ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 3, Issue – 6, December - 2020, Page No. : 302 - 308

Gingival Retraction Systems: A Review

[1]Rohit Raghavan, Professor and Head, Dept. Of Prosthodontics, Royal Dental College, Palakad, Kerala.

[2]Shajahan. P.A, Professor, Dept. Of Prosthodontics, Royal Dental College, Palakad, Kerala.

[3]Manoj. A. A, Postgraduate Student, Dept. Of Prosthodontics, Royal Dental College, Palakad, Kerala.

Corresponding Author: Rohit Raghavan, Professor and Head, Dept. Of Prosthodontics, Royal Dental College, Palakad, Kerala.

Citation of this Article: Rohit Raghavan, Shajahan. P. A, Manoj. A. A, "Gingival Retraction Systems: A Review", IJDSIR- December - 2020, Vol. – 3, Issue - 6, P. No. 302 – 308.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

A successful fixed dental prosthesis requires proper impression taking of the prepared finish line which is critical in either tooth supported fixed prosthesis (crown and bridge) or implant supported fixed prosthesis (solid abutment).To reduce the marginal discrepancy among the restoration and the prepared abutment, gingival retraction techniques should be employed in case where the prepared finish line is adjacent to the gingival sulcus. For therapeutic, preventive and aesthetic purposes, accurate marginal positioning of the restoration in the prepared finish line of the abutment is required. This article is intended to review the conventional and modern methods of gingival retraction in the fixed tooth supported prosthesis and fixed implant supported prosthesis.

Key words: Chemicomechanical retraction, gingival displacement, gingival displacement in implants.

Introduction

The success and durability of restorations depends several factors. In general, the final accuracy of the indirect restorations is affected by the type of impression making, setting accuracy, material flow, temperature, humidity, mixing, disinfection and pouring time. For periodontal health maintenance supra-gingival margins are effective, but optimal aesthetics maybe compromised. So in most cases especially in aesthetics zone, the margin of the restoration is placed sub-gingivally. The prepared finish line area needs to be accurately recorded while making an impression in tooth supported and implant supported fixed prosthesis, especially in cases where the prepared finish line is placed at the same level of gingiva or sub-gingiva . While making an impression,the gingival margin should be clean and available to allow adequate flow of the impression material on it. Gingival sulcus must also be wide enough. With the sulcular width of about 0.15 to 0.20 mm an accurate impression is usually achieved. If the sulcus width is less than this value, impression material would fail to resist against the rupture and deformation, thereupon the impression marginal accuracy is reduced.

Inefficacy of the gingival displacement technique is a primary factor in defective record of marginal details.

Gingival retraction in the fixed partial dentures

Mechanical retraction

Cord packing is the most common method in gingival retraction which is fast, simple and inexpensive, that can be used either separately or in combination with hemostatic agents in two techniques that is, single cord or dual cord5. The sulcus depth and periodontal status influences the retraction cord penetration depth. In dual cord technique, two knitted cords with different diameters are used. While making an impression, the apical cord is thinner and is kept in place. Therefore, a trough is made around the preparation area and gingival cuff recoil is delayed6. However, in supra-gingival preparation margins, the use of mentioned method is limited. Unpredictable tissue resorption and patient's discomfort are problematic issues associated with Dual Cord technique. In Single Cord method, one cord is used which is removed before impression making. The soft tissue collapse prevents accurate impression making, if the preparation finish line is deep at the sulcus5, 6.

Chemical retraction

Chemical Retraction is of three types:

a-Vasoconstrictive agents, b-Hemostatic agents, c-Astringent agents

-Vasoconstrictive agents are not coagulated like epinephrine but they act by constricting and reducing the diameter of the blood vessels. Impregnated cord with racemic epinephrine has no advantage over other retraction agents, due to elevation in blood pressure and heart rate 8, 9.

-Severe bleeding from arterioles and cut vessels are controlled by Hemostatic agents9, 10.

