European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 7, Issue 8, 2020

A COMPARATIVE EVALUATION OF THE EFFICACY OF TWO GINGIVAL RETRACTION SYSTEMS: AN IN VIVO STUDY

Dr. Pradipto Parai
MDS, Department of Prosthodontics and Crown & Bridge, Consultant and Practitioner, Supti Dental Clinic, Ranaghat, West Bengal

Dr. Polysmita Ojah
MDS, Assistant Professor, Department of Prosthodontics and Crown & Bridge, School of Dental Sciences, Sharda University, Greater Noida, UP.

Dr. Shailesh Jain
MDS, Associate Professor, Department of Prosthodontics and Crown & Bridge, School of Dental Sciences, Sharda University, Greater Noida. UP

Dr. Nausheen Khan
MDS, Department of Prosthodontics and Crown & Bridge, Consultant and Practitioner, Smile Zone Dental Clinic, Lucknow, UP

Dr. Sakshi Gangwar
MDS, Department of Prosthodontics and Crown & Bridge, Consultant and Practitioner, Vedansh Hospital, National highway, Fatehganj west, UP.

Dr. Khurshid Mattoo
MDS, Department of Prosthetic Dental Sciences, College of Dentistry, Jazan, Saudi Arabia

Abstract - Aim: To compare and evaluate the efficacy of two gingival retraction systems. Materials and method: This in vivo experimental study was carried out on 20 patients in need of tooth supported crown and bridge. Two different gingival retraction systems were used to evaluate the amount of gingival displacement. Patients were marked as A, B, C and so on and for each patient three impressions were made and named as I, II, III. Group I- Control (baseline impression), Group II- Impression with knitted retraction cord #00 size ultrapak group, Group III- Impression with 3M ESPE retraction capsule (in millimeter). The abutment tooth was prepared for full coverage crown with a sub-gingival finish line. Baseline impression was made on the first day of tooth preparation without retraction. On day 8 and day 15 impressions were made with vinyl polysiloxane regular body after displacement with anyone of 2 displacement agents. A total of three impressions were made for each abutment tooth. Impressions were poured immediately with die stone. A 3 mm thick buccolingual slice was obtained from the cast of the prepared tooth region with the die cutter. The gingival retraction was measured from the tooth to the crest of gingiva in a horizontal plane. These samples were viewed under a Profile projector (MEERA METZER PROFILE PROJECTOR MODEL-MET7-B01RD) at 10x magnification and gingival retraction was measured from the tooth surface to the crest of gingival. Datas obtained were then send for statistical analysis. Results: There was a highest mean value for group III (3M ESPE retraction capsule) -1.1879±0.2490 mmin comparison to group I, group II. On performing the student independent t test, it was found that P is <0.05 that is statistically significant. Conclusion: Impression made after retraction of gingiva with 3M ESPE retraction capsule was effective in respect to gingival displacement.

Keyword: Finish lines, gingival retraction, vinyl polysiloxane impression material

INTRODUCTION

The long term health and stability of the surrounding periodontal structures is responsible for the successs of fixed prosthodontics. The full coverage restorations influences more the health of periodontal structures than a single restoration. Often subgingival margins are required for full coverage preparations because of caries, existing restorations, esthetic demands, or the need for additional retention. So, impression making should be subgingival that it accurately records the prepared cervical finish lines and allow the fabrication of dies on which restorations are fabricated. Clinicians are however inadequate to capture the cervical finish lines.[1]

As opposed to gingival "retraction", gingival displacement promotes efficient impression making techniques with intracrevicular margins. This reversible procedure displace the gingival tissues in a lateral direction so that it can replicate the marginal detail adequately by introducing low viscosity impression material into the widened sulcus. Approximately 0.2 mm of sulcular width is considered adequate. Less than this critical width results in impression that have a more prevalence of voids in the marginal area and also cause distoration of the impression There are three main variations of the mechanical-chemical technique for gingival displacement and these include the single cord technique, the double cord technique, and the infusion method of gingival displacement.[2,3] This study was done in vivo with the aim to evaluate and compare two materials viz. Ultrapak retraction cord which is most frequently used and 3M ESPE retraction capsule for temporarily retracting the gingiva for impression making.

