

The Knowledge and Attitude of Using Gingival Retraction Cord in Fixed Prosthodontics: A Survey amongst Dental Practitioners in Benghazi, Libya

Hana E. Mahjoub¹, Khadiga I. Elfallah²

¹Lecturer, Department of Removable Prosthodontics, Faculty of Dentistry, University of Benghazi, Benghazi, Libya

²Assistant lecturer, Department of Fixed Prosthodontics, Faculty of Dentistry, University of Benghazi, Benghazi, Libya

Abstract: ***Aim:** The aim of this study is to evaluate the knowledge and attitude of using gingival retraction cords (RCs) as fixed prosthodontics practice guidelines amongst dental practitioners (DPs) of Benghazi in Benghazi, Libya. **Materials and Methods:** A descriptive cross-sectional study was done amongst the Dental Practitioners of Benghazi, Libya in 2023. A total of 100 dentists were selected randomly (from public and private dental clinics and dental schools). A survey was conducted through hard copy printed questionnaires composed of 20 open and multiple-choice questions. 93 of questionnaires were returned while 7 were missed. Data from the completed questionnaires were analyzed using the SPSS Statistical Software Package (version 25). All statistical analyses were carried out at a significance level of $P < 0.05$. **Result:** This study showed that the majority of participants are practicing fixed prosthodontics (97.8%) and most of them using elastomeric impression material for final impressions (72.5%). Almost all of participated (DPs) believed that retraction cords (RCs) are necessary (94.5%) for different reasons mainly because of resulting a good impression with good and clear margin (39.6%). They also believed that gingival sulcus details duplicated in the impression with using RCs (79.1%) with minimum width of 0.2mm (39.6%) and depth of 1 mm (48.4%). (52.7%) suggested that the (RCs) available in Libyan markets are in a good quality. Participants preferred using size 00 of the (RCs) for most of cases (61.5%) which applied with plastic instruments (91.2%) with single cord technique (62.6%) instead of double cord technique (37.4%). (69.2%) said that (RCs) did not cause gingival recession especially if left in the sulcus for only 10 mins (69.2%). The (DPs) thought there were no good results of impressions without using RCs (69.2%), so they recommended the junior colleagues to use them (85.7%). Although placing the RCs considered a difficult procedure by only (23.1%), but it is still reflected better gingival displacement method than using alternative methods as laser or electro-surgery for gingival displacement (68.1%). **Conclusion:** The dental practitioners (DPs) of Benghazi displayed an acceptable level of knowledge and attitude regarding using gingival retraction cords as fixed prosthodontics practice; however, to further enhance the proficiency, efforts should be made to encourage the practitioners to be aware of the advances in fixed prosthodontics practice through continuous education programmes.*

Keywords: Attitude, Dental Practitioner, Fixed Prosthodontics, Gingival retraction cords and Knowledge

1. Introduction

Gingival retraction is the temporary displacement of the gingival tissues away from a tooth either during preparation or before making final impressions for esthetic and functional reasons to record the prepared finish line and some unprepared tooth structure apical to the finish line accurately as restoration margins are frequently located Subgingival. To maintain the normal appearance of healthy gingiva the retraction must be a traumatic and allow access for the impression material beyond the abutment margin with sufficient thickness to withstand the tearing forces experienced during removal of impressions¹. It should provide registration of the details that increase the resistance and retention of restoration^{1,2}. To obtain accurate fit which will reduce the marginal leakage by exposing the prepared finish line and controlling the gingival fluid³. Chemico-mechanical retraction is the most popular method of gingival displacement in fixed prosthodontics when the retraction cord is soaked in a chemical agent will provide better displacement of the gingival tissue when compared to a plain retraction cord. Materials like 8% racemic epinephrine, Aluminum chloride, Alum (aluminum potassium sulfate)⁴, Aluminum sulfate and Ferric sulphate. Epinephrine provides effective vasoconstriction and hemostasis but cause adverse cardiovascular problems and/or other symptoms such as anxiety⁴. One of the popular hemostatic agents is

Aluminium Chloride, is least irritating with no permanent damage to gingival tissue when the solution is left in the sulcus for up to but not exceeding 15 minutes^{5,6}. Other methods of gingival displacement may include surgical retraction by rotary curettage using torpedo diamond bur in healthy gingiva or by electrosurgical method using an electrode, which is contraindicated with cardiac patient who has pacemaker. Finally the laser technique results less bleeding and less recession⁷. Diode laser troughing gives more amount of retraction both laterally and vertically when compared to retraction cord. Laser troughing was more satisfactory to the patients and produced less pain⁸.

