



Gingival Retraction: Revisited

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ABSTRACT

A successful sustainable fixed prosthesis is influenced by several factors, among which the technique of impression making and the accuracy of the replica plays an important role. Gingival retraction is an inevitable portion before making the impressions of the prepared teeth. However, the retraction materials and procedures must be atraumatic, economical, readily available and should not interfere with the setting reactions of the impression materials. This review article focuses on the need for gingival retraction, different retraction systems, and their recent advances.

Keyword

Gingival retraction, methods of gingival retraction, gingival retraction in implants

INTRODUCTION

Different procedures such as impression or luting of the restorations, can present different challenges. Moisture control plays an important role in any dental procedures either direct or indirect. This can be achieved through effective isolation techniques¹. There are lot of problems faced in dentistry. These can range from the restrictive effects on all the muscles involved, to other disorders resulting from limited vision and isolation, which can be a result from of gingival crevicular fluid, saliva and bleeding during tooth preparation to receive a restoration². Gingival tissue retraction is a long-established technique. Gingival retraction can be defined as the process of deflection of the marginal gingiva away from a tooth³. The purpose of gingival retraction is to

allow access to the impression material beyond the margin of the abutment and also to provide sufficient space for the impression material to be thick enough. This is because material thickness is known to affect its tear resistance⁴. The current clinical condition will determine which gingival retraction technique is used. Bleeding and its severity may be due to certain retraction technique.

NEED FOR RETRACTION⁵

1. Adequate access to the prepared tooth.
2. Exact replication of the finish line. (Figure 1).
3. For accurate reproduction of sub-gingival margins
4. Providing the best possible environment for the impression material (Figure 2), fluid control.

5. Precision of the restoration for prevention of periodontal disease.

INDICATION

- ✓ Presence of Sub gingival Caries.
- ✓ Cervical abrasion or erosion
- ✓ To control haemorrhage and gingival seepage
- ✓ Aesthetic consideration

CONTRAINDIICATION

- ✓ Poor oral hygiene
- ✓ Presence of periodontal disease
- ✓ Gingival recession
- ✓ Periodontal bone loss
- ✓ Gingival disease

CLASSIFICATION AND METHODS OF GINGIVAL RETRACTION ^(6,7,8)

Barkmeier and Williams 1978	<ol style="list-style-type: none"> 1. Surgical retraction (gingivectomy and gingivoplasty, periodontal flap procedures, electrosurgery, and rotary gingival curettage). 2. Non-surgical retraction (rubber dam and clamps, retraction cord-impregnated/non-impregnated, retraction rings, copper bands).
Thompson MJ 1959	<ol style="list-style-type: none"> 1. Conventional. 2. Radical.
Benson et al., 1986	<ol style="list-style-type: none"> 1. Mechanical method 2. Chemicomechanical method 3. Rotary gingival curettage 4. Electrosurgical methods.

METHODS OF RETRACTION

For the retraction of soft tissue, three rule techniques are accessible for utilization these days 1) mechanical; 2) chemo-mechanical; and 3) electrosurgical.

MECHANICAL METHODS

These techniques not only cause physical retraction and displacement of the soft tissues but also provide haemostasis and control of gingival crevicular fluid. These include Matrix bands & wedges, gingival protectors, rubber dams, copper ring technique,

anatomic retraction caps, plain retraction cords, and special cords.

MATRIX BANDS & WEDGES

Matrix bands allow isolation and retraction of the gingiva in cervical or subgingival restorations, and when placed between adjacent teeth the wedges physically push down and retract the gingiva. Therefore, they serve to protect the gingiva during tooth preparation⁽⁹⁾.

GINGIVAL PROTECTOR

A small instrument with a crescent-shaped tip that can be positioned and adjusted according to the contour of the gingival tissue. It protects and displaces the gingiva during the preparation of tooth structure close to the gingival margin⁽⁹⁾.

RUBBER DAM

The heavy, extra heavy, and special heavy rubber dam, along with special clamps (eg. Ferrier 212, Schultz, Brinker's clamp B5, B6), are used to retract and protect gingival tissue during tooth preparation and also provide isolation for subsequent restoration placement. Once the clamp is in the position, impression can be made using modified trays. However, it cannot be used for full mouth impression⁽¹⁰⁾.

COPPER RING TECHNIQUE

This method uses a copper band or ring filled with modelling compound or elastomeric impression material to record the subgingival margin. The copper band physically displaces the tissue and the subsequent impression records the subgingival tooth structure. However, this technique is considered harmful to the gingival tissues⁽¹⁰⁾.