MATERIALS AND METHODS

MATERIALS

a. Knitted retraction cord #00 size ultrapak (Ultradent Products, Inc., South Jordan, Utah, USA)

b. 3M ESPE retraction capsule (3M Dentschland GmbH, Dental products, carl-schurz-str.1 141453 Neuss - Gemany)

c. Vinyl PolySiloxane impression material Regular Body - Hydrophilic (3M ESPE, Dental products, 2510 Conway Avenue st.paul, MN 55144-1000 USA)

d. 3M ESPE Vinyl Polysiloxane Tray Adhesive

e. Self-polymerizing acrylic resin (DPI, Mumbai)

f. Cotton rolls

g. Modeling wax

h. Separating media

i. Dental stone

ARMAMENTARIUM

a. Mouth mirror

b. Tweezers

c. Non powdered surgical gloves

d. Bard parker handle no.4 and blade

e. Cord packer (Hu-Friedy Manufacturing, Inc., Chicago, IL, USA)

f. Stock trays sectional

g. Air-rotor handpiece

h. Diamond burs (Shofu , Germany)

i. Vernier caliper

EQUIPMENT

a. Die separating unit (EM-DC2)

b. Profile projector (MEERA METZER PROFILE PROJECTOR MODEL-MET7-B01RD, S-NO-1448, Manufactured by MEERA UDYOG, S-6, IndustrialArea, Site-A, MATHURA, U.P, INDIA)

METHOD OF COLLECTING SAMPLES

In the period between 2016 and 2018, 20 patients in need of tooth supported crown or bridgework were selected to participate in an randomized clinical trial (RCT) and each of the patients was alphabetically marked as A,B,C and so on.

The trial was conducted in the Department of Prosthodontics, IDS, Bareilly. All clinical and technical procedures were done by a single operator.

INCLUSION CRITERIA

- More than 20 years of age.
- Preparation for full coverage restorations.
- Sound gingival health of abutment teeth.
- No developmental anomaly or regressive age changes.
- 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.

An informed consent was obtained from each patient at the beginning of the study.

The study was conducted in the Department of Prosthodontics, IDS, Bareilly and Shri Ram Murti Smarak College of Engineering & Technology, Bareilly. The study protocol was accepted by the ethical committee of the Institute of Dental Sciences, Bareilly.

CLINICAL PROCEDURE

Custom tray fabrication:

A preliminary impression of the arch was made with a stock metal tray and irreversible hydrocolloid impression material. Dental stone models retrieved from these impressions were used to fabricate custom acrylic (sectional) trays with a double sheet modeling wax spacer.(Fig-1)

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 three trays were made for each sample.(Fig-2)

Gingival retraction and impression making:

The abutment tooth was prepared for full coverage crown with a sub-gingival finish line without retraction of gingival sulcus. On day 1 – the baseline impression was made. On day 8 and day 15 impressions were made after displacement with anyone of 2 displacement agents.

Baseline impression:

Baseline impressions were made for the control group in which no gingival displacement was done. Impressions were made with 3M Vinyl Polysiloxane regular body. Impressions were made and removed from participant's mouth after the material was set and subsequently disinfected with glutaraldehyde solution for 20 minutes.(Fig-3)

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.(Fig 4) Packing was started from the mesial interproximal area by gently pushing it into the

sulcus with the gingival cord packer instrument (Hu Freidy) using the single cord technique.(Fig 5,6) Retraction cord was kept in place for 10 minutes. Cord was removed and impression was made with Vinyl Polysiloxane regular body.

3M ESPE retraction capsule and impression:
3M ESPE retraction capsule system is available in capsule that are designed with an extra-fine tip that fits directly into the sulcus.(Fig-7)When compared with retraction cords, the retraction procedure with this material can be up to 50% faster. Lower risk of hemorrhage, versus deal retraction cords and easy access into the sulcus Additionally, while patient comfort is not typically a factor associated with retraction, this product offers dentists an option that is easier on patients.

After 2 minutes, this was remove with air-water spray and suction, leaving a dry, clean and open sulcus area. Hence this lowers the risk of bleeding and post haemorrhage and impression was made with Vinyl Polysiloxaneregularbody.(Fig 8)

Groups:
Group I- impression without retraction.

Group II- impression after retraction with gingival retraction cord.

Group III- impression after retraction with 3M ESPE retraction capsule.

A total of three impressions were made for each abutment tooth. Each impression was given a label as AI, AII, AIII, similarly BI, BII, BIII where denotes A, B denotes sample of a patient and I, II, III denotes the group.