-Astringent agents such as alum, aluminum chloride and zinc chloride are metal salts that helps in inhibition of plasma proteins' inter-capillary immigration, decreasing the permeability of the cell, controlling the moisture in the peripheral tissues through protein precipitation on the superficial layer, and enhancing the mechanical strength of the mucosa. Thus, under physiological condition, protein precipitation has hemostatic effects11, 12.

Epinephrine and Sympathomimetic agents

It is a commonly used retraction agent that helps in providing good hemostasis and vasoconstriction. By activating sympathetic peripheral vascular α1 receptors, it has localized hemodynamic effects and results in tissue ischemia. Temporary gingival retraction results from localized vasoconstriction. However, its use is limited by its adverse effects. In healthy ones, maximal permissible dose of epinephrine is 0.2 mg and in patients with cardiovascular disease, it is 0.04 mg; which is equivalent to the epinephrine that is in two local anesthesia cartridges that contain epinephrine 1/100000.

Ferrous sulfate

It has a concentrated solution to help in coagulating bleeding finish line and to act as an effective astringent. Within a few days (1-2 days), it can result in temporary gingival discoloration-yellowish brown and black. The use of this compound in Implants has been controversial, as it can delay the setting time of the polyether and polyvinyl siloxane impression material. It is recommended to completely rinse out with copious water in order to remove the excess material.

Ferric sub-sulfate

Also known as Monsel solution, it helps in retracting the gingiva within 3 minutes15 .When compared to epinephrine, greater gingival displacement and favorable tissue recovery is achieved. Soft and hard tissues discoloration may result due to the acidic and corrosive properties of ferrous salts.

Zinc chloride (bitartrate)

It has a burning effect and may result in soft and probably hard tissues scarring; as a result of which, both 8% and 40% concentrations are not usually recommended9, 15.

Tannic Acid

The recommended time is 10 minutes. It has less hemostatic effects when compared to epinephrine, but tissue recovery is better9.

Negatol Solution

It is a strong acidic substance which is a mixture of 45% meta-cresol sulfonic acid and formaldehyde that may lead to decalcification of the tooth structure9.

Aluminum sulfate and aluminum potassium sulfate (alum)

They are both hemostatic agents that results in inhibition of inter-capillary plasma proteins immigration and disruption of bleeding by means of vasoconstriction and precipitation of tissue proteins on the superficial layer of the mucosa10 .To the extent of treatment levels, postoperative inflammation is slightly low in concentrations. Aluminum potassium sulfate at high concentrations can result in severe inflammation and necrosis of tissue. It's effects on tissue contraction in a concentration of 100% is less than epinephrine in a slight difference. Although it has very limited effects on the gingival retraction, it can be an alternative to epinephrine as it is safe and effective. The primary concern is that sulfate compounds may either inhibit or delay the polymerization reaction of the additive silicone impression materials.

Aluminum chloride

It is an astringent that acts by precipitating the tissue proteins and resulting in vascular constriction. Its vasoconstrictor effects are less compared to epinephrine14. It creates the least irritation among various other medical impregnated cords. It has been usually used in 5. 25% concentrations and has very little systemic effects. Its major drawback is inhibition of polyether and polyvinyl siloxan material. After the retrieval of the cord, it keeps the sulcus open longer and acts more effectively than epinephrine (50% of the sulcus width is closed after the retrieval of the cord impregnated with epinephrine at the same time while the sulcus which was retracted using cord impregnated with aluminum chloride, 80% of the its first width will remain open even after 12 minutes . Before making an impression, remnants of aluminum chloride must be thoroughly rinsed out, so as to not interfere with the perfect setting of polyvinyl siloxane.

Chemicomechanical retraction

It is the most commonly used method by almost 80% of dentists. Hemostatic agents can be used simultaneously in order to prevent bleeding during cord packing and impression making, Epinephrine, aluminum chloride and ferric sulfate are normally used as pre-treated retraction cord or impregnating simple cord16. The use of aluminum chloride is more common as compared to epinephrine. In one study, about 33% of the people showed side effects to epinephrine while 24% other retraction agents. Removal of aluminum chloride and ferrous sulfate impregnated cords results in bleeding due to hyperemia, but epinephrine provides optimal homeostasis by long-term constriction of the gingival capillaries. **Polymers and pastes**

Recently, polymers and pastes have been also included in gingival retraction techniques. Two millimeters prepared spongy tapes made from polymeric materials are swelled by keeping in contact with moisture and slowly provide enough space between the gingival sulcus and prepared finish line. Gingival recovery occurs slowly within 24 hours17.

