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# Assessment of lateral and vertical tissue displacement obtained by the retraction cord and the Magic Foam® paste: a randomized controlled clinical trial

Avaliação do deslocamento tecidual lateral e vertical obtido pelo fio retrator e a pasta Magic Foam: ensaio clínico controlado randomizado

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## ABSTRACT

**Objective:** to assess the amount of vertical and lateral gingival tissue displacement and recovery obtained by a retraction cord and Magic Foam® paste. **Material and Methods:** twenty- two participants, requiring full coverage prosthesis in the anterior area, were prepared using a deep subgingival chamfer finish line, then randomly allocated to the retraction cord group (Group RC, n = 11 teeth) or the Magic Foam® Paste group (Group FP, n = 11 teeth). The amount of lateral and vertical tissue displacement was measured by comparing the pre- and post- displacement casts at three fixed points (midbuccal, mesial and distal) using a stereomicroscope. After two weeks, tissue recovery was assessed by taking an impression using a double mix. The amount of tissue recovery was measured vertically from the gingival margin to the bottom of the sulcus and by comparing the results to the pre-displacement records. **Results:** there was no significant difference in the vertical gingival displacement ($P > 0.05$). However, there was significantly less lateral gingival displacement of the Magic Foam® Paste in the mesial and mid-buccal surfaces only ($P < 0.05$). The Magic Foam® Paste showed significantly more tissue recovery than the retraction cord ($P< 0.05$). **Conclusion:** both the retraction cord and the Magic Foam® Paste are considered effective means of retraction as they give the least amount of retraction needed both laterally and vertically.

## KEYWORDS

Gingival retraction techniques; Gingiva; Retraction cord; Tissue recovery; Stereomicroscope.

## RESUMO

**Objetivo:** avaliar a quantidade de deslocamento e recuperação vertical e lateral do tecido gengival obtido por uso do fio retrator ou pasta Magic Foam. **Material e Métodos:** foram selecionados vinte e dois participantes que necessitavam de prótese com cobertura total na região anterior, os dentes foram preparados usando uma linha de acabamento em chanfro subgengival profundo, em seguida, pacientes foram alocados aleatoriamente para o grupo de fio retrator (Grupo RC, n = 11 dentes) ou grupo de Pasta Magic Foam (Grupo FP, n = 11 dentes). A quantidade de deslocamento lateral e vertical do tecido foi medida comparando os modelos pré e pós-deslocamento em três pontos fixos (médio-vestibular, mesial e distal) usando um microscópio estereoscópico. Após duas semanas, a recuperação tecidual foi avaliada por meio de molde usando uma mistura dupla. A quantidade de recuperação tecidual foi medida verticalmente da margem gengival até o fundo do sulco e comparando os resultados com os registros pré-deslocamento. **Resultados:** não houve diferença significativa no deslocamento gengival vertical ($p > 0,05$). No entanto, houve deslocamento gengival lateral significativamente menor com a Pasta Magic Foam apenas nas superfícies mesial e médio-vestibular ($p <0,05$). A Pasta Magic Foam mostrou uma recuperação tecidual significativamente maior do que o fio retrator ($p < 0,05$). **Conclusão:** tanto o fio retrator quanto a Pasta Magic Foam são considerados meios eficazes de retração, pois proporcionam a menor quantidade de retração necessária tanto lateral quanto verticalmente.

## PALAVRAS-CHAVE

Técnicas de retração gengival; Gengiva; Fio retrator; Reparação tecidual; Estereomicroscópio.

## INTRODUCTION

Gingival tissue displacement is crucial for obtaining a well-seated and successful prosthesis with an excellent emergence profile. Gingival tissue displacement should be obtained in both lateral and vertical dimensions to ensure an adequate bulk of impression material interfacing with the prepared tooth [1]. Gingival sulcus width less than 0.2 mm results in impression voids, higher incidence of tearing and decreased marginal accuracy [2]. Meticulous handling of gingival tissues is important for preserving its health, maintaining the biological width and preventing trauma. Proper gingival retraction ensures proper positioning of the finish line, during preparation, in an esthetic area where the finish line should be subgingival. The finish line must be smooth and continuous to ensure a well-seated restoration without marginal discrepancy and cement dissolution [3].

