

Gingival Tissue Management In Restorative Dentistry:A Review

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Abstract: One of the primary goals of a long term successful restorative therapy is to establish a physiologic periodontal climate that facilitates the maintenance of periodontal health .Tissue management includes placing the gingival tissues away from the preparation margins so that impression can be made, combined with providing for hemostasis when the gingival tissues are susceptible to bleeding. The purpose of this article is to discuss the various techniques which can provide adequate gingival retraction such as, mechanical, chemical, chemicommechanical, and surgical.

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I. Introduction

Bryan stated that, —We must keep constantly in mind that the dental restorations we make have a two fold purpose; the restoration of the tooth or teeth to function and the protection of the supporting tissues from injury. It is clear then that restorative procedures must be based not only mechanical specifications but must also fulfill biologic requirement [1].Gingival tissue management can be defined as “The procedure of temporary eversion or resection of gingiva away from the tooth surface or deepening of gingival sulcus to expose the cervical portion of tooth in order to have proper marginal finish to the restoration or by establishing a good cervical cavosurface margin to the tooth preparation .A healthy periodontium is a pre-requisite for gingival tissue management and maintaining the biologic width is mandatory.Biologic width is defined as the dimension of soft tissue which is attached to the portion of the tooth coronal to the crest of alveolar bone. Restorations placed within the Biologic width result in gingival inflammation, clinical attachment loss and bone loss seen clinically as gingival recession and periodontal pocket formation. .[2]

The various methods for the soft tissue retraction in the crown and bridge procedures are as follows:

1. Mechanical
2. Mechanical-Chemical Method
3. Surgical
4. Newer Methods

II. Mechanical Method

Physical displacing of the gingival tissue was one of the first methods for insuring adequate reproduction of the prepared finish line.

1. **Rubber dam-** Excellent impressions are obtainable when the prepared teeth are in a clean and dry environment.Rubber dam is not only an asset in the preparation of the tooth, but also when the impression is made. With this technique, wax must be used to block out the clamp and prevent its displacement. Use of Heavy Weight Rubber Dam, which gives immediate results & used for simple ,minimal preparation. Disadvantage is Full arch impressions are not feasible.[3]

2. **Cotton fibers, cord, string, or unwaxed floss** -Use of Rolled Cotton or Synthetic Cords which are forcibly introduced into the gingival sulcus. Results are seen within 30 minutes.[4].Plain cotton cord is poor in its ability to adequately displace gingiva when compared with chemically impregnated cords. Tissue recovery, on the other hand, is excellent. Tissue can be traumatized by overpacking of cords.[5]

3. **A copper band or tube-** also known as Matrix method[6] .It is not only used as a means of carrying the impression material but also a mechanism for displacing the gingiva to insure that the gingival finish line is captured in the impression.

4. **Zinc oxide Eugenol cement placed on cotton-**is a technique recommended for deep cervically involved teeth. The advantages are acceptable tissue tolerance and extended working time to finish the preparation and make the impression. The disadvantage is the time necessary to make this technique work adequately.

5. **A temporary crown filled with thermoplastic stopping material or gutta-percha-** can cause prolonged or lasting recession if left in place for more than twelve hours. The disadvantages of this technique include the amount of time necessary to fit and adapt the band, the difficulty in removing the modeling compound and trauma to the tissue caused by the band.[5]

III. Mechanical-Chemical Method:

Mechanical chemical dilation consists of cords impregnated with chemicals that are eased into the intracrevicular space beneath the cavity margin without force. A cord is for mechanically separating the tissue from the cavity margin and a chemical for hemostasis as impressions are made.[5,7]

Three criteria for gingival retraction material are:-

1. Effectiveness in gingival displacement and homeostasis.
2. Absence of irreversible damage to gingival
3. Paucity of untoward systemic effects.[5]

Classification

Chemically, active gingival retraction agents are categorized as

Class I (vasoconstrictors, adrenergics)

Class II (hemostatic agents, astringents).[8]

3 major categories as suggested by Marzouk.

