

REVIEW ARTICLE

Gingival Retraction- A Prosthodontic Review

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Received: 16 February, 2022

Accepted: 22 March, 2022

ABSTRACT

Fixed dental prosthesis success requires appropriate impression taking of the prepared finish line. This is critical in either tooth supported fixed prosthesis (crown and bridge) or implant supported fixed prosthesis (solid abutment). If the prepared finish line is adjacent to the gingival sulcus, gingival retraction techniques should be used to decrease the marginal discrepancy among the restoration and the prepared abutment. Accurate marginal positioning of the restoration in the prepared finish line of the abutment is required for therapeutic, preventive and aesthetic purposes.¹ This article discusses the current methods that are applied for displacement of gingival tissues so that adequate amount of unprepared tooth structure can be recorded with least distortion of impression material as well as minimal damage to attachment apparatus of the tooth.²

FORCES INVOLVED WITH RETRACTION OF PERIODONTAL TISSUES

Deformation of gingival tissues during retraction and impression procedures involves four forces: retraction, relapse, displacement and collapse. The aim of gingival retraction is to atraumatically allow access for the impression material beyond the abutment margin and to create space in order to provide sufficient thickness of impression material in gingival sulcus region so that it can better withstand the tearing forces encountered during removal of impressions.³ The fiber-rich, highly organized periodontal complex surrounding natural teeth provides support for gingival tissues when they are retracted, mitigating the collapse of the tissues when the retraction agents are removed before making the impression.⁴

GINGIVAL DISPLACEMENT TECHNIQUES

MECHANICAL RETRACTION

The most common method in gingival retraction which is fast, simple and inexpensive is cord packing that can be used separately or in combination with hemostatic agents in two techniques: single cord or dual cord.⁵ Retraction cord penetration depth is influenced by the sulcus depth and periodontal status. In dual cord technique, two knitted cords with different diameters are used. The apical cord is thinner and is kept in place during impression making. Thus a trough is made around the preparation area and gingival cuff recoil is delayed.⁶ However, using the mentioned method is limited in supra-gingival preparation margins.⁷ Unpredictable tissue resorption and patient's discomfort are problematic issues associated

with Dual Cord technique⁶. One cord is used in Single Cord method which is removed before impression making. If the preparation finish line is deep at the sulcus, the soft tissue collapse prevents accurate impression making^{6,7}.

ADVANTAGE

- Inexpensive

DISADVANTAGES

- Rapid collapse of sulcus after removal
- Trauma to epithelial attachment
- No hemostasis
- Time- consuming
- Risk of sulcus contamination
- Painful

CHEMICOMECHANICAL RETRACTION

Research has been carried out on a wide variety of chemicals for use with retraction cords. The chemical agents that are commonly used are discussed below. Epinephrine Although epinephrine provides effective vasoconstriction and hemostasis,⁶ 33% of its application is accompanied by significant local and systemic side effects. “Epinephrine syndrome”, which is characterized by tachycardia, hyperventilation, raised blood pressure, anxiety and postoperative depression can occur in patients who are susceptible to epinephrine.⁷

ADVANTAGES

- Vasoconstrictive
- Hemostatic

DISADVANTAGES

- Systemic effects: epinephrine syndrome
- Risk of inflammation of gingival cuff
- Rebound hyperemia
- Risk of tissue necrosis

Aluminum sulfate and aluminum potassium sulfate, both the agents are hemostatic and retractive, and result in minimal postoperative inflammation at therapeutic concentrations,⁷ Although severe inflammation and tissue necrosis result from concentrated aluminum potassium sulfate solutions.⁸ These act by precipitating tissue proteins with tissue contraction, inhibiting transcapillary movement of plasma proteins and arresting capillary bleeding.⁹

ADVANTAGES

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

DISADVANTAGES

- Offensive taste
- Risk of necrosis if in high concentration

FERRIC SULFATE

Owing to its iron content, ferric sulfate stains the gingival tissue yellow-brown to black color for a few days after its use. The use of this agent for gingival displacement in implants is

further questionable due to its ability to disturb the setting reaction of polyether and polyvinyl siloxane impression materials.¹⁰

ALUMINUM CHLORIDE

It is an agent that acts by precipitation of tissue proteins but causes less vasoconstriction than epinephrine. It is least irritating of all the medicaments used for impregnating retraction cord but it possesses a vital shortcoming of inhibiting the polyvinyl siloxane and polyether impression materials.¹⁰

ADVANTAGES

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

DISADVANTAGES

- Less vasoconstriction than epinephrine
- Risk of sulcus contamination
- Modifies surface detail reproduction
- Inhibits set of polyvinyl siloxane and polyether impressions

INERT MATRIX-POLYVINYL SILOXANE

This material acts by generating hydrogen that causes expansion of material against the sulcus walls during setting.