ANATOMIC RETRACTION CAPS:

The retraction caps work on the same principle as a copper band, except that it is available pre-shaped for easy placement between adjacent teeth. Once they are placed properly, the patient bites on them⁽¹⁰⁾.

RETRACTION CORDS

One of the most common methods of gingival retraction. They are classified based on the chemical treatment, as plain and impregnated. Based on their configuration they are broadly classified into knitted, twisted, or braided⁽¹¹⁾.

KNITTED CORDS

It has interlocking loops that prevent the cord from displacement when the adjacent segment is pushed into the sulcus. This configuration allows the cord to passively bend and shape when placed in the gingival sulcus. However, these cords tend to compress while being placed and, therefore, to compensate for this, a slightly thicker size should be selected. As they have a tendency to unravel, a non-serrated and smoother instrument is recommended for their packing^(12,13).

TWISTED CORDS

It has a tendency to untwist and fray, when placed in the sulcus. Therefore, they are least indicated compared to the other types^(12,13).

BRAIDED CORDS

It has a tight weave that allows for easy placement into the gingival sulcus without fear of fraying. When pressure is applied along one segment, these cords have a greater tendency to be pushed out of the sulcus from another point^(12,13).

They are colour coded, depending on the thickness: Black-000 (Figure 3), yellow-00, purple-0, blue-1, green-2, and red-3.

CHEMICAL METHOD:

EPINEPHRINE

Epinephrine provides effective vasoconstriction and haemostasis, but 33% of its use is accompanied with significant local and systemic side effects. “Epinephrine syndrome”, can occur in patients who are susceptible to epinephrine which is characterized by tachycardia, hyperventilation, increased blood pressure, anxiety and postoperative depression⁽¹⁴⁾.

Advantages

- ✓ Vasoconstrictive
- ✓ Haemostatic

Disadvantages

- ✓ Systemic effects: epinephrine syndrome
- ✓ Risk of gingival margin inflammation
- ✓ Rebound hyperaemia
- ✓ Risk of tissue necrosis

ALUMINUM SULFATE AND ALUMINUM POTASSIUM SULFATE

Both the agents are haemostatic and retractive, and result in minimal postoperative inflammation at therapeutic concentrations, whereas concentrated aluminium potassium sulphate solutions cause severe inflammation and tissue necrosis. They act by precipitating tissue proteins with tissue contraction, inhibiting transcapillary movement of plasma proteins and arresting capillary bleeding⁽¹⁵⁾.

Advantages

- ✓ Haemostasis
- ✓ Least inflammation of all agents used with cords
- ✓ Little sulcus collapse after cord removal

Disadvantages

- ✓ unpleasant taste
- ✓ In high concentration there is risk of necrosis

FERRIC SULFATE

Because of its iron content, ferric sulphate stains the gingival tissue yellow-brown to black colour for a few days after its application. The use of this agent for gingival displacement in implants is also questionable, as it may interfere with the setting reaction of polyether and polyvinyl siloxane impression materials. *Conrad et al*, concluded that the combination of ferric sulphate gingival retraction fluid and translucent porcelain restoration resulted in black internalized discoloration of the dentine and patient’s dissatisfaction⁽¹⁶⁾. In vitro studies have shown that dentinal exposure to strongly acidic ferric sulphate, for 30 seconds, can result in removal of superficial smear layer. Removal of the smear layer with haemostatic agents has been shown to negatively affect the bonding mechanism of self-etching adhesive which may be another explanation for possible marginal microleakage and discoloration⁽¹⁷⁾.

Advantages

- ✓ Haemostasis

Disadvantages

- ✓ Tissue discoloration
- ✓ Acidic taste
- ✓ Risk of sulcus contamination
- ✓ Inhibits set of polyvinyl siloxane and polyether impressions

ALUMINUM CHLORIDE

Aluminium chloride is an active ingredient that acts by precipitating tissue proteins, but causes less vasoconstriction than epinephrine. It is the least irritating of all agents used for impregnating retraction cords, but it has significant deficiencies in inhibiting the setting of polyvinyl siloxane and polyether impression materials⁽¹⁸⁾.

Advantages

- ✓ No systemic effects
- ✓ Least irritating of all chemicals
- ✓ Haemostasis
- ✓ Little sulcus collapse after cord removal

Disadvantages

- ✓ Less vasoconstriction than epinephrine
- ✓ Risk of sulcus contamination
- ✓ Inhibits set of polyvinyl siloxane and polyether impressions

This agent keeps the sulcus open and more effective even after clinicians removed the cord (10-20% of original opening 8 minutes after cord removal) than epinephrine-medicated cords (50% closure of sulcus observed over a similar duration). After 12 minutes, only the sulci filled with aluminium chloride were open to 80% of the space originally created. However, it is more important to remove the aluminium chloride residue after removing the retraction cord and before making the impression as aluminium chloride can prevent the complete setting of polyether and polyvinyl siloxane impression materials⁽¹⁹⁾.