There are different techniques for gingival retraction; mechanical, chemico-mechanical and surgical [4]. The ideal requirements of a gingival retraction agent are to provide sufficient vertical and lateral gingival displacement, reversible retraction without permanent tissue damage, locally and systemically safe [5], control of bleeding and gingival fluid flow. Impregnated retraction cords can either be pre-soaked in a medicament or placed in one just before use, in order to arrest hemorrhage and crevicular fluid seepage [6]. New products (such as: Expasyl®, Magic Foam® paste and Merocel®) are now available that provide sufficient retraction with less time consumption, less gingival damage during retraction, more comfort for the patient and more regeneration and recovery of the epithelium after retraction [4].

Magic Foam® (Coltene - whaledent AG 9450 Altstattent – Switzerland) Paste is a cordless retraction technique that can be easily placed and removed, has an adequate working time, but lacks hemostasis [1]. Therefore, the aim of this study was to compare the amount of vertical and lateral gingival tissue displacement and recovery using Magic Foam Paste® and an impregnated knitted retraction cord.

## MATERIAL AND METHODS

### Trial design

This study was a randomized clinical trial, with a parallel arm design and 1:1 allocation ratio. This study was reported according to the Consolidated Standards of Reporting Trials (CONSORT) [7]. The study was approved by the Research Ethics Committee of the Faculty of Dentistry, Cairo University (approval #19215). All participants signed an informed consent.

### Sample size calculation

Sample size calculation was done using a G*Power version 3.1.9.2. Independent t-test was used to detect the proper sample size. Mean and standard deviation were used to detect the amount of lateral gingival displacement according to Thimmappa et al. (2018) [8] and by adopting an alpha level of 5% and power at 80% and an effect size 1.47. The predicted sample size was a total of 18 teeth (9 teeth each group). Sample size was increased by 25% to be a total of 22 teeth (11 teeth each group).

### Randomization

The randomization sequence was generated using a random number table done by computer software (www.randomizer.org) with an equal allocation ratio (1:1) [9]. The random number table was generated and kept with a supervisor who was not involved in the study procedure. Allocation sequence concealment was done through sequentially numbered opaque sealed envelopes containing a card with either Group RC (retraction cord - Ultrapack® (Ultradent 505 west 10200 South Jordan, Utah, USA) or Group FP (Magic Foam® Paste). Implementation of the allocation sequence concealment was guaranteed by selecting and opening an envelope after tooth preparation was done.

### Participants

Participants with an age range of 20-45 years old were recruited from the outpatient clinic of the Fixed Prosthodontics department, Faculty of Dentistry – Cairo University, requiring a full coverage restoration (single crown or bridge). The inclusion criteria were: good oral hygiene without any active periodontal disease, thick gingival biotype with less than 3 mm periodontal pockets. Participants with gingival recession, thin gingival biotypes, pregnant or had bad oral hygiene were excluded. Gingival biotype (thick or thin) was determined by probing the buccal

gingival sulcus for the presence or absence of probe shadow [10] (Figure 1).

## Interventions

Medical and dental history, extraoral and intraoral examinations, periapical radiographs were obtained for every participant. Study casts were obtained before any preparations for all participants.

Pre-displacement impressions were done using a two-step impression technique with putty and light body (polyvinyl siloxane impression material) before preparation. Preparation was done using a tapered stone with round end size 13 to obtain a supra-gingival finish line. Retraction was done by the Magic Foam® Paste or an impregnated knitted retraction cord to obtain a deep subgingival chamfer finish line with a thickness of 0.8-1 mm to receive a PFM restoration with an occlusal reduction of 1- 1.5 mm, an axial reduction of 1.2 - 1.5 mm and a facial reduction of 1.4 mm - 1.7 mm.

In the retraction cord group (Group RC n = 11), the appropriate size of the impregnated cord was selected according to the sulcus depth and placed 0.5 mm below the gingival margin and was gently packed by a smooth cord packer, to avoid tearing of the periodontal ligaments, starting from mesial side along the whole surface of the tooth: buccally, distally and lingually (Figure 2). The retraction cord was left for 10 minutes in the sulcus then the sulcus was rinsed.