ADVANTAGES

- No risk of inflammation or irritation
- Nontraumatizing
- Ease of placement
- Painless
- No adverse effects

DISADVANTAGES

- Limited capacity for hemostasis (no active chemistry)
- Less effective with subgingival margins

SURGICAL RETRACTION

Lasers: Properties of laser mainly depend on their wavelength and waveform characteristics. Diode lasers are commonly used for gingival retraction around natural teeth, as they result in less bleeding and gingival recession.

- Neodymium: yttrium-aluminum-garnet (Nd:YAG) lasers
- Erbium: yttrium-aluminum-garnet (Er:YAG) lasers
- CO₂ laser¹²

ADVANTAGES

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

DISADVANTAGES

- Er:YAG laser is not as good at hemostasis as CO₂ laser
- CO₂ laser provides no tactile feedback, leading to risk of damage to junctional epithelium.¹²

ELECTROSURGERY

To enlarge the gingival sulcus, a small J-shaped electrode is used and is oriented parallel to the long axis of the tooth so that only tissues from inner wall of the sulcus are removed. Retaining focus on minimizing the production of lateral heat is significant.¹³

ADVANTAGES

- Efficient
- Precise hemostasis while incising the tissues

DISADVANTAGES

- Contraindicated in patients with pacemakers.
- Cannot be used concomitantly with nitrous oxide/oxygen sedation as nitrous oxide is a flammable agent
- Cannot control hemorrhage once it starts
- Adequate band of healthy attached tissue is necessary.

ROTARY CURETTAGE

Even though slight deepening of the sulcus may result, rotary curettage does not have much effect on gingival margin heights if adequate keratinized gingiva is present around the teeth.¹⁴

ADVANTAGES

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

DISADVANTAGES

- Causes considerable hemorrhage
- High risk of traumatizing the epithelial attachment.

POLYMERS AND PASTES

Recently, polymers and pastes have been introduced in 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.¹⁵ The strength of epithelial attachment is 1 N / mm. Very low 0.01 N / mm pressure will cause the sulcus to open and quick recovery happens. Pressure of 0.1 N / mm makes the sulcus open at 1.5 mm limit and delays the recovery to 2 minutes per 0.5 mm opening. Paste infusion into the gingival sulcus provides constant and non-destructive pressure of 0.1 N / mm. If the paste remains in place for 1 minute, enough pressure to open the sulcus 0.5 mm will be achieved within 2 minutes.¹⁶ Expasyl paste material provides high hemostasis and a little gingival retraction and is a chemical agent in an injectable matrix that may be applied in impression making and delivery of indirect restorations. It must be isolated to the saliva during application. Expasyl paste contains aluminum chloride 15% as a hemostatic agent and White Clay for consistency and is injected directly into the gingival sulcus. Moreover, it can be 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 effects remain 4 minutes after thorough rinsing with air and water. Disadvantages are greater cost, inhibiting polymerization of polyether and polyvinyl siloxane impression materials. It is also less effective in sub-gingival positioned deep margins. But it is a simple, fast and painless method which doesn't create any chemical reaction, tissue inflammation and trauma. Compared to traditional methods, possible risk of tissue trauma to the epithelial attachment, gingival recession and bone loss is avoided.¹⁷

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.¹⁸

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. However, it is less effective in sub-gingival margins.¹⁸ Expasyl and Magic Foam Cord resulted in less tissue destruction compared to other methods.

In 2009, a study conducted by Beier US *et al.* revealed that Magic Foam Cord is effective in epi-gingival and sub-gingival prepared margins less than 2 mm; however, in bevel and sub-gingival prepared margins, single cord is much more efficient to Magic Foam Cord.¹⁹

DISCUSSION

Gingival retraction holds an indispensable place during soft tissue management before an impression is made. Several problems that can arise from poor marginal fit of fixed dental prostheses can be prevented if the margins of prepared tooth are recorded after adequate exposure by any of the above mentioned gingival retraction methods. The choice of technique and material depends on operator's judgement of the clinical situation apart from availability and cost of the materials. Swift increase in research work in the recent past leaves no option for a clinician, but to be updated and to possess optimum knowledge to rationalize the use of materials and techniques that are employed for gingival displacement in proximity to both teeth as well as implants.

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