INERT MATRIX-POLYVINYL SILOXANE

During setting this material acts by producing hydrogen that causes expansion of material against walls of the gingival sulcus⁽²⁰⁾.

Advantages

- ✓ No risk of inflammation or irritation
- ✓ Non-traumatizing
- ✓ Ease of placement
- ✓ Painless
- ✓ No adverse effect

Disadvantages

- ✓ limited capacity for haemostasis (no active chemistry)
- ✓ less effective with subgingival margins

CHEMICALS IN AN INJECTABLE MATRIX

Injecting 15% aluminium chloride in a Kaolin matrix, into the gingival sulcus allows the clinician to achieve significant mechanical retraction to make adequate impressions. Unlike other chemo-mechanical method, the injectable aluminium chloride was less painful, comfortable and administration was quicker. The strength of the epithelial attachment is 1 N/mm. Very low pressure (0.01 N/mm) opens sulcus and cause almost immediate recovery. A pressure of 0.1 N/mm allows a sulcus opening of 1.5 mm and a delayed recovery of up to 2 minutes per 0.5 mm opening. The paste is injected into the sulcus, exerting a stable, non-damaging pressure of 0.1 N/mm. If the paste is left in place for 1 minute, this pressure is sufficient to obtain a 0.5 mm of sulcus opening for 2 minutes. This injectable matrix contains white clay to ensure the consistency of the paste and its mechanical action, while aluminium chloride enhances the haemostatic effect. Air and water spray can be used to remove the paste from sulcus⁽²¹⁾.

Advantages

- ✓ Reduced risk of inflammation (injectable form)
- ✓ Nontraumatizing to junctional epithelium
- ✓ Hydrophilic
- ✓ Ease of placement
- ✓ Painless
- ✓ No adverse effects

Disadvantages

- ✓ Inhibits set of polyvinyl siloxane and polyether impressions

- ✓ More expensive
- ✓ Less effective with deep subgingival margin

SURGICAL METHOD

ELECTROSURGERY

To enlarge the gingival sulcus, a small J-shaped electrode is used and is oriented parallel to the long axis of the tooth. The tissues on the inner wall of the sulcus are removed. It is important to continue to focus on minimizing lateral heat build-up⁽²²⁾.

Advantages

- ✓ Efficient
- ✓ Precise haemostasis while incising the tissues

Disadvantages

- ✓ Contraindicated in patients with pacemaker,
- ✓ nitrous oxide is a flammable agent and cannot be used concomitantly with nitrous oxide and oxygen sedation
- ✓ Cannot control bleeding once it starts
- ✓ Adequate band of healthy attached tissue is required.

ROTARY CURETTAGE

Although the sulcus may deepen slightly, rotary curettage does not significantly affect the height of the gingival margin if there is adequate keratinized gingiva surrounding the tooth⁽²⁴⁾.

Advantages

- ✓ Fast
- ✓ Ability to reduce excessive tissue
- ✓ Ability to recontour gingival outline

Disadvantages

- ✓ Causes significant bleeding
- ✓ High risk of trauma to epithelial attachment, The absence of keratinized gingiva at the base of the sulcus may result in

gross recession and deepening of the sulcus due to excessive tissue reaction.

LASERS

In dentistry, soft tissue reduction with lasers has been the subject of intensive investigation in recent years. Laser application to gingival tissue is made possible by the use of versatile optical fibres (the most widely used diameter range for prosthetic applications ranged from 320 - 400 micrometres), ensuring precise laser action at sulcular level. Lasers used in dentistry includes Co2 lasers, Nd YAG (Neodymium-Yttrium-Aluminium-Garnet) lasers, Argon lasers, etc.,

Principle:

The Lasers works by photoablation, creating a completely blood-free incision, followed by rapid and painless healing without inflammation. For soft oral tissue resection, ND- YAG laser is preferred and can be used effectively prior to impression, especially in case of hypertrophied tissue, without local anaesthesia for gingival retraction. the pulsed Nd-YAG laser beam is guided into the surgical site via a flexible quartz optical fibre. This beam is invisible at the correct operating wavelength, so YAG laser uses the red Helium-Neon laser to provide a visible coaxial aiming beam. The fibre tip extends approximately 1 mm from the handpiece to ensure accurate beam placement and guidance. The fibre tip is held in contact with the soft tissue and pushed in the same way as a traditional scalpel. Laser technique takes slightly longer than using a scalpel, but allows very controlled tissue removal without bleeding and pain. Using too much laser energy will cause tissue contraction and unwanted damage to the crown margins. Healing is faster and uneventful. Laser safety instructions should always be followed by the operator. Postoperative

instruction includes morning and night warm saltwater rinses for 5 to 7 days and the use of an ultra-soft toothbrush on the affected area using an adapted sulcular brushing bass technique⁽²³⁾.