Expasyl paste material results in high hemostasis and gingival retraction and is a chemical agent in an injectable

matrix that may be used in impression making and delivery of indirect restorations. It must be isolated to the saliva during application. Expasyl paste is composed of aluminum chloride 15% which is used as a hemostatic agent and White Clay for consistency and it is injected directly into the gingival sulcus3, 4. It can be also compressed into the gingival sulcus via a plastic instrument or cotton pellet. If the soft tissue biotype is thin, the paste remains in place for 1-2 minutes and if it is thick, it remains for 3-4 minutes. Retraction effect remains 4 minutes after thorough rinsing with air and water. Disadvantages include high cost, inhibition of polymerization of polyether and polyvinyl siloxane impression materials. It is also less effective in sub-gingival positioned deep margins, however, it is a simple, quick and painless technique which does not result in any chemical reaction, tissue inflammation or trauma. When compared to traditional methods, the possibility of risk of trauma to the epithelial attachment, gingival recession and bone loss can be avoided. Gingi Trac paste is an astringent agent, generally used in hemostasis and gingival retraction. To increase the width of the retraction, a cap for single unit prepared tooth or a stock tray containing the matrix of firm paste for multiple unit prepared teeth can be used for 3-5 minutes.

Inert Matrix Poly Vinyl Siloxane system introduced Magic Foam Cord paste material for gingival retraction which contains expandable polyvinyl siloxane. Setting expansion of the material against gingival sulcus wall is achieved by hydrogen dioxide release. It provides some amount of homeostasis, but prior to injection it is essential to use hemostatic agents separately. Increasing the width of the retraction is recommended to bite on a cap about 5 minutes to compress more paste into the sulcus. This is a simple, fast and painless system which has no chemical reaction, inflammation, and tissue trauma.

Matrix impression making

In 1983, Livaditis introduced a system that required making impressions using three different viscosities of the material18. In this technique, initially an occlusal matrix of elastomeric material (semi rigid consistency) is provided from the prepared teeth and trimmed in certain dimensions; then, cord packing is done in the usual way. After retrieving the cord, final impression is taken using high viscosity matrix of the preparation; in other words, gingival retraction is achieved with proper placement of the high viscosity matrix material. Maintaining the matrix impression in position, full arch pick-up impression is taken using a stock tray containing medium viscosity material. This technique helps in controlling four forces affecting the gingiva during sub-gingival impression. Sulcular debris is removed and the matrix design prevents the collapse of the gingival margin and tearing of the impression material by pressing the high viscosity material into the sulcus. The prolonged chair side time is the only problem with this method.

Surgical Retraction

Rotary curettage

Following the administration of local anesthesia, a trough is prepared using a diamond bur in the gingival sulcus adjacent to the finishing line area. The height of the marginal gingiva is preserved but the sulcus gets deeper. This method can be used only if there is adequate keratinized gingiva. Trauma to the epithelial attachment may lead to gingival recession due to exacerbated inflammatory response5.

Electrosurgery

Following local anesthesia, electric current is passed through a thin wire producing a trough in the gingival sulcus adjacent to the finishing line and hemostasis is also

achieved. The sulcular width is increased by moving a small J-Shaped electrode parallel to the tooth long axis19. When electro-surgery was compared with rotary curettage, it showed no difference in tissue response within 4-12 weeks. The sulcular volume of the impression material was greater in electro surgery when compared to the rotary curettage. In patients with cardiac pacemaker, the electro surgery is contraindicated. The risk is high if it is used with Nitrous oxide.