1) vasoconstrictors

a) Epinephrine, b) Nor –epinephrine

2) biologic fluid coagulants

a) 100% Alum, b) 15-25% Aluminium chloride, c) 10% Aluminium potassium sulfate, d) 15-25% Tannic acid

3) surface layer tissue coagulants

a) 8% Zinc chloride, b) Silver Nitrate

Classification of chemicals by THOMPSON

1) Styptics

a) 8% Zinc chloride b) Ferric subsulfate (monsell's powder) c) 20% Tannic acid d) 14% Alum

2) Chemical Caутery

a) 40% Zinc chloride b) Potassium hydroxide

3) Vasoconstrictors

a) Epinephrine b) 3% Ephedrine sulfate

Vasoconstrictors:

Most commonly used agents are 8% racemic epinephrine and non-epinephrine .These physiologically restrict the blood supply to the area by decreasing the size of the blood capillaries which decreases haemorrhage, decreases tissue fluid seepage and consequently decreases the size of gingiva. [4]

Donovan et al, Benson et al[7,8] stated that in many patients it produces an epinephrine syndrome that may include tachycardia, increased respiratory rate, hypotension, nervousness, and feelings of weakness in the extremities, frank apprehension and post-operative depression. Therefore epinephrine is not recommended in

patients with cardiovascular disorders, diabetics, hyperthyroidism or hypertension and known hypersensitivity to epinephrine.

Fluid coagulants

Biologic fluid coagulants coagulate blood and tissue fluids locally thus creating a surface layer that is an efficient sealant against blood and crevicular fluid seepage. These are safe agents with regard to systemic effects. [4]

Alum in 100 % concentration has been shown to be only slightly less effective than epinephrine in shrinking the gingival tissue. Cord saturated with 100% alum can be left in the sulcus for as long as 20 minutes without adverse effects and shows good tissue recovery. A 0.1mm permanent loss of crestal gingival usually occurs. It is safer and has fewer systemic effects.[10]

Aluminum chloride solution(15% and 25%): It is one of the most commonly used chemical. A 10 min. application is usually sufficient. The 25 % solution has been advocated for use with other chemical agents because it approximately doubled the haemostatic success of each other chemicals. It has been observed that 25% aluminum chloride was significantly more aggressive than 0.05% tetrahydrozoline.[11]

Tannic Acid (20%-40%): It is less effective than epinephrine, but it shows good tissue recovery whereas the haemostatic effectiveness is minimal.

Negatol solution: It is 45% condensation product of metacresolsulphonic acid and formaldehyde. It provides better retraction than epinephrine but tissue recovery is poor. It is highly acidic and decalcifies teeth in both 10% and 100% solutions. It is classified as chemical cautery agent and is not recommended for gingival displacement.[12,13,14,15]

Ferric sulfate (Monsel's solution): It is advocated for use in gingival displacement. It is slightly more effective than epinephrine in gingival displacement. The recommended time of use is 3 minutes. Tissue recovery is good, but the solution is messy to use. It is highly acidic and hence corrosive hence it is injurious to the soft tissue and enamel. However ferric sulphate (13.3%) does not traumatize the tissue and the healing is more rapid with aluminum chloride. Ferric sulphate is compatible with aluminum chloride but not with epinephrine, it will result in the development of a massive blue precipitate.

Zinc chloride (8% and 40%): Effective gingival displacement by 8% zinc chloride is similar to epinephrine while 40% Zinc chloride is slightly more effective. As there are very caustic, they cause a chemical cautery and hence not recommended.[5]

IV. Surgical Tissue Dilatation

Surgical resection of the gingiva is the preferred method for providing access to the margin of the preparation. A ribbon of gingival tissue is removed from the sulcus around margin with dental electro surgery. Continuous visualization of the sub epithelial margin is difficult for the dentist. Cords, chemicals, rubber or leather ring, copper, stainless steel and aluminum bands with other materials have been suggested for this purpose. Under local anesthesia, the gingiva is excised apical to the margin of the preparation with periodontal knives or no.11 Bard-parker blade. The gingiva regenerates and is restored to its normal position provided it was healthy when the preparation was started. When the tooth is prepared, resection of the gingiva or inadvertent removal of plaque and calculus during the preparation results in shrinkage of the pocket wall and leads to exposure of the tooth surface beyond margin of the preparation.[12,16,17]

Electrosurgery:

D'Arsonvalin[1891] demonstrated in his experiment that electricity at high frequency would pass through a body without producing a shock/pain but produces an increase in the internal temperature of the tissue which was used as a basis for electrosurgery[4]

Electro surgery has been used in dentistry for more than half a century. Two general types of electrosurgical units (ESU) are

- Monopolar
- Bipolar.

Both types are used extensively in medicine, but only monopolar systems have been established in dentistry (except for the use of bipolar units by oral surgeons).

In one technique, the inner epithelial lining of the gingival sulcus is removed, thus improving access for a sub gingival crown margin, and effectively controlling postsurgical hemorrhage (provided that the tissue are not inflamed). Unfortunately there is potential gingival tissue recession after treatment. The depth of tissue removal is determined by the morphology of the tissue and the biologic width.

Electro surgery requires profound local anesthesia and all the armamentarium should be made of plastic.