In the Magic Foam® Paste group (Group FP, n = 11), the paste was injected around the margins of the prepared tooth and into the sulcus. The patient was then instructed to bite on the Comprecap for 3-5 minutes until setting of the paste. The Comprecap was then removed with the set material and the sulcus was rinsed to remove any remnants of the paste, then was air dried (Figure 3).

After gingival displacement, an addition silicone light body was injected into the sulcus and around the prepared tooth and a wash was injected in the putty index taken before preparation. The tray was held in the patient's mouth under pressure until the impression

**Figure 2 -** Retraction cord in place.

**Figure 1 -** Upper first premolar thick gingival biotype.

**Figure 3 -** Application of the Magic Foam® paste.

material was set. The impression was disinfected using 0.5% sodium hypochlorite for 10 minutes then rinsed and poured with a type IV dental stone to produce a master cast for measurements.

## Outcomes

Gingival displacement measurements were done on the cast in three fixed points on the abutment: the mid-buccal and the transitional line angles, mesially and distally. The dies were left without ditching then sliced (Figure 4). Measurements were done using a stereomicroscope. All the measurement were done by an independent evaluator blinded to the intervention groups.

The amount of lateral gingival displacement was measured from the tooth surface to the free gingival margin for both the pre- and post-retracted dies. The amount of displacement was calculated by subtraction.

The amount of vertical displacement was measured from the gingival margin, coronally, to the bottom of the sulcus for both the pre- and post- retracted dies. The amount of displacement was calculated by subtraction (Figures 5-6).

After 2 weeks, the patients were recalled to assess tissue recovery by taking an impression using a double mix. The amount of tissue recovery was measured vertically from the gingival margin to the bottom of the sulcus and by comparing the results to the pre-displacement records (Figure 7).

## Statistical methods

Statistical analysis was performed using SPSS 20®, Graph Pad Prism® and Microsoft Excel

2016. Data was represented as a mean and standard deviation, presented in tables and figures. Data were explored for normality using Shapiro Wilk and Kolmogorov-Smirnov normality test which revealed that all data were parametric (P-value > 0.05). Accordingly, comparison between pre- and post-displacement records were performed using a paired t-test; while comparison between two groups was performed by an independent t-test. Furthermore, comparison between three sides within the same group was performed using a One-Way analysis of Variance (ANOVA) test followed by Tukey`s post hoc test for multiple comparisons.

