Research Article

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A Comparative Evaluation of the Efficacy of Different Gingival Retraction Materials: An In-Vivo Study

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ABSTRACT

Background: The study was designed to clinically evaluate efficacy of 3 new retraction systems knitted retraction cord "00" size ultrapak (Ultradent Products, Inc., South Jordan, Utah, USA), Magic Foam Cord (Coltène /Whaledent, Inc., Cuyahoga Falls, OH, USA) and Polyvinyl acetate strips (Merocel, Mystic. Connecticut). The abutment tooth was prepared for full coverage crown with an equi-gingival finish line. On day 1 – the baseline impression was made. On day 2, day 8, and on day 16, impressions were made after displacement with any one of the 3 displacement agents according to Latin block design.

Keywords: Gingival retraction, Gingival displacement, Magic foam, Merocel.

INTRODUCTION

Fixed partial dentures (FPDs) are consistently used in routine practice for rehabilitation of dentulous and partially edentulous subjects. Harmony between the prosthesis and the periodontium is crucial. Indirect restorations, including cast gold inlays, onlays, partial veneer restorations, complete crowns, metal-ceramic, all-ceramic crowns and bonded ceramic inlays and onlays are routinely used to restore defective teeth.[1]

MATERIALS AND METHODS

Inclusion criteria

- Patient 20-40 years of age.
- Preparation for full coverage crowns.
- Periodontally healthy teeth.
- No developmental anomaly or regressive age changes.
- Posterior abutment teeth.
- Patient systemically healthy with no medical condition which could affect their periodontal condition.

Exclusion criteria

- Tipped, tilted or rotated abutment teeth.
- Teeth with gingival pathology.

Clinical procedure

Custom tray fabrication:

A preliminary impression of the arch was made with a stock metal tray and irreversible hydrocolloid impression material (DPI, Mumbai). Perforations were made on the custom tray with a round bur. The tray included one tooth on either side of the abutment teeth. A total of four trays were made for each sample.

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Gingival retraction and impression making:

The abutment tooth was prepared for full coverage crown with an equi-gingival finish line. On day 1 – the baseline impression was made. On day 2, day 8, and on day 16, impressions were made after displacement with any one of the 3 displacement agents according to Latin block design.

Baseline impression:

Baseline impressions were made for the control group in which no gingival displacement was done. Impressions were made with Silagum putty consistency. Impressions were made and removed from patient's mouth after the material was set and subsequently disinfected with glutaraldehyde solution.

Gingival retraction using cord and impression:

Isolation of the tooth with cotton rolls was done to maintain a dry working area. The required dimension of the retraction cord was selected. Retraction cord (Ultrapak "00"size, Ultradent Inc) was looped around the tooth. Packing was started from the mesial interproximal area by gently pushing it into the sulcus with the gingival cord packer instrument (Hu Friedy) using the single cord technique. Retraction cord was kept in place for 10 minutes.

Magic Foam Cord (MFC) retraction and impression:

Magic Foam Cord system (Coltène/Whaledent, Inc.) was available in cartridges which were automixed using syringe tips and applied into the gingival sulcus using oral tips. Anatomic comprecaps preselected according to size of the tooth were placed over it and patient was instructed to close mouth under bite pressure. Magic Foam Cord was left in place for 5 min according to manufacturer's instructions and impression was made similar to baseline impression. Merocel strip retraction and impression:

Merocel strips (Mystic, Connecticut) were cut into thin sections of 2 mm thickness. Temporary crowns were fabricated using a putty index. Material used for temporary crowns was Luxatemp (DMG Elbgaustr, Hamburg, Germany) available in cartridges and automixed using syringe tips. Merocel strips were gently pushed into the sulcus with the gingival cord packer instrument (Hu Friedy) and temporary crown inserted over it. The patient was instructed to maintain bite pressure on the temporary crown. It was left in place for 10 minutes. Impressions were made similar to impression made with retraction cord.

Sample preparation:

Mesio-distal width of the tooth was measured on the impression with the help of vernier caliper and the center point of the tooth was marked on the tray, two secondary markings were made 3 mm mesial and distal to the first marking for the secondary cut. The tray was positioned and stabilized on the platform of a die cutter, and a primary cut was made on the marked central portion of tooth in the buccolingual direction through the entire length of the tray. Two secondary cuts were made mesial and distal to the primary cut along the entire length of the tray such that two 3 mm thick buccolingual slices were obtained.

