaken for the study were selected according to the inclusion and exclusion criteria, which were as follows:-

Inclusion criteria

- 1) Study was conducted on prepared right or left central incisors for 30 patients.
- 2) Patients with age more than 18 years were selected requiring fixed prosthesis with minimum of one abutment.
- 3) Presence of healthy gingiva and periodontium around the abutments.
- 4) Abutment teeth of normal size and contour(no developmental anomaly or regressive age changes)

Exclusion criteria

- 1) Age less than 18 years.
- 2) Gingival and periodontal disease.
- 3) Uncontrolled diabetes, hypertension, hyperthyroidism and other cardiovascular diseases.

Method

30 patients were selected as per the above mentioned criteria and were segregated into 2 groups:-

Group A

In 15 patients gingival retraction was done by laser retraction system.

Group B

In 15 patients gingival retraction was done by magicfoamcord retraction system.

Shoulder finish lines were prepared at the gingival crest level. Pre displacement impression were made with addition silicone material using two stage double mix technique to measure the initial sulcus width (figure 1). The impressions were inspected under magnification, voids and streak free impressions were included in the study. Upon removal, the impressions were rinsed under running tap water and disinfected by immersing it in 5.25% sodium hypochlorite solution for 10 minutes. Cast was poured with type IV dental stone using vacuum mixer and vibrator. Gingival retraction was done by laser retraction system (group A) and magicfoam retraction system (group B).

In case of group A i.e laser retraction system (figure 2), the diode laser machine with the initiated fiber tip having a diameter of 400 microns was programmed for gingival retraction at 0.8 watt power with a frequency of 25 khz in continuous mode. The retraction area was cleansed with 3 % hydrogen peroxide and rinsed with light spray of water and dried with air. The retraction area was anesthetized by 5% lignocaine hydrochloride gel for 1 minute, then the initiated fiber tip was placed into the sulcus just inside the crest of gingiva with very light pressure and moved around the tooth in small paint brush stroke.

In case of group B i.e. magicfoam retraction system (figure 3), the cartridge was attached to the automixing gun and

then mixing syringe with intraoral tip was placed into the gingival sulcus and gingival retraction material was applied all around the tooth. After injecting the retraction material, the corresponding comprecap was placed on the abutment to push the material deep into the gingival sulcus. After 5 minutes, the comprecap with the set retraction material attached to it was removed from the patient's mouth.

Post displacement impressions were made immediately after removal of retraction system and evaluated in a similar manner as pre displacement impressions (figure 4). The impressions were poured with type IV dental stone using vacuum mixer and vibrator. After the final set of type IV stone, casts were retrieved and trimmed to obtain a flat base. The midlines of maxillary central incisors were marked on buccal and palatal surfaces of the casts using digital calliper at cervical and coronal level. They were sectioned by using mechanical saw in an apico-coronal direction with the midline as a reference point (figure 5). Thus each tooth had equal halves and sectioned halves were stabilised on mounting jig. The pre and post displacement sulcus width were studied by placing sectioned halves under stereomicroscope (figure 6). The measurement was made from the crest of gingival margin to the corresponding midbuccal surface of the tooth. The width of the sulcus at the crest of gingival margin was obtained for both the halves. The mean of these two halves were considered as one reading. Pre and post displacement sulcus width was measured for all the samples (figure 7).

The amount of lateral displacement was calculated by subtracting the pre displacement values from the post displacement values of all the sectional halves.

2. Results

Data for all groups were obtained and statistical analysis was done by applying independent sample t test

The post displacement values of both the groups were analyzed, and it was found that group A produced more displacement (mean value 0.62 ± 0.09 mm) than group B (mean value 0.42 ± 0.04 mm) (bar diagram I)

The amount of lateral displacement in both the groups was calculated by subtracting the predisplacement values from post displacement values. The amount of lateral displacement of both the groups were analyzed, it was found that group A (mean value 0.61 ± 0.09) produced more displacement than group B (mean value 0.41 ± 0.04) (bar diagram II). Comparison between both groups produced highly significant amount of gingival displacement.