The tissue through extend about 0.3 to 0.5 mm below the margin of the cast restoration for definite margin detection in the impression and on master dies.[18]

Advantages of Electrosurgery:[18]

- It controls any degree of haemorrhage, increases operative efficiency and reduces chair time.
- It prevents seeding of bacteria into the incision site.
- The active electrodes are flexible wires and are selfsterilizing;
- It permits planning of soft tissues, a procedure unique to electro surgery.
- It improves the quality restorations and eliminates scar formation.

Disadvantages of Electrosurgery:[18]

- Contraindicated in patients with a non compatible or poorly shielded cardiac pacemaker patient.
- It produces an unpleasant odor and sometimes an unpleasant taste.

Oringer's solution – after the procedure of making final impression or retraction during restorative procedures, a tincture of myrrh and benzoin (Oringer's solution) should be placed on surgical area and air dried for 4-5 times. The healing is rapid and takes place within a week time .Oringer's can be replaced by ORABASE[5].

ORABASE:It is composed of gelatin, pectin and sodium carboxymethylcellulose in Plastibase . ORABASE Paste is available in 5 g and 30 g tubes.

Gingitage/Rotary Curettage

Dr. Fred Hansing in 1972-75 originally developed the techniques for gingival tissue management during cast, restoration fabrication by using high speed diamond instrument which he refined later and was called gingitage. It is also done with pencil shaped instrument at 7500 rpm as given by Moskow 1964.Used to remove sulcular tissue. Healing is satisfactory.

The technique of using rotary diamond instrument to enlarge the sulcus has been termed as "**Gingitage**". It involves preparation of the tooth subgingivally while simultaneously curetting the inner lining of the gingival sulcus with rotary diamond instrument.11 Definitive tissue removal allows room for placement of retraction cord and impression material.

Kamansky et al reported less change in gingival height with rotary curettage than with lateral displacement using retraction cord. With curettage there was apparent disruption of the apical sulcular and attachment epithelium, resulting in apical positioning of the junctional epithelium and increase in sulcus depth. The changes were quite small, and not regarded as clinically significant. Thick palatal tissue responded better to the technique than the tissues on the facial aspect of maxillary anterior teeth.

Tupac and Neacy found no significant difference between retraction cord and rotary curettage. The goal is to eliminate the trauma of pressure packing and necessity of electrosurgical procedures. The gingitage technique is followed by non pressure placement of retraction cord rather than packing into sulcus and without causing permanent damage to the soft tissue.[19,14]

Cryosurgery [4]

It is a destruction of tissue by application of extreme cold, usually by delivering the refrigerant to the tissues by means of a partially insulated tube (cryoprobe), First application accomplished by White in 1899.

Liquid Nitrogen or nitrous oxide gas is used. At -150 C cell death due to cryonecrosis occurs.

Advantages:

Minimum blood loss.,more conservative treatment. ,lesspost operative pain and cosmetic deformity.

Limitations:

No way of determining adequacy of margins and depth of tissue destruction[2]

V. Recent Advances

1.Lasergingivectomy [4]

Most commonly used lasers are the CO2 and Neodymium; yttrium-aluminium garnet (Nd:YAG) in the infra-red range. Diode lasers are also used for gingival retraction around natural teeth, as they result in less bleeding and gingival recession.

Advantages

Sterilizes sulcus, reduced tissue shrinkage, excellent hemostasis, relatively painless,

Disadvantages

Healing is delayed., Needs experience..

2.Expasyll Injectable Retraction Method:

Expasyll (Kerr Corporation, Orange, CA) is a clay-like material that is dispensed from a syringe apparatus through a narrow needle-like tip. It is available in vials and dispensed directly into the sulcus with a heavy duty delivery gun loaded with a syringe[20,21]. This dispenser is specially prepared to extrude the paste at a pressure of 0.1N/mm²; it is the maximum amount of pressure to prevent damage to the epithelial attachment.

The force exhibited by the expa-syll is still nearly 50 times less than that of single and the double cord technique. Expa-syll is injected into the sulcus at approximately 2mm/second. Expasyll has no chemical or setting reaction. It does not go through an expansion phase. The material is left in place for up to 2 min and is then rinsed off with an air/water syringe. The sulcus is then ready for the impression[22]. The material contains aluminum chloride, a potent hemostatic agent.[20] Hence, no violation occurs to the gingival complex. Gingival recession is also not encountered. After removal of Expasyll, sulcus is clean which reduces artifacts during making of digital CAD/CAM impressions.[23] It provides the best outcome of chemical choices available.