Pouring of impression and Sample preparation:
Each of the three impressions was poured immediately with die stone. Mesio-distal width of the tooth was measured with help of vernier caliper and the center point of the tooth was marked on the cast, a second marking was made 3 mm distal to the first marking for the secondary cut. The cast was positioned and stabilized on the platform of a die cutter (Fig 9) and a primary cut was made on the marked central portion of tooth in the buccolingual direction through the entire length of the cast.(Fig10) A second cut was made distal to the primary cut along the entire length of the cast such that a 3 mm thick buccolingual slice was obtained.

Evaluation of the amount of displacement:
The gingival retraction was measured from the tooth to the crest of gingiva in a horizontal plane.(Fig 11) The samples were viewed under a Profile projector (MEERA METZER PROFILE PROJECTOR MODEL-MET7-B01RD) at 10x magnification.(Fig12, 13, 14)

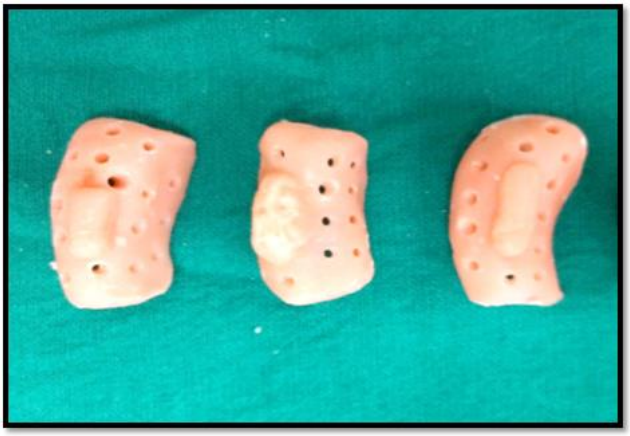

Figure 1: SECTIONAL CUSTOM TRAYS FOR VINYL POLYSILOXANE IMPRESSION MATERIAL REGULAR BODY

FIGURE 2: USED RETRACTION - MATERIALS

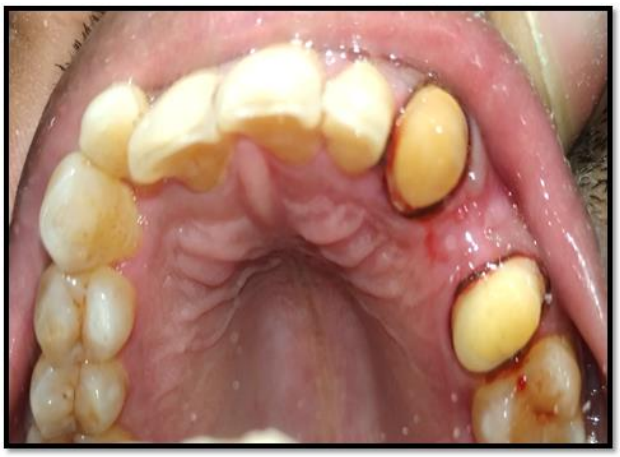

FIGURE 3: RETRACTION PROCEDURE BY KNITTED RETRACTION CORD

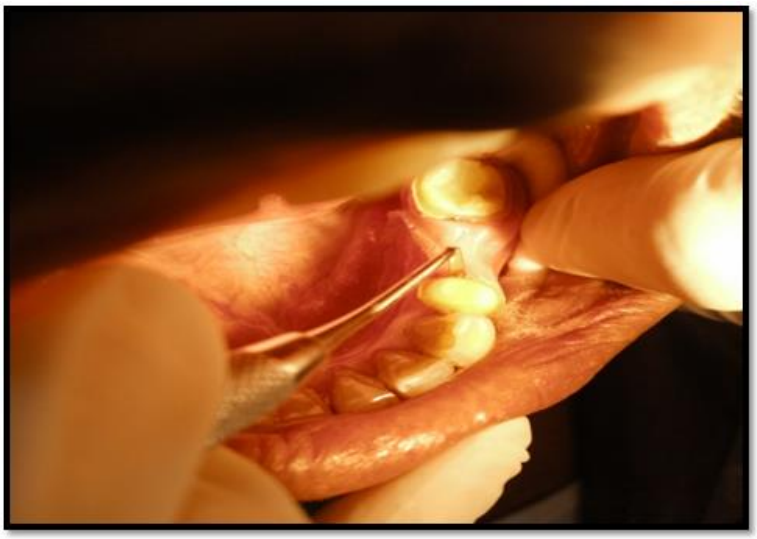

FIGURE 4: PLACEMENT OF MEROCEL IN 35 WITH CORD PACKER (HU-FRIEDY)