Laser

Lasers can be used for gingival retraction in either direct or indirect restorative treatments. The laser characteristics hugely depend on the wavelength and waveforms. Laser is a high powered focused beam which results in tissue vaporization in 100°C -150°C19. Laser induced tissue retraction is a kind of trough which allows to make precise impression with biological width preservation. It provides good homeostasis and can be applied without the use of any localized anesthesia. It also an advantage of having minimum postoperative pain and discomfort.

Er-based and Nd: YAG lasers energy is usually absorbed into the superficial and deep tissue layers, respectively. Usually in a natural dentition, retraction is achieved by diode laser as it results in less bleeding and gingival recession. YSGG Laser (Water lase) is very useful in either soft or hard tissue surgical interventions. Co2 laser has greater hemostatic effect than Er: YAG laser, however, it does not make any tactile feedback as a result of which junctional epithelium injury is likely to occur. Lasers prevent tissue recession, unlike Dual cord technique. When pulsed Nd: YAG lasers were compared to retraction cord impregnated with ferric sulfate or aluminum chloride, it revealed that bleeding and tissue inflammation are lower, but healing rate is greater.

Gingival retraction in implant supported prosthesis

Recently, the use of implant-related treatment modality has increased widely. Cement retained restorations are preferred, to screw the retained restorations. In aesthetic regions and minimal inter-arch space, custom abutments with subgingival margins are useful. Emergence profile of the abutment prevents pickup impression in the cement retained prostheses, however, the resemblance of impression copings to the manufactured final abutment in screw retained implants allow the operator to make pick up impression20.

Tissue support of the implant is not the same as the periodontal structure, so following gingival retraction, tissue collapse is not restricted. The poorly adherent and permeable junctional epithelium has low regenerative capacity in implants. The gingival fibers are parallel to the implant collar and the biologic width is 2.5 ± 0.5 mm. The collagen fiber orientation is either parallel or parallel-oblique. Soft tissue biotype has also been effective, i.e. thin fragile periodontal biotypes should be handled carefully to prevent recession while more often a pocket is formed in thick fibrotic biotypes.

Mechanical retraction

Except for shallow sulcus depth and a thick periodontal biotype, mechanical retraction techniques may be contraindicated around the implants. Traumatic application of packing instruments may result in microscopic scratches on the implant collar and then biofilm aggregation5.

Injectable matrix

Due to high viscosity of the matrix,the retraction force is limited thus preventing the sulcus from trauma, but efficient retraction is not achieved, especially when the relapsing and collapsing forces are important. When compared to natural teeth, biologic width is greater in

dental implants, i.e the implants are deeply placed in aesthetics region5.

Rotary curettage, Electrosurgery, Laser

Rotary curettage has a high risk of scratching the implant surface and exposing the implant threads. In implants,electro-surgery is contraindicated (arcing happens). Unlike other lasers, water is the prime chromphore for CO2 laser. Therefore, it gets reflected off the metal surfaces. CO2 laser absorbs very little energy near the metallic implant surfaces and the temperature increases less than 3°C. Also, these lasers do not change the implant surface properties. Laser exposes the implant margins by creating a trough. Therefore, it creates large defects, when used around the deep implants. It is indeed questionable in anterior, aesthetics regions5, 21.

G- Cuff

There are many challenging techniques to record the subgingival contour of the abutment. Implants when compared to the teeth revealed that there was no special technique to retract the gingiva before impression making. Chang et al. studied the effects of cordless retraction material (Expasyl) on the implant surface and found that minimal changes happened. Wide healing caps or temporary abutments which are utilized in some kinds of implant systems (e.g. Bicon) did not have predictable results due to various tissue rebound. G-Cuff™ is an impression device that is claimed to take an accurate registration of a dental implant abutment22.

The main purpose of G-Cuff is to support the soft tissues that surround the implant abutment. So it retracts the gingiva to permit the impression material or digital intra-oral scanner recording the implant abutment, so that the final restoration can be accomplished within two visits. The instructor claimed that the using G cuff for restoration is more accurate than open tray and close tray impression techniques. It is helpful especially for unidentified dental implants and also eliminates the need to transfer the copings and analogs.Unlike retraction cord,it is not traumatic for the soft tissue, however, more studies are recommended so its efficiency can be verified. Further research is also recommended, especially on abutment level impressions.