Advantage

- ✓ Excellent haemostasis: carbon dioxide laser
- ✓ Reduced tissue shrinkage
- ✓ Relatively painless
- ✓ Sterilizes sulcus

Disadvantage

- ✓ Er:YAG laser is not as good at haemostasis as CO2 laser
- ✓ CO2 laser provides no tactile feedback, leading to a risk of damage to the junctional epithelium.

RECENT ADVANCEMENTS:

Expasyl retraction system (1-2min):

This is a viscous synthetic paste containing 10% aluminium chloride, and 80% kaolin, with water and modifiers⁽²⁵⁾. It is available as a small-sized, reusable capsule that can be decontaminated, and the small cannula tip helps to inject the material into the gingival sulcus.

Merocel:

A synthetic polymer with a sponge-like texture and it is cut into 2 mm thick strips. Made from hydroxylated polyvinyl acetate, a biocompatible polymer. Once placed in the gingival sulcus, it absorbs fluid and, expand until it occupies the gingival sulcus⁽²⁶⁾.

Magic foam (5 mins):

A polyvinylsiloxane-based material that has the ability to expand and displace the gingival tissues when placed in the sulcus. Used in conjunction with a compression cap, on which the patient is allowed to bite for retraction. It is an atraumatic method, that

does not use haemostatic agent that can easily contaminate the impression site⁽²⁷⁾.

GingiTrac:

It is available as a prefilled syringe in a paste form containing an astringent, aluminium sulphate. Often used in combination with a compression caps⁽²⁸⁾.

Racegel:

Available in gel form and contains haemostatic agents such as 25% aluminium chloride, oxyquinol, and excipients. Due to its thermodynamic behaviour, it increases in viscosity upon contact with tissue, allowing it to be easily washed away without irritating surrounding tissue. Racegel can be used with or without retraction cords⁽²⁸⁾.

Retraction capsule:

Astringent retraction paste supplied as a capsule with a long, slim nozzle and a soft edge to deliver a highly viscous astringent paste directly into the gingival sulcus. It is composed of 15% aluminium chloride. The nozzle is equipped with an orientation ring with white markings that prevents excessive impingement in the gingival sulcus⁽²⁸⁾.

Stay-put retraction cord:

This is a special retraction cord with a thin wire incorporated in the centre. This cord can be pre-shaped and its flexibility makes it easier to place in the sulcus. It is available in four sizes width (0–3) and also as plain and pre-impregnated⁽²⁹⁾.

GINGIVAL DISPLACEMENT IN IMPLANTS:

There are few situations in the restorative phase of implants require the fabrication of customized abutments with subgingival margins, especially in the aesthetic area. However, the tissues surrounding the implants are delicate and are at high risk for damage and recession, when traumatized during retraction

procedures. Rotary curettage increases the risk of the bur damaging the implant surface and exposing the implant threads due to tissue retraction. Electrosurgery is contraindicated with an implant due to the risk of arcing. CO₂ lasers have very little energy absorption, minimal temperature rise (< 3 °C), and minimal collateral damage. These lasers typically do not alter the structure of the implant surface. However, large defects occur when inserted deeply around the implants. The injectable matrix technology seems promising in the implant situations and requires further development⁽³⁰⁾.

G-Cuff:

A gingival cuff is a dental device consisting of a tubular-conical shape collar used to make impression during the restorative phase of a dental implants. The main objective of it is to displace the peri-implant soft tissue so that the impression material can reach the abutment surface for optimal restoration⁽³¹⁾.

GINGIVAL DISPLACEMENT IN DIGITAL IMPRESSIONS:

Digital computer-aided design/computer-aided manufacturing (CAD/CAM) impressions require a clean gingival sulcus. Retraction cord fibres that are left in gingival sulcus may affect the accuracy of the impression resulting in errors due to artifact. The 15% aluminium chloride injectable matrix reduces these artifacts by leaving a clean gingival sulcus on removal⁽³²⁾.

CONCLUSION

Gingival retraction is considered an important step in impression making as it greatly influences the restorative outcome. Recent advances have made it possible to expand gingival tissue in a minimally invasive manner. However, the choice of technique

and material is completely at the clinician's hands based on the situation.

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