FIGURE 5: RETRACTION PROCEDURE BY 3M ESPE RETRACTION CAPSULE

FIGURE 6: IMPRESSION MADE BY VINYL POLYSILOXANE IMPRESSION MATERIAL REGULAR BODY WITHOUT RETRACTION AND WITH RETRACTION

FIGURE 7: DIE CUTTER

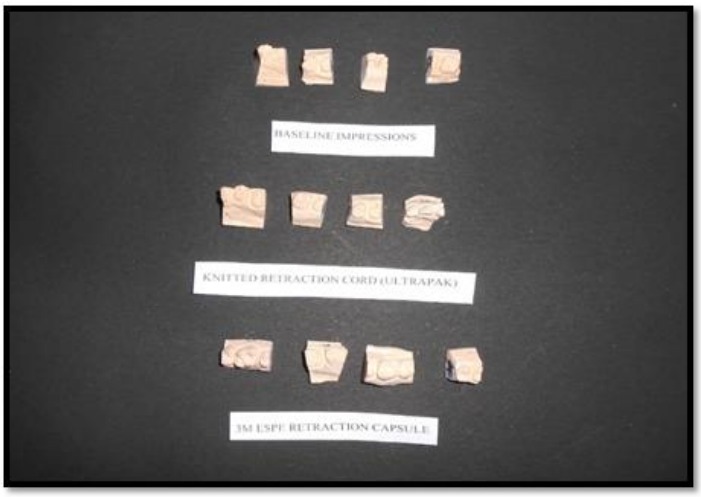

FIGURE 8: SECTIONING OF THE DIES DONE FOR EACH GROUP

FIGURE 9: DIE PLACED ON THE PROFILE PROJECTOR FOR EVALUATION OF THE DISPLACEMENT

FIGURE 10: PROFILE PROJECTOR

STATISTICAL ANALYSIS

The data were entered on a Microsoft Excel spreadsheet and imported into Statistical Package for Social Sciences (SPSS) version 22 (SPSS Inc., Chicago, IL, USA) for statistical analysis. Data was present in mean and standard deviation. Student independent t-test was performed to find significant difference in different groups. A *P*-value less than 0.05 is considered statistically significant.

RESULTS

A total of 20 patients in need of full coverage restorations in which abutments are of sound gingival health and no pathology associated were selected in this study. There were three groups in this study: Group I-Control (baseline impression), Group II-Impression with knitted retraction cord #00 size ultrapak group, Group III- Impression with 3M ESPE retraction capsule (in millimeter). Impression were made by vinyl polysiloxane regular body: hydrophilic (3M ESPE, Dental products,2510 Conway Avenue st.paul, MN 55144-1000 USA) with and without retraction of gingiva to evaluate the efficacy of these two gingival retraction systems.

Table- 1: Mean value of gingival displacement measured in millimeter of different groups

GROUP	Mean	Std. Deviation	Minimum	Maximum
GROUP I Control(baseline impression)	0.7840	0.2521	0.3600	1.1650
GROUP II Knitted retraction cord	0.9611	0.2670	0.4550	1.4100
GROUP III 3M ESPE retraction capsule	1.1879	0.2490	0.7550	1.6300

The mean values with respect to the gingival displacement of different groups are tabulated which shows that gingival retraction with 3M ESPE retraction capsule that is a mechano-chemical method was effective for the proper displacement of gingiva in order to reproduce the finish line in the cast for the fabrication of restoration.

Table 2- Comparison of mean gingival displacement calculated by Student independent t-test between group I and group II

GROUP	Mean	Std. Deviation	t-Value	P-Value
Group I: Control	0.7840	0.2521	2.157	0.037*
Group II: Knitted retraction cord	0.9611	0.2670		

Comparison between group I and group II was done by student independent t-test. Mean values of Group I, i.e. Control group and Group II i.e. Knitted retraction cord are -0.7840±0.2521, 0.9611±0.2670 respectively. t-value is 2.157 and P value is 0.037. (*P < 0.005) which is statistically significant.