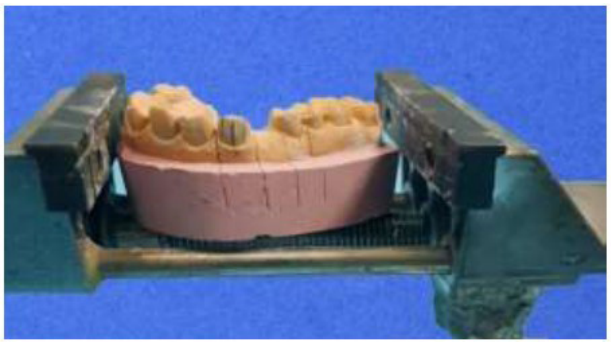

**Figure 4 -** Cast placed in holder for sawing the die.

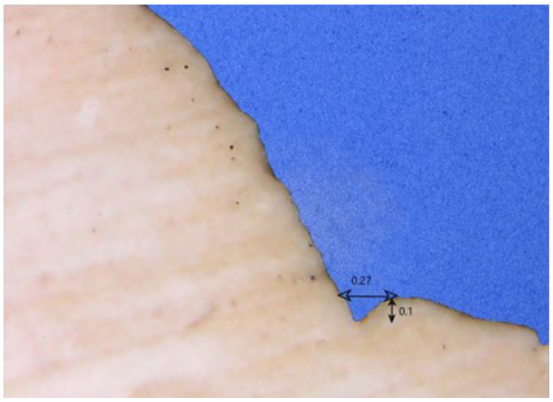


**Figure 5 -** Amount of vertical and lateral tissue displacement before retraction.

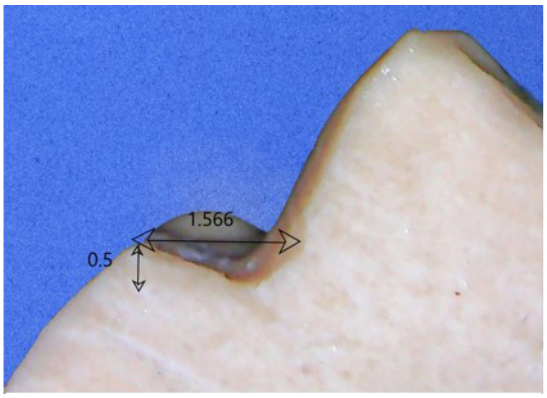


**Figure 6 -** Amount of lateral and vertical tissue displacement after retraction.

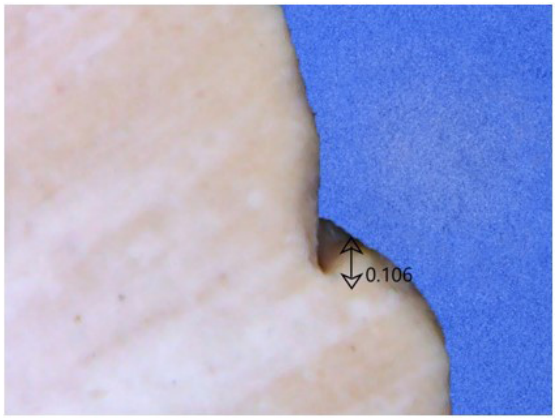


**Figure 7 -** Amount of vertical tissue recovery after 2 weeks.

## RESULTS

Exploring data normality revealed that the data were normal (P value < 0.05). Twenty-two patients were randomly divided into two groups and analyzed with no dropouts (n = 11).

Regarding vertical displacement, both agents (separately) showed a statistically significant difference between pre- and post- displacement values in all tooth surfaces (P value < 0.05). The Magic Foam® Paste (Group FP) showed a non-significant lower vertical displacement compared to the retraction cord (Group RC). There was no significant difference between the two groups regarding the pre- and post-displacement values on all surfaces (P value > 0.05) (Table I, Figure 8).

Regarding lateral displacement, both agents (separately) showed a statistically significant difference between pre- and post- displacement values in all tooth surfaces (P value < 0.05). The Magic Foam® Paste (Group FP) showed an insignificant lower lateral displacement in the distal surface compared to the retraction cord (Group RC). There was a significant difference between the two groups regarding the pre- and post-displacement values in the mid-buccal and mesial surfaces (P value < 0.05) (Table II, Figure 9).

Regarding tissue recovery, the Magic Foam® Paste (Group FP) showed a significantly higher tissue recovery than the retraction cord (Group RC) in the mid-buccal and distal surfaces (P value < 0.05); however, it was significantly lower regarding the mesial surface (P value < 0.05) (Table III, Figure 10).

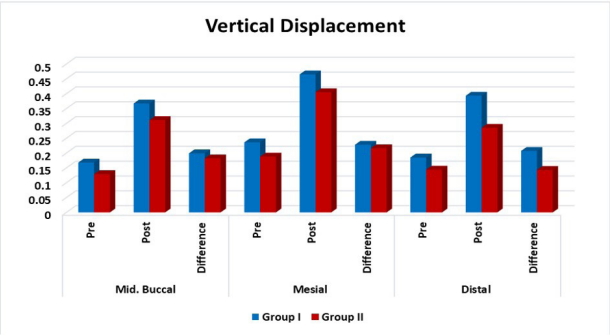


**Figure 8 -** Bar chart represents comparison between group RC (I) & FP (II) regarding pre displacement, post displacement and difference records of mesial, mid. buccal and distal surfaces.