Conclusions

Gingival retraction techniques can be classified as chemical, mechanical or surgical. In this article, different gingival management techniques have been discussed, comprising non-medicated cords, medicated cord, cordless techniques, astringent hemostatic agents, gingival retraction paste, vasoconstrictive agents, lasers, rotary curettage, electrosurgery. Gingival retraction in dental implants and digital impression have also been discussed.

References

1. Al Hamad KQ, Azar WZ, Alwaeli HA, et al. A clinical study on the effects of cordless and conventional retraction techniques on the gingival and periodontal health. J Clin Periodontol. 2008;35:1053-1058.
2. Kostić I, Najman S, Kostić M, et al. Comparative review of gingival retraction agents. Acta medica Medianae. 2012;51:81-83.
3. Bennani V, Schwass D, Chandler N. Gingival retraction techniques for implants versus teeth: current status. J Am Dent Assoc. 2008;139:1354- 1363.
4. Prasad KD, Hegde C, Agrawal G, et al. Gingival displacement in prosthodontics: A critical review of existing methods. J Interdiscip Dentistry. 2011;1:80-86.
5. Scott A. Use of an erbium laser in lieu of retraction cord: a modern technique. Gen Dent. 2005;53:116-119.

6. Cloyd S, Puri S. Using the double-cord packing technique of tissue retraction for making crown impressions. Dent Today. 1999;18:54-59
7. Mohan M, Gupta A, Shenoy V, et al. Pharmacological agents in dentistry: a review. Br J Pharm Res. 2011;1:66-87.
8. Tarighi P, Khoroushi M. A review on common chemical hemostatic agents in restorative dentistry. Dent Res J. 2014;11:423-428.
9. Jokstad A. Clinical trial of gingival retraction cords. J Prosthet Dent. 1999;81:258-261.
10. Bowles W, Tardy S, Vahadi A. Evaluation of new gingival retraction agents. J Dent Res. 1991;70:1447-1449
11. Polat NT, Ozdemir AK, Turgut M. Effects of gingival retraction materials on gingival blood flow. Int J Prosthodont. 2007;20:57-62.
12. Weir DJ, Williams BH. Clinical effectiveness of mechanical-chemical tissue displacement methods. J Prosthet Dent. 1984;51:326-329.
13. Wassell R, Barker D, Walls A. Crowns and other extra-coronal restorations: impression materials and technique. Br Dent J. 2002;192:679-690.
14. Gupta G, Sunil Kumar M, Rao H, et al. Astringents in dentistry: a review. Asian J Pharm Health Sci. 2012;2:428-432.
15. Csillag M, Nyiri G, Vag J, et al. Dose-related effects of epinephrine on human gingival blood flow and crevicular fluid production used as a soaking solution for chemo-mechanical tissue retraction. J Prosthet Dent. 2007;97:6-11.
16. Ferrari M, Nathanson D. Tissue management and retraction technique combined with all-ceramic crowns: case reports. Pract Periodontics Aesthet Dent. 1995;7:87-94
17. Prasad KD, Hegde C, Agrawal G, et al. Gingival displacement in prosthodontics: A critical review of existing methods. J Interdiscip Dentistry. 2011;1:80-86.
18. Livaditis GJ. The matrix impression system for fixed prosthodontics. J Prosthet Dent. 1998;79:208-216.
19. Shillingburg HT, Sather DA, Wilson E, et al. Fundamentals of fixed prosthodontics: Quintessence Pub.2012.
20. Misch CE. Dental implant prosthetics. 2nd Edition: Elsevier Health Sciences: 2014.
21. Martin E. Lasers in dental implantology. Dent Clin North Am. 2004;48:999-1015.
22. Chang YS, Bennani V, Tawse-Smith A, et al. Effect of a cordless retraction paste material on implant surfaces: an in vitro study. Braz Oral Res. 2011;25:492-499. :433-444.