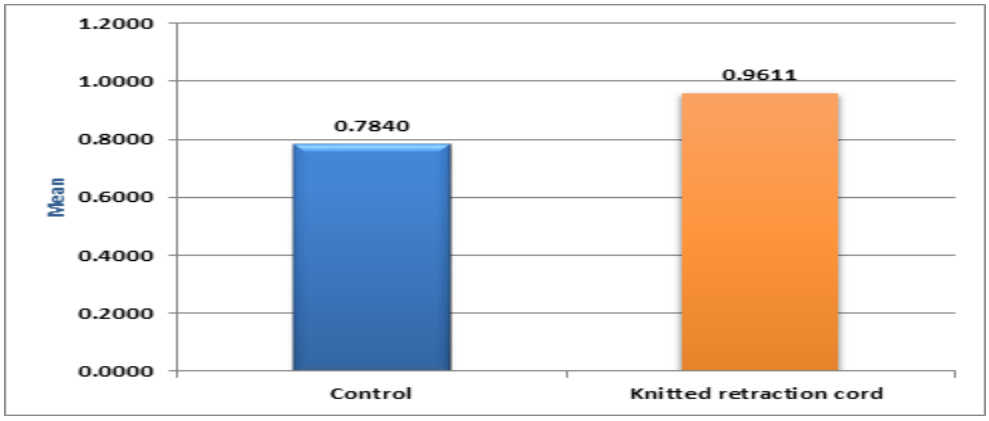

Fig 11: Graph showing the gingival displacement of group I and group II

Table 3- Comparison of mean gingival displacement calculated by Student independent t-test between group I and group III

GROUP	Mean	Std. Deviation	t-Value	P-Value
Group I- Control	0.7840	0.2521	5.097	0.001*
Group III- 3M ESPE retraction capsule	1.1879	0.2490		

Comparison between group I and group III was done by student independent t-test. Mean values of Group I, i.e. Control group and Group III, i.e. 3M ESPE retraction capsule are -0.7840±0.2521, 1.1879±0.2490 respectively. t-value is 5.097and P value is 0.001. (*P < 0.005) which is statistically significant.

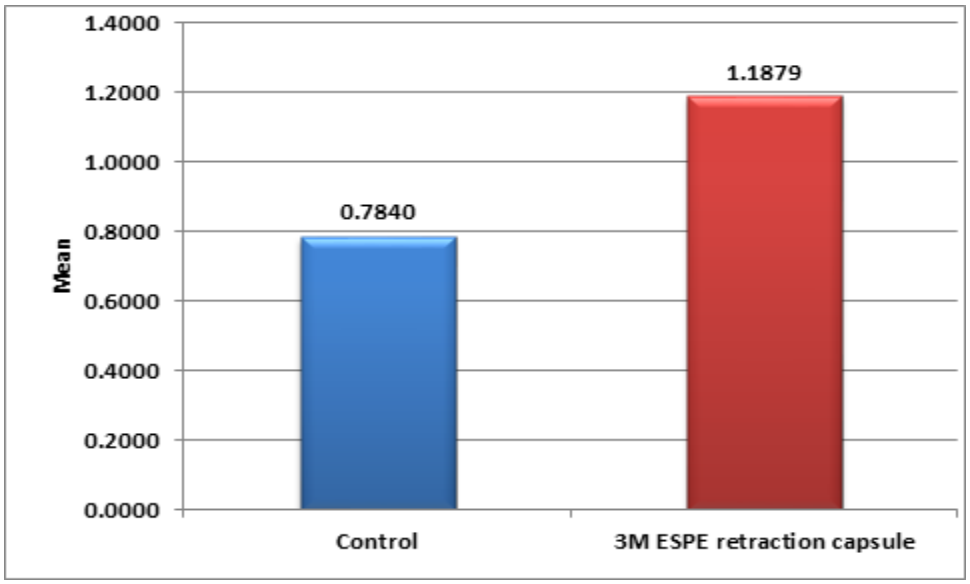

Fig 12: Graph showing the gingival displacement of group I and group III

Table 4- Comparison of mean gingival displacement calculated by Student independent t-test between group II and group III

GROUP	Mean	Std. Deviation	t-Value	P-Value
GROUP II- Knitted retraction cord	0.9611	0.2670	2.778	0.008*
GROUP III- 3M ESPE retraction capsule	1.1879	0.2490		

Comparison between group II and group III was done by student independent t-test. Mean values of Group II, i.e. Control group and Group III, i.e. 3M ESPE retraction capsule are 0.9611±0.2670, 1.1879±0.2490 respectively. t-value is 2.778and P value is 0.008. (*P < 0.005) which is statistically significant.