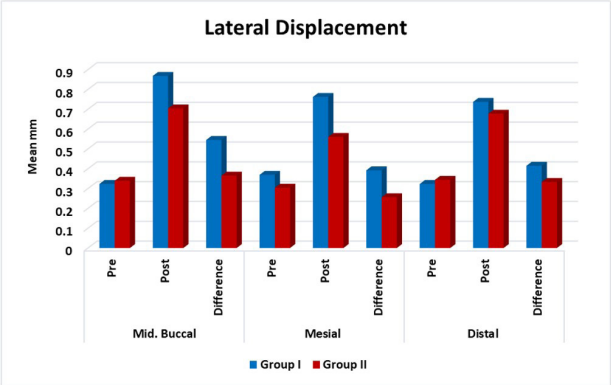


**Figure 9 -** Bar chart represents comparison between group RC (I) & FP (II) regarding pre displacement, post displacement and difference displacement records of mesial, mid. buccal and distal surfaces.

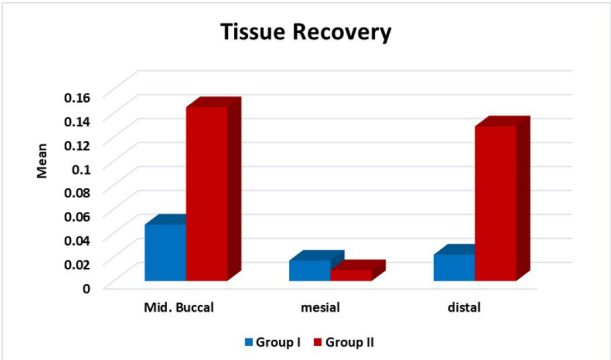


**Figure 10 -** Bar chart represents tissue recovery in group RC (I) & FP (II).

## DISCUSSION

Gingival displacement is important; especially if the finish line is subgingival, as the margin of the restoration must be kept 2 mm away from the crest of the underlying alveolar bone [11]. The relation between the supra crestal fiber attachment, the margin location and the location of the base of the sulcus is a critical factor to avoid encroachment of the biological width [12]. If the biological width is violated, an inflammatory response results in alveolar bone resorption, increased pocket depth, increased loss of periodontal support, exacerbation of subgingival bacteria, increased chronic inflammation, exposure of the restoration margins and the biological and esthetic failure of the restoration and surrounding periodontium [13].

There are different methods for gingival retraction: mechanical, chemo-mechanical (Cord or Cordless) or surgical, each having its advantages and disadvantages. Therefore, this study was done to compare retraction cord to

**Table I -** Comparison between both groups regarding vertical displacement in all surfaces in pre- and post- displacement records and the difference between them

| Vertical Tissue Displacement | | Group RC | | Group FP | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Mid-Buccal | Pre | 0.168 | 0.06 | 0.129 | 0.069 | 0.13 |
| | Post | 0.367 | 0.123 | 0.311 | 0.122 | 0.34 |
| | Difference | 0.199 | 0.077 | 0.182 | 0.089 | 0.75 |
| Mesial | Pre | 0.236 | 0.09 | 0.188 | 0.091 | 0.28 |
| | Post | 0.465 | 0.195 | 0.405 | 0.234 | 0.59 |
| | Difference | 0.228 | 0.119 | 0.216 | 0.148 | 0.85 |
| Distal | Pre | 0.185 | 0.09 | 0.144 | 0.054 | 0.21 |
| | Post | 0.393 | 0.141 | 0.285 | 0.101 | 0.13 |
| | Difference | 0.207 | 0.152 | 0.143 | 0.041 | 0.29 |

**Table II -** Comparison between both groups regarding lateral displacement in all surfaces in in pre- and post- displacement records and the difference between them

| Lateral tissue displacement | | Group RC | | Group FP | | P value |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | |
| Mid-Buccal | Pre | 0.323 | 0.156 | 0.339 | 0.141 | 0.871 |
| | Post | 0.868 | 0.279 | 0.704 | 0.138 | 0.091 |
| | Difference | 0.545 | 0.179 | 0.365 | 0.146 | 0.013* |
| Mesial | Pre | 0.369 | 0.253 | 0.304 | 0.156 | 0.578 |
| | Post | 0.762 | 0.442 | 0.560 | 0.126 | 0.234 |
| | Difference | 0.392 | 0.192 | 0.256 | 0.085 | 0.031* |
| Distal | Pre | 0.323 | 0.142 | 0.344 | 0.126 | 0.722 |
| | Post | 0.737 | 0.257 | 0.677 | 0.199 | 0.533 |
| | Difference | 0.415 | 0.189 | 0.333 | 0.115 | 0.151 |

Note: (*) means there was a significant difference between the two groups regarding lateral tissue displacement on the midbuccal and mesial surfaces p value < 0.05.