Anova test was applied to check the predisplacement values amongst both the groups. Both the groups were comparable as there was no statistically significant difference (p value < 0.001)

Post displacement sulcus width values were compared to their pre displacement in each of the groups. They were analyzed by applying independent sample t test. It was clearly evident that both gingival retraction systems produced highly significant amount of gingival displacement

when compared to their predisplacement status (p value < 0.001)

3. Discussion

Clinical success of fixed prosthodontic restorations fabricated in the dental laboratory depends on the accuracy of final impression. A good quality impression is influenced by location of the finish lines, periodontal health and sulcus bleeding during impression making. Modern impression materials employed in the restorative dentistry require displacement of gingival tissues to expose and record the intracrevicular or gingival finish lines on the tooth surface. The gingiva must be displaced temporarily to make an accurate impression.¹

Gingival displacement is simple and effective when dealing with the healthy gingival tissues and margins that are properly placed slightly into the sulcus.¹

Horizontal or lateral displacement of the gingival sulcus is a generally recognized prerequisite for making accurate impression to achieve desirable emergence profile of fixed restoration particularly when the finish line is at, or just within the gingival sulcus.⁸ Therefore it is necessary to displace the free gingival margin effectively. The critical sulcular width has been reported to be approximately 0.15-0.2mm at the level of the finish line which is important for good flow of impression material around the finish line.⁹ Impressions with less sulcular widths have higher incidence of voids, tearing of impression materials and reduction in marginal accuracy.¹⁰

Various gingival displacement methods such as mechanical, chemo-mechanical (chemicals embedded in cords or in an injectable matrix), and surgical (lasers, electrosurgery and rotary curettage) are available.⁸

The present study was designed and conducted with the purpose of comparative evaluation of clinical efficacy of two systems of gingival retraction. In this study, 2 different commercially available gingival retraction systems were compared in terms of their ability to displace gingiva laterally.

Laufer and his co-investigators¹¹ in 1997 reported that the sulcus remain open for longer periods at the midbuccal point. Therefore in this study, midbuccal point was considered suitable for the sulcus width measurement.

Soft tissue lasers can be used as substitute to conventional retraction techniques, because they provide adequate retraction along with haemostasis with less working time and good patient comfort. Marginal fit of indirect restorations depends on a proper gingival retraction and an accurate recording of the finish line. To capture the details of finish line accurately, retraction has to be done apically as well as laterally. A minimum lateral displacement of 0.2mm is required, for the impression material to flow into gingival sulcus with a dimensional accuracy. Gingival sulcus is lined by sulcular epithelium with two basal layers of cells, from which remaining cell layers proliferate. If retraction procedure is carried out by removing superficial layers of epithelium,

without damaging basal cell layer and connective tissue cells, the tissue changes and shrinkage of gingiva can be avoided. A minimum retraction of 0.2mm can be obtained by removing 200µm thickness of epithelium from the sulcus by using laser.⁶ Laser offers certain advantages such as lesser operating time and lesser collateral heat generation, with good haemostasis and patient comfort. But it does not offer much of tactile feedback to the operator during the procedure. Use of diode lasers for retraction purposes has shown less recession around natural teeth as compared to retraction cord. Studies have shown bacterial reduction at treatment site and improvement in gingival marginal health after one week.⁶

Overuse of laser energy causes shrinkage of the tissue and unwanted exposure of the crown margins. The operator should always follow laser safety guidelines.⁷

Magicfoam retraction system, an another atraumatic retraction, physically displaces gingival due to expanding polyvinyl siloxane material along with comprecap anatomic. Gingival displacement could be due to expansion of the elastomeric material in around 5 minutes and gentle pressure exerted by comprecap anatomic. Elastomeric material is devoid of astringent, so it is favourable for tissues.^{1,13}

According to a clinical study of Magic Foam Cord conducted in University of Innsbruck, Austria, 2006, by Prof. DDr. Dumfahrt H.; they concluded clinical proven performance of magic foam retraction material is 97 % usable retractions, which lead to a perfect impression.⁷

In the present study, the mean score of lateral displacement for Laser group (0.476 mm) was found to be significantly greater than magicfoam. Thus Laser system showed greater lateral displacement than magicfoam retraction system.