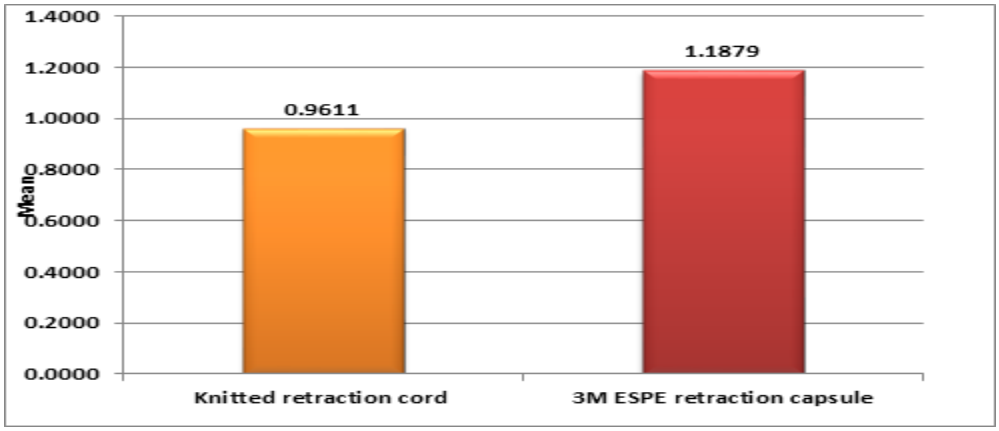

Fig 13: Graph showing the gingival displacement of group II and group III

DISCUSSION

Gingival retraction laterally displaces the gingival so that low viscosity impression material flow into the sulcus and capture the prepared finish line and a portion of unprepared apical tooth surface.[9] It also helps in easy removal of excess cement during cementation of prosthesis without any tissue laceration and assist in evaluation of caries and marginal fit. It allows to extend the restoration subgingivally thus increasing the surface area so as to enhance retention of the prosthesis.[4]

Donovan et al and Livaditis reported that approximately 10 min is required for adequate gingival displacement when retraction cord is left in place within the intracrevicular sulcus. Whereas leaving it for longer than 10 min can damage the epithelial tissue.[2,6,12] Hence in the present study Knitted retraction cord and 3M ESPE retraction capsule were left in place for 10 minutes.

Ferrari et al stated that material used for gingival retraction had some beneficial action on gingival sulcus such as absorption of intraoral fluids and ensure a gingival displacement without its damage and without requiring local anesthesia.[5] Here, in this study subgingival preparation or equigingival preparation of finish lines were done for esthetics or other reason such as caries existing restoration and need for additional retention. Mechanical technique- Knitted retraction cord #00 size ultrapak (Ultradent Products, Inc., South Jordan, Utah, USA) dipped into aluminum chloride (5.25%)was used for gingival retraction in one group and in the other group mechano chemical- 3M ESPE retraction capsule (3M Dentschland GmbH, Dental products,carl-schurz-str.1 141453 Neuss - Gemany) was used for the same. A control group with baseline impression was made to compare this two types of gingival retraction systems.

There is no concurrency quoted in the literature for assessment of the clinical competency with gingival retraction cords. However, indirect assessments of the sulcus dilation with impression materials and assessing the section dies by travelling microscope and ability to stop bleeding are the only criterias for assessment of clinical performance of retraction cords.[7,8] Previously several studies have assessed retraction with the help of sectioned dies/casts under an optical microscope, but such measurements can be affected by the distortions due to pouring and setting of stone die.

Use of modern technology like Boley's gauge with a miniature video camera, periodontal probes and flexible scales can render the method difficult by producing errors during visualization of the markings intraorally.[10] Hence to overcome these limitations and to record even the minute difference in sulcular width, in the present study evaluation of impressions after retraction by the two materials was done under a profile projector.