**Table III -** Tissue recovery in both groups

| Tissue Recovery | Group RC | | Group FP | | P value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Mid-Buccal | 0.047 | 0.092 | 0.145 | 0.117 | 0.03* |
| Mesial | 0.017 | 0.001 | 0.009 | 0.0003 | 0.001* |
| Distal | 0.022 | 0.001 | 0.129 | 0.001 | 0.001* |

Note: (*) means there was a significant difference between the two groups on all surfaces regarding tissue recovery p value < 0.05.

magic foam paste in vertical and lateral gingival tissue displacement and tissue recovery. This study was a randomized clinical trial to simulate the conditions of retraction in a patient's mouth when a gingival retraction agent is used. The null hypothesis is Magic Foam® paste and retraction cord doesn't differ in lateral and vertical gingival displacement or in tissue recovery.

Ultrapack® (Ultradent 505 west 10200 south South Jordan – Utah – USA) knitted impregnated retraction cord was used as it is the gold standard method of retraction. The knitted design of the ultrapack® has the advantage of exerting a gentle, outward force after placement upon wetting which opens up the sulcus more than the diameter of the cord, providing rapid tissue displacement, detailed margins, and quality impressions [14]. The Magic Foam® Paste was used due to its ease of application with a dispenser device directly into the gingival sulcus with less working time and trauma. Furthermore, copious irrigation after removal of the material isn't required due to the absence of a chemical agent [15]. The amount of lateral and vertical displacement was

calculated using a stereomicroscope for its 3-D examination [16].

On comparison, the retraction cord gives more vertical and lateral gingival displacement than the Magic Foam® Paste. The retraction cord had more gingival displacement in both vertical and lateral direction, but that increase in retraction was only significant in the lateral direction. Therefore, the null hypothesis was rejected partially. This may be attributed to the absence of an astringent agent from the Magic Foam® Paste while the retraction cord is impregnated with an astringent. Moreover, the amount of retraction relatively depends on the bite pressure of the patient on the Comprecap. Both of the retraction cord and the magic foam paste provided the least gingival displacement measures (more than 0.22 mm) which is necessary for proper recording of the finish line during impression making [17]. This was in agreement with Goutham et al. (2018) and Raghav et al. (2014) [5,18] who compared the amount of lateral displacement between retraction cord and Magic Foam® Paste and found that the retraction cord provides a more significant lateral gingival displacement than the Magic Foam® Paste. Another study by Gupta et al. (2013) compared magic foam paste to stay put impregnated retraction cord and found out insignificant difference regarding vertical and horizontal gingival displacement. However, magic foam paste induced the least bleeding on removal and was easier to place with less time consuming [19].

Another study by Mehta et al. (2019) was in agreement with the study findings and found that magic foam paste had significantly less lateral gingival displacement than impregnated retraction cord [20]. Although magic foam paste has no astringent agent, it provides sufficient retraction through the expanding nature of its silicone foam and the pressure applied through the comprecap on biting that ensures the foam paste to be pushed in the gingival sulcus [21]. A study by Singh et al. (2019) compared magic foam paste with retraction cord and found out that, retraction cord provided more lateral displacement but the results was non-significant [22].

A study conducted by Thimmappa et al. (2018) measuring vertical and lateral gingival displacement using a stereomicroscope between magic foam paste, ultrapack® retraction cord and merocel® strips, found out that magic foam paste had less significant lateral and vertical gingival displacement in comparison to ultrapack® retraction cord [8]. These findings are in partial agreement with the study findings regarding the amount of gingival displacement offered by magic foam® paste which are less than retraction cord. Magic foam® paste as a cordless retraction technique could be better and more tissue friendly than retraction cords from a histopathological point of view as mentioned by Phatale et al. (2010) [23].