The aim of the study is to evaluate the knowledge and attitude of using gingival retraction cords as fixed prosthodontics practice guidelines amongst dental practitioners of Benghazi, Libya.

2. Materials and Methods

A descriptive cross-sectional study was done amongst dental practitioners of Benghazi, Libya. Practicing in Private and Public Clinics and Dental Schools. A total of 100 dentists were selected randomly from private and public sectors and dental schools. 93 answered questionnaires were collected while 7 were missed. A survey was conducted through a printed standard questionnaire with 20 multiple-choice

questions, which is adapted to a survey done by RAJA & NAIR⁹. Data from the completed questionnaires were collected and analyzed, the statistical analysis was done using SPSS statistical software package (Version 25). All statistical analyses were carried out at a significance level of $P < 0.05$. Results were analyzed by descriptive analysis.

3. Results

This study showed that the majority of participants are practicing fixed prosthodontics (97.8%) and most of them using elastomeric impression material for final impressions (72.5%). Almost all of participated dental practitioners (DPs) believed that retraction cords (RCs) are necessary during taking final impressions of fixed restorations (94.5%), and that is because of different reasons mainly was the resulting of good impression with good and clear margin (39.6%). Some of (DPs) wearing eyeglasses (51.6%), which

may help in placing the RCs. Small percentage of DPs were using surgical loupes during their clinical practice (15.4%). The participants also believed that gingival sulcus details duplicated in the impression by using (RCs) (79.1%) with minimum width of 0.2mm (39.6%) and depth of 1 mm (48.4%). (52.7%) suggested that the (RCs) available in Libyan markets are in a good quality. Participants preferred using size 00 for most of cases (61.5%) with plastic instruments (91.2%) with single cord technique (62.6%). (69.2%) said that (RCs) did not cause gingival recession especially if left in the sulcus for only 10 mints (69.2%). The DPs thought there were no good results of impressions without using RCs (69.2%), so they recommended using RCs before impression (85.7%). Although it is considered a difficulty procedure for (23.1%), but it is still reflected better gingival displacement than using alternative methods as laser or electro-surgery for gingival displacement (68.1%). (Table 1)

Table 1: Response rate of the participants on different parameters evaluated

	Frequency	Percent	Valid Percent	Cumulative Percent
Q1: Do you practice fixed prosthodontics?				
• Yes	89	97.80%	97.80%	97.80%
• No	2	2.20%	2.20%	100%
Q2: Which impression materials do you usually use?				
• Alginate	14	15.40%	15.40%	15.40%
• Elastomeric	66	72.50%	72.50%	87.90%
• Others	11	12.10%	12.10%	100.00%
Q3: Do you think that the gingival (RCs) using is necessary for successful clinical practice?				
• Yes	86	94.50%	94.50%	94.50%
• No	5	5.50%	5.50%	100.00%
Q4: If your answer is Yes, the reason is because...				
• Impression with good margin is obtained.	36	39.60%	41.90%	41.90%
• Visibility of finish line	3	36.30%	38.40%	80.20%
• Subgingival preparation of finish line	17	94.50%	19.80%	100.00%
Q5: If your answer is no, the reason is because:				
• Handling the cord is difficult	2	2.20%	40.00%	40.00%
• Time consuming	2	2.20%	40.00%	80.00%
• No clinical advantages	1	1.10%	20.00%	100.00%
Q6: Do you use eyeglasses?				
• Yes	44	48.40%	48.40%	48.40%
• No	47	51.60%	51.60%	100.00%
Q7: Do you use surgical eye loupes?				
• Yes	14	15.40%	15.40%	15.40%
• No	77	84.60%	84.60%	100.00%
Q8: In your opinion, what is the minimum width of gingival sulcus that's required to be copied in the impression?				
• 0.2 mm	36	39.60%	39.60%	39.60%
• 0.4 mm	23	25.30%	25.30%	64.80%
• 0.6 mm	8	8.80%	8.80%	73.60%
• 0.8 mm	2	2.20%	2.20%	75.80%
• No idea	22	24.20%	24.20%	100.00%
Q9: To what depth the impression material should flow in the gingival sulcus?				
• 1 mm	44	48.40%	48.40%	48.40%
• 1.5 mm	28	30.80%	30.80%	79.10%
• 2 mm	13	14.30%	14.30%	93.40%
• No need to flow	6	6.60%	6.60%	100.00%
Q10: Do you think that the gingival sulcus copied in the impression can be duplicated in the cast?				
• Yes	72	79.10%	79.10%	79.10%
• No	19	20.90%	20.90%	100.00%
Q11: How do you rate the quality of the retraction cords available in Libyan market?				
• Good	48	52.70%	52.70%	52.70%
• Fair	42	46.20%	46.20%	98.90%
• Bad	1	1.10%	1.10%	100.00%
Q12: Which size of retraction cord do you use in most of the cases?				