Evaluation of samples for gingival retraction:

The gingival retraction was measured from the tooth to the crest of gingiva in a horizontal plane. The samples were viewed under a Stereomicroscope (Stereozoom microscope, Model CD-500A) at 10x magnification. The images were captured and analysed using Image ProPlus software.

RESULTS

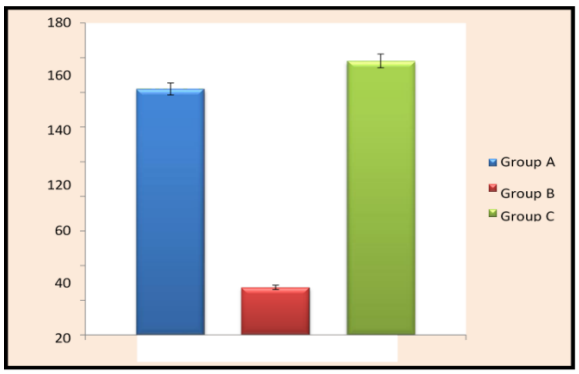
A total of 20 teeth in patients in need of tooth supported crown or bridgework were selected. There were four groups in the study Group WR (Without Retraction), Group A (Retraction Cord), Group B(Magic Foam Cord) and Group C(Merocel Retraction Strips).

Gingival retraction

Gingival retraction was done in Group A, B and C using the respective materials whereas Group WR was without retraction. The gingival sulcus measurements were done indirectly using PVS impressions which were analysed under a stereomicroscope and measured using Image ProPlus software. The measurements obtained were tabulated and statistically analysed

Table 1: Gingival retraction values.

Sample no.	Group WR (without retraction) (mm)	Groupl A (cord) (mm)	Groupl B (Magic foam) (mm)	Group C (Merocel) (mm)
1	0.22	0.25	0.34	0.27
2	0.20	0.23	0.31	0.21
3	0.14	0.21	0.29	0.22
4	0.13	0.25	0.31	0.23
5	0.29	0.34	0.38	0.27
6	0.14	0.32	0.39	0.3
7	0.20	0.30	0.33	0.24
8	0.19	0.20	0.46	0.36
9	0.21	0.52	0.56	0.32
10	0.20	0.28	0.40	0.38
11	0.32	0.37	0.42	0.32
12	0.28	0.34	0.43	0.47
13	0.22	0.41	0.36	0.33
14	0.32	0.52	0.55	0.43
15	0.30	0.58	0.61	0.52
16	0.28	0.40	0.49	0.33
17	0.31	0.49	0.49	0.40
18	0.30	0.40	0.47	0.32
19	0.31	0.42	0.52	0.43
20	0.34	0.40	0.47	0.32



Graph 1: Graph for time of placement.

Individual comparison with Tukey's Post Hoc test revealed, highly significant mean difference in time of placement between Group A and Group B (p=0.0001), between Group B and Group C (p=0.0001) and between Group C and Group A (p=0.002)

DISCUSSION

Pain is considered as a subjective feeling or experience; therefore it is quite difficult to standardize conditions to assess it. Patient perception of materials used intraorally is of utmost importance, so pain score was used as another criteria for evaluating the effectiveness of the retraction material In the present study, pain was assessed on the basis of pain score used by Yang et al in their study.[37] To evaluate pain, patients were asked about the pain perceived during retraction immediately after each material was applied based on a scale of 1 to 4 (1, no pain; 2, mild pain; 3, moderate pain; 4, severe pain).