These findings are in agreement with the study conducted by Enrico F. Gherlone / Carlo Maiorana⁵ in the year 2004 highlighted the lower traumacity of the laser assisted sulcus conditioning (980-nm diode and Nd: YAG) on the periodontal structures, as compared with conventional (mechanical and surgical) techniques. The study concluded that the laser can be a valuable tool for obtaining anatomical information for fixed prosthesis and it is capable of yielding correct results with maximum respect for the anatomy of the oral tissue. In addition, during impression making, 980-nm diode laser may exhibit a higher haemostatic capacity than the Nd: YAG Laser.

This study is also in the agreement with the study conducted by Vamsi Krishna CH, Gupta N, Reddy KM⁶ in which diode laser was used for lateral displacement of gingiva on 20 abutment teeth at three specific sites where they found gingival retraction which ranged from 230µm – 670µm, closer to the thickness of sulcular epithelium and which was greater than the limit of minimum retraction of 200µm. The procedure was carried out within less time and a considerable improvement in patient comfort has been reported.

Both the retraction groups in the study produced greater amount of gingival retraction than the minimum sulcus width required for the elastomeric impression material.

Several techniques have proven to be relatively predictable, safe, and efficacious. But no clinical study has demonstrated the superiority of one technique over the other, so the choice of which procedure to use depends upon the clinical situation and operator preference.

However there were certain limitations of the study such as:-

- 1) The influence of distendability of gingiva, gingival thickness, varied sulcus depth, visibility and accessibility on the gingival retraction are not considered.
- 2) Further studies are required on these gingival retraction systems based on variables not considered in this study.
- 3) Further studies are required to be evaluated on a variety of clinical sites i.e. in anterior as well as posterior segments of both maxillary and mandibular arch.

4. Conclusion

The following conclusions were drawn through the results of the study:

- 1) Both the retraction systems produced highly significant amount of lateral displacement as compared to their pre displacement state.
- 2) Laser retraction system produced more amount of lateral displacement when compared to magicfoam retraction system.

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Figure 1: Pre-displacement impression