For tissue recovery, only the vertical gingival displacement is measured because it was carried out after cementation and the prosthesis does not resemble natural tooth dimensions to be carried out in a lateral direction. Tissue recovery was carried out 2 weeks after cementation as according to Gupta et al. (2012) [24], this is the maximum time taken for the junctional epithelium to heal normally. In the current study, Magic foam® paste had significant lower lateral displacement values and better tissue recovery which could indicate its use with epi-gingival and subgingival (less than 2 mm) preparation margins with less trauma to the gingival tissues than retraction cords as concluded by Beier et al. (2009) [25].

One of the limitations of this study was the small sample size and only thick gingival biotypes were included. Further studies are needed, with increased sample size, to show the effect of finish line design on the selection of retraction agents. Sulcus depth variations should be eliminated to decrease confounders. More studies can be done by measuring the amount of tissue dilation using an impression instead of a cast to eliminate the variation of the die material flow and any variations during cast construction. Profile projector can be used as a measuring tool.

## CONCLUSION

Within the limitations of this study, the following could be concluded:

- Retraction cord technique produced more lateral gingival displacement compared to the magic foam® paste.
- Magic foam® paste is easier in application and less traumatic with more tissue recovery after displacement.

- Both the ultrapack® knitted retraction cord and the magic foam paste are an effective means of retraction as they give the minimum amount of retraction needed.

## Author's Contributions

NAAEG: Methodology, writing and formal analysis. OSEDEM: Supervision. GAEHAN: Supervision.

## Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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## Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Research Ethics Committee, Faculty of Dentistry, Cairo University. The approval code for this study is: #19215.