Composition

- Kaolin 66.75%
- Aluminum chloride 6.54%
- Oil of lemon 0.33%
- Water 25.36%
- Colorant 1.02%
- pH = -3.

Advantages

Minimal or no physical damage to the gingival tissues, time saving *in situ* ations where multiple teeth are being impressed, Predictable hemostasis.

Disadvantages

More expensive, inhibits set of polyvinyl siloxane and polyether impressions,less effective with very subgingival margins.

3.Magic Foam Cord [21]

Magic foam cord is a new nonhemostatic method. It is a vinyl polysiloxane material designed for retraction of the gingiva. The material expands, and after 5 min, impression can be made. The material expands (160%) after 5 min.

Technique

1. Pre-fit the Comprecap over the prepared tooth.
2. Apply Magic Foam Cord around the preparations
3. Place Comprecap and let the patient bite on it. Wait for a minute and remove the cap to which the material sticks leaving a clean and retracted gingival margin

Advantages

Less traumatic than retraction cord ,color of foam makes it easy to see during use ,easy to remove, adequate working time.

Disadvantages

No hemostasis provided,expensive, less effective on subgingival margins, intraoral tips too large to inject material adequately into the sulcus.

4.Matrix Impression System

Matrix impression system is a new system in which impression procedure includes three steps. First, a matrix of occlusal registration elastomeric material is done over the prepared tooth. The retraction cord is removed and a definitive impression is recorded in the matrix using a high viscosity elastomeric impression material. After the matrix impression is positioned, medium viscosity elastomeric material is loaded in an impression tray and is seated over the matrix and remaining teeth to create impression of the entire arch. The design of the matrix also forces the high viscosity impression material along the preparations and into the sulcus. The matrix impression system uses three impression materials of different viscosities.[24]

Advantages

Eliminates chances of tearing of the sulcus ,cleans blood and debris,delivers impression material with more accuracy and speed ,holds the sulcus open for an increased time.

Disadvantages

Increased chairside time.

5.Merocel Strips

Merocel is a new retraction material to displace gingiva with no tissue injury before making impression. Merocel retractions strips are synthetic material, which are specifically chemically extracted from a polymer hydroxylate polyvinyl acetate that creates a net-like strip without debris or free fragments. Placement of Merocel retraction technique does not require use of local anesthesia. Merocel retraction strip provides very excellent gingival retraction when compared to conventional retraction cord.[25] The porous and sponge-like microstructure of Merocel produces a dry field for the impression to accurately capture the details.[26] The absence of fibers decreases the risk of postoperative problems.

Advantages

It is shaped easily,effectively absorbs oral fluids, cleans sulcus.

6.Gingitrac [21]

Gingitrac is a paste system that uses a syringe to apply the paste around the margins. The syringe is preloaded with the paste. The paste contains aluminum sulfate as an astringent. If necessary, a hemostatic agent can be applied before its use. The cap is first filled with the paste and then placed over the tooth for 5 min. The paste is applied with a syringe in the sulcus. For impressions of more than one tooth, a plastic tray is used to carry a firm paste matrix over which the Gingitrac paste is syringed. The tray is then positioned and removed after 3–5 min. For both single and multiple tooth preparations, retraction of gingiva is by pressure application. The paste is removed prior to impression making.

Advantages

Easier to express from automix gun , longer shelf life,faster setting time,controls oozing of blood, fast and easy removal

7.Racegel [21]

Racegel is a new hemostatic agent. Before impression making, it is used to obtain hemostasis and dry field in the sulcus. Racegel becomes more viscous on tissue contact because of its thermodynamics. It contains 25% aluminum chloride, oxyguinol, and excipients. Aluminum chloride is an astringent. The bright orange color makes it easy to dispense, place, and rinse. The gel can be used with or without gingival retraction cords. Racegel produces finish line exposure with minimum bleeding. It is easily rinsed, leaving no irritation of the surrounding tissue. Its thermal effect is reversible when rinsed with water.

8.Stay put [21]

Stay put impregnated combines the advantages of both an impregnated and braided cord with the adaptability of an ultrafine copper filament. Aluminum chloride hexahydrate is used for impregnation. Nonimpregnated stay put cord is also available which can be impregnated with hemostatic agent as needed.

Advantages

Hemostasis is fast, possible to be preshaped,pliable and can be adapted,relatively safe for cardiac patients.

VI. Conclusion:

Proper tissue management is a key factor in accurately duplicating subgingival margins. Various advanced materials are available for gingival retraction and the procedure can be relatively painless, quick, and atraumatic. Depending on the type of clinical case and the other related factors like accessibility, age, systemic disease etc the method for gingival tissue retraction may be chosen.

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