• 0	11	12.10%	12.10%	12.10%
• 0	56	61.50%	61.50%	73.60%
• 0	16	17.60%	17.60%	91.20%
• 1	8	8.80%	8.80%	100.00%
Q13: Which instrument do you use to pack the cord?				
• Cord packer	5	5.50%	5.50%	5.50%
• Plastic instrument	83	91.20%	91.20%	96.70%
• Periodontal probe	1	1.10%	1.10%	97.80%
• Dental explorer	2	2.20%	2.20%	100.00%
Q14: How many cord do you usually placed in most cases?				
• Single cord	57	62.60%	62.60%	62.60%
• Double cord	34	37.40%	37.40%	100.00%
Q15: Do you think that retraction procedure will cause gingival recession?				
• Yes	28	30.80%	30.80%	30.80%
• No	63	69.20%	69.20%	100.00%
Q16: How long you leave the retraction inside the gingiva?				
• 10 min	63	69.20%	69.20%	69.20%
• 20 min	20	22.00%	22.00%	91.20%
• 30 min	7	7.70%	7.70%	98.90%
• An hour	1	1.10%	1.10%	100.00%
Q17: Do you think that you can get good successful preparation and impression without using the retraction cord?				
• Yes	28	30.80%	30.80%	30.80%
• No	63	69.20%	69.20%	100.00%
Q18: Do you recommend gingival retraction to your junior colleagues?				
• Yes	78	85.70%	85.70%	85.70%
• No	13	14.30%	14.30%	100.00%
Q19: Do you think that the laser or electrosurgical retractions are more beneficial than cords?				
• Yes	29	31.90%	31.90%	31.90%
• No	62	68.10%	68.10%	100.00%
Q20: Do you consider a cord packing procedure is a difficult procedure?				
• Yes	21	23.10%	23.10%	23.10%
• No	70	76.90%	76.90%	100.00%

4. Discussion

In this study (97.8%) of the involved participants were practicing fixed prosthesis, and (72.5 %) were making their final impressions using elastomeric materials. While only (12.1%) answered that they were using intraoral scanners, and surprisingly (15.4%) were using alginate as final impression material. For its long-term success of fixed prosthesis, the surrounding hard and soft tissues should be very healthy. An adequate and accurate duplication of the prepared teeth and the corresponding finish lines so the periodontium will be preserved via restoration with suitable emergence profile and smooth gingival margins that minimizes cement dissolution¹⁰⁻¹².

In the present study (94.5%) of participants believe that using gingival retraction cord is necessary for successful clinical practice.(38.4%) of them used the retraction cords(RCs) for the visibility of finish line, while(19.8 %)return the reasons to subgingival preparation of finish line. But the highest percentages of participants (41.9%) thought that it would help in getting impression with good margins. Only (5.5%) of participants thought that no need to use retraction cord because it is difficult to handle and time consuming as it was said by (40%), or it may not have any clinical advantage as (20 %) thought.

For therapeutic, preventive and aesthetic purposes accurate marginal positioning of the restoration in the prepared finish line of the abutment should minimize the marginal

discrepancy between the restoration and the prepared abutment. For periodontal health, maintenance supra- gingival margins are effectively preferred; but they do not provide optimal aesthetics like in sub-gingival ones¹³⁻¹⁵. The primary sulcular width is 0.2mm and the sulcular environment must be perfect before subgingival impression, which has less accuracy for a smaller sulcular width¹⁶⁻²⁰.