Die used in the study was sectioned mid buccally and 3 mm on either side to get two buccolingual slices of 3 mm each for all the samples. Laufer et al reported that the sulcus remained open for longer periods at the mid-buccal point. Hence the mid-buccal point was considered suitable for sulcus width measurement.[11]

CONCLUSION

Gingival retraction is necessary for adequate displacement of gingiva, so as to capture the prepared finish line which helps in the marginal fit of the resroration and to prevent microleakage. The present in vivo study has been designed to assess the comparative efficacy of two different gingival retraction systems: non-medicated, knitted retraction cord and 3M ESPE retraction capsule. Two groups were analysed based on criteria of gingival displacement. Profile projector 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.

- The mean values with respect to the gingival displacement of different group I, group II, group III are 0.7840±0.2521, 0.9611±0.2670, 1.1879±0.2490 respectively. Which shows that gingival retraction with 3M ESPE retraction capsule that is a mechano-chemical method was effective for the proper displacement of gingiva in order to reproduce the finish line in the cast for the fabrication of restoration.

- Comparison between group I and group II was done by student independent t-test. Mean values of Group I, i.e. Control group and Group II i.e. Knitted retraction cord are -0.7840±0.2521, 0.9611±0.2670 respectively. t-value is 2.157 and P value is 0.037. (*P < 0.005) which is statistically significant.
- Comparison between group I and group III was done by student independent t-test. Mean values of Group I, i.e. Control group and Group III, i.e. 3M ESPE retraction capsule are -0.7840±0.2521, 1.1879±0.2490 respectively. t-value is 5.097and P value is 0.001. (*P < 0.005) which is statistically significant.
- Comparison between group II and group III was done by student independent t-test. Mean values of Group II, i.e. Control group and Group III, i.e. 3M ESPE retraction capsule are 0.9611±0.2670, 1.1879±0.2490 respectively. t-value is 2.778and P value is 0.008. (*P < 0.005) which is statistically significant.

Hence, 3M ESPE retraction capsule may be considered for achieving both effective hemorrhage control and optimum gingival retraction compared to knitted retraction cord, however this aspect require further studies.

REFERENCES

1. Chaudhari J, Prajapati P, Patel J, Sethuraman R, Naveen YG. Comparative evaluation of the amount of gingival displacement produced by three different gingival retraction systems: An in vivo study. Contemp Clin Dent. 2015;6(2):189.
2. Donovan TE, Chee WW. Current concepts in gingival displacement. Dent Clin North Am.2004;48(2):vi-433-44
3. Benson BW, Bomberg TJ, Hatch RA, Hoffman W. Tissue displacement methods in fixed prosthodontics. J Prosthet Dent. 1986;55(2):175-81.
4. Yankov S, Chuchulska B, Slavchev D, Hristov I, Todorov R. THE PLACE OF RETRACTION CORDS AMONG THE TISSUE DISPLACEMENT METHODS. Journal of IMAB–Annual Proceeding Scientific Papers. 2017. 21;23(4):1854-8.
5. Ferrari M, Cagidiaco MC, Ercoli C. Tissue management with a new gingival retraction material: a preliminary clinical report. J Prosthet Dent. 1996;75(3):242-7.
6. Livaditis G. Comparison of the new matrix system with traditional fixed prosthodontic impression procedures. J Prosthet Dent. 1998;79(2):200-7.
7. Gupta D, Bhide S, Gandhi P, Paliwal, Jyoti. Comparative Evaluation of Clinical Efficacy of Two Different Retraction Systems- An In-Vivo Study. Indian J Stomatol. 2012;3(2):7-13.
8. Chaudhari J, Prajapati P, Patel J, Sethuraman R, Naveen Y. Comparative evaluation of the amount of gingival displacement produced by three different gingival retraction systems: An in vivo study. Contemp clin Dent. 2015;6(2):189-94.
9. Kopac I, Cvetko E, Marion L. Gingival Inflammatory Response Induced by Chemical Retraction Agents in Beagle Dogs. Int J Prosthodont. 2002;15(1):14-9.
10. Safari S, Ma VS, Mi VS, HoseiniGhavam F, Hamedi M. Gingival retraction methods for fabrication of fixed partial denture: literature review. J Dent Biomater. 2016;3(2):205-213.
11. Laufer B, Baharav H, Ganor Y, Cardash H. The effect of marginal thickness on the distortion of different impression materials. J Prosthet Dent. 1996;76(5):466-71