Pain scores were statistically analysed using the Chi Square Test. Results of the present study indicated that none of the materials caused severe pain i.e. score 4. Pain score ranged between to 3 i.e. no pain to moderate pain. It may be inferred that majority of teeth in subjects of Group B (85%) complained of no pain which was found to be higher than Group C (55%) and Group A (35%) subjects respectively. Out of the 6 subjects who complained of moderate pain 50% each belonged to Group A and Group C respectively. This finding was found to be statistically significant (p=0.024). Individual comparison showed no statistically significant

difference for pain perception between Group A and Group C (p=0.381) a finding similar to Group B and Group C (P=0.07).However a significant difference in pain perception was noted for subjects between Group A and Group B (P=0.04).Based on the results, among the three materials used, Magic Foam Cord were assessed as the least painful followed by

Merocel strips and retraction cord was assessed as the most painful by patients. Reduced pain during placement of MFC may be due to the difference in application procedure. During placement of MFC there was passive syringing of the material into the sulcus which is more comfortable to the patient whereas during placement with a cord packer, some amount of pressure was applied by the operator to secure the material in place. The results were in accordance with the study by Yang et al which stated that the use of the medicated cord was more painful than the injection types. This confirms the clinical convenience and comfort of injection-type retraction materials.[37]

For a clinician time is money. Hence time of placement is an important criteria to decide the efficacy of any material. The time of placement was statistically analysed using One Way Analysis of Variance (ANOVA). The mean ±SD for Group A (retraction cord) was142.1 ± 15.65, for Group B (MFC) was 27.50 ± 5.69 and for Group C (Merocel) was 158.20± 17.60. Among the three groups, Group B showed the lowest mean for time of placement. The difference in means of time of placement between the three groups was statistically significant ($p<0.05$).Comparison between the groups revealed that the difference between Group A (retraction cord) and Group B (MFC) as well as between Group B (MFC) and Group C (Merocel) was highly significant (p=.0001).There was also a significant difference between Group A and Group C (p=0.002) From the results of the present study it may be concluded that Magic Foam Cord (MFC) was the least time consuming followed by retraction cord and Merocel strips which required the maximum time for placement.

The maximum time of placement for Merocel may be associated to the difficulty encountered while securing the material in place during the process of placement and retraction. Merocel strips were found to be easily placed when dry than when wet.

Also, placement of retraction cord as well as merocel with a cord packer was more time

consuming and cumbersome. The reduced time of placement of MFC may be attributed to the fact that MFC is applied with an applicator gun using automixing tips directly into the sulcus.[47] Results of the present study were comparable to other studies which indicated that paste retraction system was easier to apply as compared to retraction cord and also less time consuming. No haemostatic chemicals were used to contaminate the impression site, hence no need for extensive rinsing, thus saving time.[37, 51]

Within the limited scope of this study it can be concluded that Magic Foam Cord (MFC) was found to be a promising retraction material system in terms of gingival sulcus widening, reduced haemorrhage, reduced pain experienced by the patient and minimal time required for placement.

CONCLUSION

Three groups were analysed based on criteria like retraction produced, haemorrhage score, pain score and time of placement. Stereomicroscope was used to measure the amount of retraction. Based on the results and within the limited scope of the study the following conclusions can be drawn.

1. All three materials were reasonably acceptable for gingival retraction as they provided retraction more than the minimum amount of retraction (0.2mm) required for a fixed partial denture impression.

2. For gingival retraction Magic Foam Cord was found to be most effective, however retraction cord also showed optimum results.

3. In terms of hemorrhage control, Magic Foam Cord was found to be more effective.

4. Magic Foam Cord was the least painful to the patient while retraction cord was most uncomfortable to the patient.

5. Magic Foam Cord was easy to place and also less time consuming whereas Merocel required more time for placement.

Scope of the study:

This study was done in vivo to compare the effectiveness of retraction cord, Magic Foam Cord (MFC) and Merocel strips. In future this study can be expanded to assess the histological effects of these materials on the periodontium. Further the gingival displacement by mechanical methods may be compared with the mechano- chemical methods. Studies may be done with other variables like location of abutment teeth (anterior or posterior, maxillary or mandibular), distendability of gingiva and gingival thickness.

Limitations of the study:

The present study used knitted retraction cords and braided or twisted cords were not considered as an option. Hence it was difficult to generalize the results for all types of cords. Also, non-medicated cords were used for the study and all the three methods used were purely mechanical. Chemically impregnated cords can be compared with these materials. Another limitation during placement of merocel strips was, need for temporary crowns at the time of impression making, because it was difficult to secure the material in place during the process of placement and retraction. However, retraction cord is placed without temporary crowns which may affect the retraction produced.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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