According to the present study (39.6%) of participants agreed with many papers regarding the minimal depth of gingival sulcus to be 0.2mm, while (25.3%) thought that it may be 0.4mm, (8.8%) said it is 0.6mm. Practitioners have no idea about sulcus width were (24.2%). Regarding the time of application, (69.2%) said that retraction cord should not be placed for more than 10 min.

Inefficient gingival displacement may result due to sulcular width that is less than 0.15 to 0.20m. The impression marginal accuracy is reduced by rupture and deformation of the impression material because of insufficient amounts. Therefore, gingival displacement should provide adequate horizontal and vertical space between the prepared finish line and gingiva, to prevent the rupture and deformation of silicon impression materials. The recommended sulcus width must be at least 0.2mm, so the retraction agent is needed to be located in the sulcus for at least 4 minutes²¹⁻²³. Therefore, gingival displacement without irreversible damage to the gingival tissues is necessary to permit flow of low viscosity impression material into sulcus and record the prepared finish line accurately^{6,24}.

In this study the depth to which impression material should flow in sulcus was surveyed. (44%) of practitioners believed that it should flow within the gingival sulcus about 1mm. (28%) said it should flow 1.5mm. Only (6%) of participants believed that the impression materials no need to flow inside the gingival sulcus. (79.1 %) of participants thought that gingival sulcus copied in impression can be duplicated in the cast.

The material used for gingival retraction must be effective in lateral and vertical retraction of the gingival crevice in order to permit an adequate volume of impression material. It should not cause irreversible tissue damage. If it resulted in a reversible damage clinical and histological healing must be complete within two weeks. The gingival retraction material should be efficient in a short period of time and have enough time to retract the sulcus in order to permit an accurate impression. It should not have any harmful systemic effect. In addition, gingival retraction materials should control the crevicular fluid and gingival bleeding especially when elastomeric materials are used for the impression²⁵⁻²⁸.

Several techniques of gingival displacement have been proposed: Mechanical, Mechano-chemical (chemicals embedded in cords or in injectable matrix form), and surgical (electro surgery, lasers, rotary curettage). The examples of Mechano-chemical techniques are retraction cords (RCs) and retraction paste system are the most widely accepted techniques^{29,30}. The Mechano-chemical methods with cords impregnated in hemostatic agent have compound action of pressure pushing and medicaments like aluminium chloride, epinephrine, aluminium potassium sulfate, and ferric sulfate. Fifteen percent aluminium chloride was very helpful by leaving a perfect sulcus on removal. Epinephrine was used for a Mechano-chemical procedure, therefore, medical history was routinely taken as well as the patient's pulse rate and blood pressure should be checked. Although the majority of patients never had complaining of systematic manifestation. Absorption of the retraction agents into the surrounding tissues must not cause systemic effects. The amount of reabsorbed material depends on the type of retraction agents, tissue ulceration and the amount of prepared tooth abutments³¹⁻³⁵. Gingival withdrawal agents must be effective in providing significant horizontal and vertical gingival spaces with controlling bleeding and gingival fluid flow. But it should not cause any systemic effects or permanent damage in adjacent tissues due to chemical manipulation. Any resultant damage must be reversible and recover within 2 weeks clinically and histologically. Maximum apical recession following the gingival retraction should not exceed 0.10mm³⁵. Mechanical gingival retraction is fast, simple and inexpensive. The single or dual cord can be used separately or in combination with hemostatic agents³⁶. Removal of dry retraction cord from the gingival sulcus can cause injury to the delicate sulcus epithelial lining and bleeding may result²⁷. Unless wetting the retraction cord before removal from the gingival sulcus^{37,38}. To control the bleeding, gingival fluid flows and allows sufficient penetration of the impression material into sulcus. Forces such as retraction, relapse, and collapse will control gingival displacement. The relapse is affected by rebound of the adjacent attached gingiva due to elasticity of the gingival cuff. While tissue collapse after removing the

retraction agent reduced by well-differentiated periodontal fibers support the gingival fibers during retraction^{7,(39-41)}.

The current survey was designed to evaluate the knowledge and practice of Mechano-chemical technique (Gingival retraction cords (RCs)) as it is the known and widely used method. In this survey (52.7%) of participants said that the retraction cords available in Libyan markets are good in quality and (46.2%) said it is fair.