Figure 2: Retraction using Laser



Figure 3: Retraction using Magicfoam



Figure 4: Post- displacement impression



Figure 5: Sectioning of the cast and Working model



Figure 6: Assessment of the working model under stereo microscope

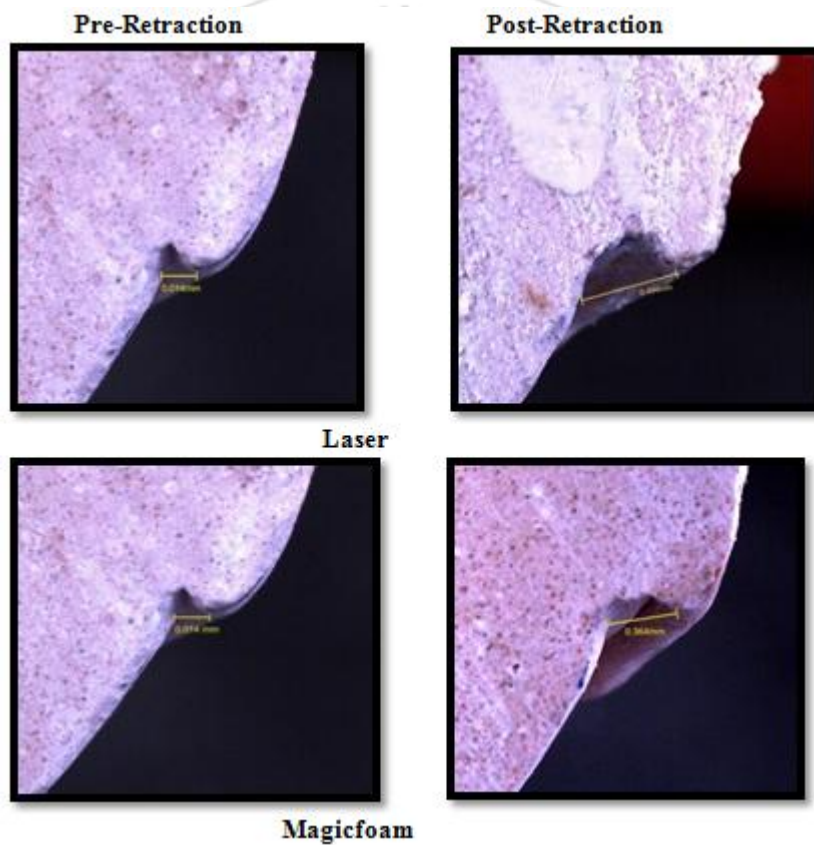
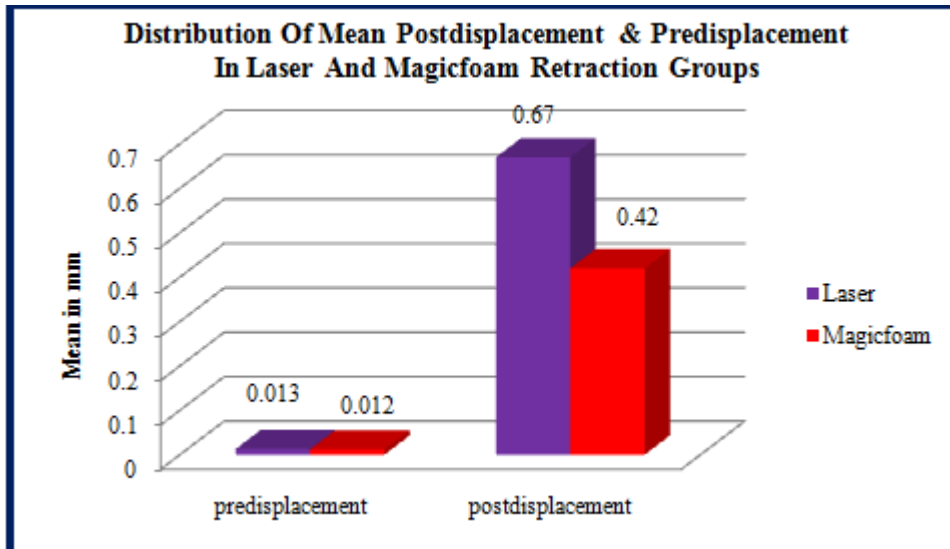
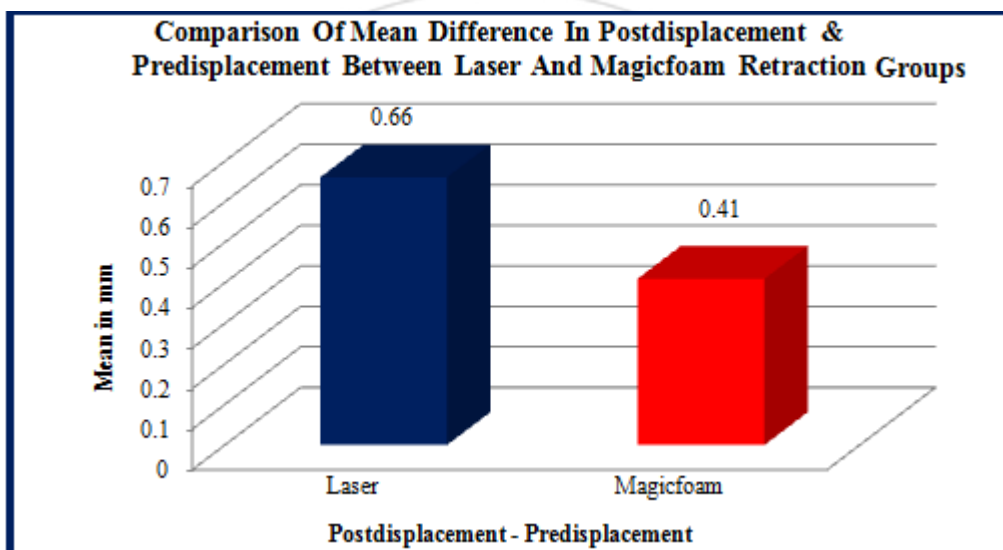


Figure 7: Stereomicroscopic model analysis showing lateral displacement



Bar diagram I: Mean postdisplacement and predisplacement in laser and magicfoam retraction groups



Bar diagram II: Difference in postdisplacement and pre displacement between laser and magicfoam retraction groups.