## REFERENCES

1. Prasad KD, Hegde C, Agrawal G, Shetty M. Gingival displacement in prosthodontics: a critical review of existing methods. J Interdiscip Dent. 2011;1(2):80-6. http://dx.doi.org/10.4103/2229-5194.85023.
2. Laufer BZ, Baharav H, Ganor Y, Cardash HS. The effect of marginal thickness on the distortion of different impression materials. J Prosthet Dent. 1996;76(5):466-71. http://dx.doi.org/10.1016/S0022-3913(96)90002-5. PMid:8933434.
3. Benson BW, Bomberg TJ, Hatch RA, Hoffman W Jr. Tissue displacement methods in fixed prosthodontics. J Prosthet Dent. 1986;55(2):175-81. http://dx.doi.org/10.1016/0022-3913(86)90336-7. PMid:3514852.
4. Tabassum S, Adnan S, Khan FR. Gingival retraction methods: a systematic review. J Prosthodont. 2017;26(8):637-43. http://dx.doi.org/10.1111/jopr.12522. PMid:27465933.
5. Goutham GB, Jayanti I, Jalaluddin M, Avijeeta A, Ramanna PK, Joy J. Clinical assessment of gingival sulcus width using various gingival displacement materials. J Contemp Dent Pract. 2018;19(5):502-6. http://dx.doi.org/10.5005/jp-journals-10024-2290. PMid:29807958.
6. Kumbuloglu O, User A, Toksavul S, Boyacioglu H. Clinical evaluation of different gingival retraction cords. Quintessence Int. 2007;38(2):e92-8. PMid:17510720.
7. Moher D, Hopewell S, Schulz KF, Montori V, Gøtzsche PC, Devereaux PJ, et al. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. Int J Surg. 2012;10(1):28-55. http://dx.doi.org/10.1016/j.ijsu.2011.10.001. PMid:22036893.
8. Thimmappa M, Bhatia M, Somani P, Kumar DRV. Comparative evaluation of three noninvasive gingival displacement systems: an in vivo study. J Indian Prosthodont Soc. 2018;18(2):122-30. http://dx.doi.org/10.4103/jips.jips_225_17. PMid:29692565.
9. Urbaniak G, Plous S. Research Randomizer (version 4.0). 2013. [Computer software]. Retrieved on June 22, 2013, from http://www.randomizer.org/.
10. Abraham S, Deepak KT, Ambili R, Preeja C, Archana V. Gingival biotype and its clinical significance – a review. Saudi J Dent Res. 2014;5(1):3-7. http://dx.doi.org/10.1016/j.ksujds.2013.06.003.
11. Baba NZ, Goodacre CJ, Jekki R, Won J. Gingival displacement for impression making in fixed prosthodontics: contemporary principles, materials, and techniques. Dent Clin North Am. 2014;58(1):45-68. http://dx.doi.org/10.1016/j.cden.2013.09.002. PMid:24286645.
12. Ercoli C, Tarnow D, Poggio CE, Tsigarida A, Ferrari M, Caton JG, et al. The relationships between tooth-supported fixed dental prostheses and restorations and the periodontium. J Prosthodont. 2021;30(4):305-17. http://dx.doi.org/10.1111/jopr.13292. PMid:33210761.
13. Shenoy A, Shenoy N, Babannavar R. Periodontal considerations determining the design and location of margins in restorative dentistry. J Interdiscip Dent. 2012;2(1):3. http://dx.doi.org/10.4103/2229-5194.94184.
14. Safari S, Ma VS, Mi VS, Ghavam HF, Hamedi M. Gingival retraction methods for fabrication of fixed partial denture: literature review. J Dent Biomater. 2016;3(2):205-13. PMid:28959744.
15. Sampath P, Varma L, Varma M, Shabu A. Recent advances on gingival tissue management in restorative dentistry. Indian J Dent Sci. 2019;11(4):185.
16. Chandra S, Singh A, Gupta KK, Chandra C, Arora V. Effect of gingival displacement cord and cordless systems on the closure, displacement, and inflammation of the gingival crevice. J Prosthet Dent. 2016;115(2):177-82. http://dx.doi.org/10.1016/j.prosdent.2015.06.023. PMid:26443067.
17. Shivasakthy M, Ali SA. Comparative study on the efficacy of gingival retraction using polyvinyl acetate strips and conventional retraction cord - an in vivo study. J Clin Diagn Res. 2013;7(10):2368-71. http://dx.doi.org/10.7860/JCDR/2013/6980.3526. PMid:24298531.
18. Raghav D, Shah A, Singh S, Khalil H, Kola M, Kumar P. A comparative clinical and quantitative evaluation of the efficacy of conventional and recent gingival retraction systems: an in vitro study. Eur J Prosthodont. 2014;2(3):76. http://dx.doi.org/10.4103/2347-4610.140514.
19. Gupta A, Prithviraj DR, Gupta D, Shruti DP. Clinical evaluation of three new gingival retraction systems: a research report. J Indian Prosthodont Soc. 2013;13(1):36-42. http://dx.doi.org/10.1007/s13191-012-0140-y. PMid:24431705.
20. Mehta S, Virani H, Memon S, Nirmal N. A comparative evaluation of efficacy of gingival retraction using polyvinyl siloxane foam retraction system, vinyl polysiloxane paste retraction system, and copper wire reinforced retraction cord in endodontically treated teeth: an in vivo study. Contemp Clin Dent. 2019;10(3):428-32. PMid:32308315.
21. Kamath R, Sarandha DL, Baid GC. Advances in gingival retraction. Int J Clin Dent Sci. 2011;2(1):64-7.

22. Singh AA, Rao BK, Gujjari AK. Evaluation of gingival displacement using foam cord and retraction cord: an in vivo study. J Int Oral Health. 2019;11(1):8. http://dx.doi.org/10.4103/jioh.jioh_169_18.

23. Phatale S, Marawar PP, Byakod G, Lagdive SB, Kalburge JV. Effect of retraction materials on gingival health: a histopathological study. J Indian Soc Periodontol. 2010;14(1):35-9. http://dx.doi.org/10.4103/0972-124X.65436. PMid:20922077.

24. Gupta D, Bhide SV, Gandhi PV, Paliwal Y. Comparative evaluation of clinical efficacy of two different retraction systems- an in-vivo study. Indian J Stomatol. 2012;3(1):7-13.

25. Beier US, Kranewitter R, Dumfahrt H. Quality of impressions after use of the Magic FoamCord gingival retraction system-a clinical study of 269 abutment teeth. J Prosthet Dent. 2010;103(1):22. http://dx.doi.org/10.1016/S0022-3913(09)60209-2.

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