In supra-gingival preparation margins retraction cord penetration depth depends on the sulcus depth and periodontal status. Dual cord technique is used in which two different diameter cords are used. A trough is made around the preparation area by the thinner apical cord during impression making. Therefore, gingival cuff recoil is delayed, but unpredictable tissue resorption may be associated with Dual Cord technique. If the preparation finish line is deep at the sulcus Single Cord is used and removed before impression making. The soft tissue collapse prevents accurate impression making^{42,43}.

(69.2%) of Libyan dentists in this study thought they could not get successful preparation and impression without using gingival retraction cords and (85.7%) recommended using gingival displacement cords for their junior colleagues.

Retraction cords require high technical sensitivity and clinical skills. If sulcular epithelium and connective tissue attachment are damaged, tumor necrosis factor alpha (TNF- α) level increases followed by cord packing, however, complete clinical improvement occurs within 2 weeks. Improper cord packing force may be associated with the sulcular inflammation and marginal gingiva contraction. Bleeding that occurs after removing the cord could be reduced by moisturizing the cord⁴⁴⁻⁴⁶. Trauma to the epithelial attachment could be avoided by preventing the packing instrument slippage. That is why serrated round end instruments are generally used with braided cord because small indentations in the instrument's head sink in the cord. Non-serrated flat end instruments are applied in twisted cords with sliding motion^{47,48}. Recently, polymers and pastes have been introduced for gingival retraction. Two millimeters prepared spongy tapes made from polymeric materials are swelled in contact with moisture and slowly provide enough space between the gingival sulcus and prepared finish line. Gingival recovery happens slowly within 24 hours. For example, Merocyl strip is effective in gingival tissue expansion to expose the prepared finish line^{49,50}. This method doesn't create any chemical reaction, tissue inflammation or trauma. In addition, it is more simple, fast and painless than conventional methods. Therefore, the risk of tissue trauma to the epithelial attachment, gingival recession and bone loss is avoided, but they are less effective in sub-gingival positioned deep margins, greater cost, and may inhibit polymerization of polyether and polyvinyl siloxane impression materials^{51,52}. When adequate keratinized gingiva is available a diamond bur is used to prepare a trough in the gingival sulcus adjacent to the finish line area under local anesthesia. Gingival recession may result due to exacerbated inflammatory response which lead to trauma to the epithelial attachment^{53,54}.

The presented survey revealed that (23.1%) of participants considered the cord packing procedure difficult and (91.2%) were used plastic instrument for packing the (RCs). About (62.6%) used single cord while (37.4%) used double cord. (69.2%) of participants thought that (RCs) may cause reversible gingival inflammation without recession. While (30.8%) of participants thought that traumatic displacement of gingiva by chemo-mechanical technique may lead to irreversible inflammation and recession. (69.2%) said the cord is left in the sulcus not more than 10 min, while (22%) thought it may stay 20 min without causing irreversible changes.

The cordless methods in which the gingival displacement was mostly accomplished with electro-surgery, laser, and turning curettage were used by dental specialists⁵³. When electrosurgery is to be used, a small J-Shaped electrode is moved parallel to the tooth long axis to prepare a trough in the gingival sulcus adjacent to the finish line following local anesthesia. Sulcus width is increased and hemostasis is achieved. No difference in tissue response within 4-12 weeks between the electro-surgery and rotary curettage. Electrosurgery is contraindicated in patients with cardiac pacemakers. It has a high risk if used with Nitrous oxide⁵³⁻⁵⁵. Laser is used to create a trough allowing making precise impression with biological width preservation. It provides great homeostasis and can be applied without any localized anesthesia. It has minimum postoperative pain and discomfort^{52,54}. (31.9%) of participants thought that laser troughing and electrosurgery may be more beneficial than retraction cords, while the majority of (68.1%) thought that cordless methods do not have more value than gingival retraction cords (RCs).

5. Conclusion

The dental practitioners (DPs) of Benghazi displayed an acceptable level of knowledge and attitude regarding using gingival retraction cords as fixed prosthodontics practice guidelines. However, to further enhance the proficiency, efforts should be made to encourage the practitioners to be aware of the advances in fixed prosthodontics practice through continuous education programmers.

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