



## Gingival Retraction: Past to Current Trends - A Review

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### ABSTRACT:

The success and longevity of a fixed prosthesis are influenced by several factors, out of which are the technique of impression making and accuracy in replicating it plays a crucial role. Gingival retraction holds an indispensable position before recording the impression of the prepared tooth. However, the retraction materials and procedures should be atraumatic, cost effective, easily available and should not interfere with the setting reactions of the impression materials. Therefore, this review article highlights the need for gingival retraction, pre-retraction considerations, various retraction systems, and their recent advancements.

**KEYWORDS:** Fixed prosthesis, gingival retraction, retraction cord.

### I. INTRODUCTION

The long-term success of a prosthodontic restoration is enormously dependent on the gingival and periodontal factors<sup>1</sup>. As the margins of the restoration maintain an intimate interaction with the surrounding soft tissues, all procedures performed should prioritize the health of the gingiva and periodontium. Despite the drawbacks considered, few restorations require subgingival margins<sup>2, 3</sup>. In situations like these, the adjacent soft tissues need to be retracted and displaced adequately to enable the impression material to penetrate and record, not only the features of preparation and finish line but also some portion of the unprepared tooth structure apically<sup>4</sup>. This is further influenced by the variations in the sulcular depth, distensibility of gingival tissues, gingival bio-type, gingival inflammation, etc. making it a technique-sensitive procedure. The sulcular width of at least 0.2 mm is required, so that the impression material from the sulcus is retrieved without any tear or distortion<sup>5</sup>. However, a thorough assessment of the gingival tissues and adjacent supporting structures is essential before

planning for restoration with subgingival margins or before any gingival retraction is contemplated<sup>6</sup>. Over the past few decades, the gingival retraction systems have evolved tremendously, assuring a thorough and minimally invasive retraction<sup>7</sup>.

### NEED FOR GINGIVAL RETRACTION<sup>8</sup>:

- ✓ For widening the gingival sulcus to enable the impression material to reach the subgingival margins and to accurately record the finish line.
- ✓ It helps in the fabrication of a perfect die with accurate margins for proper contouring and placement of restorative margin.
- ✓ Enables blending of the restorative margins with the unprepared tooth surface.
- ✓ Finishing of the margins on the prepared tooth.
- ✓ After cementation, it helps in the easy retrieval of excess cement without any tissue damage.
- ✓ Helps to visualize and assess the marginal fit of the restoration and diagnose cervical caries if any are present.
- ✓ To enhance access and prevent damage to the gingiva caused by high-speed rotary instruments during preparation.
- ✓ Control of hemorrhage during restorative procedures.
- ✓ Enables the removal of excess gingival tissue.

### RATIONALE FOR GINGIVAL DISPLACEMENT<sup>9</sup>:

The goal of the procedure is to reversibly displace the gingival tissues, not only in a lateral but also in the apical direction so that a bulk of low-viscosity impression material enters the widened sulcus and records the marginal details more accurately.

### BIOLOGIC WIDTH CONSIDERATIONS:

Biologic width is defined as the dimension of the soft tissue attached to the portion of the tooth coronal to the crest of the alveolar bone that



includes the total width of the junctional epithelium (range between 0.71 to 1.35mm, mean 0.97mm) and supraalveolar connective tissue attachment (rang 1.06 - 1.08mm, mean 1.07mm) resulting in the biologic width of  $0.97 + 1.07 = 2.04$  mm. The significance of biologic width is that it acts as a barrier and prevents the penetration of microorganisms into the periodontium. Therefore, to permit adequate healing and to maintain a healthy periodontium, a minimum of 3mm space between the restoration margin and the alveolar bone is recommended. This maintains an adequate biologic width (2.04mm) even when the margins are placed 0.5mm within the sulcus. Violation of biologic width results in bone loss under the preparation margin, gingival recession, pocket formation, localized gingival hyperplasia, and progressive periodontal tissue loss<sup>10,11</sup>.

#### METHODS OF GINGIVAL RETRACTION MECHANICAL METHODS OF GINGIVAL RETRACTION:

These techniques not only tend to physically retract and displace the soft tissues but also provide hemostasis and control 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 provide isolation and retraction of gingiva for cervical or subgingival restorations and wedges physically depress the gingiva for retraction when placed interproximally. Thus, they are used for protecting the gingiva during tooth preparation<sup>12</sup>.

#### Gingival protector:

It is a small instrument with a crescent-shaped tip that can be placed and adjusted according to the contour of the gingival tissues. It physically displaces and protects the gingiva during the preparation of tooth structure close to the gingival margin<sup>12</sup>.



#### Rubber-dam:

The heavy, extra heavy, and special heavy rubber

dam, together with specialized clamps (eg. Ferrier 212, Schultz, Brinker's clamp B5, B6), can be used to retract and protect the gingival tissues during the tooth preparation and provide isolation for subsequent restoration placement as well. With the clamps in position, modified trays can be used to record impressions. However, it cannot be applied for full mouth impressions<sup>12</sup>.

#### Copper ring technique:

This method involves the use of a copper band or ring filled with modeling compound or elastomeric impression material to record the subgingival margins. The copper band physically displaces the tissue and the subsequent impression records the subgingival tooth structure. However, this technique is considered detrimental to the gingival tissues<sup>13</sup>.

#### Anatomic retraction caps:

The retraction caps work on the same principle as the copper bands, except that they are available pre-shaped for easy placement between adjacent teeth. Once they are properly positioned, the patient bites on them<sup>13</sup>.



#### Retraction cords:

They are one of the popular methods of gingival retraction. Based on the chemical treatment, they are classified as plain and non-impregnated. Based on their configuration they are broadly classified into knitted, twisted, or braided<sup>14</sup>.

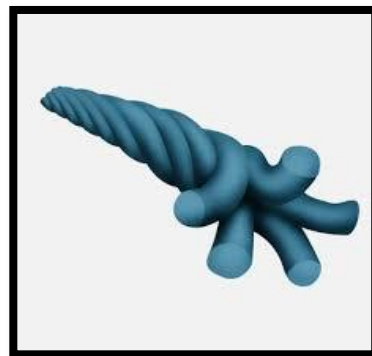
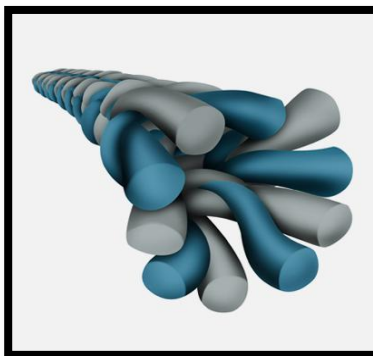
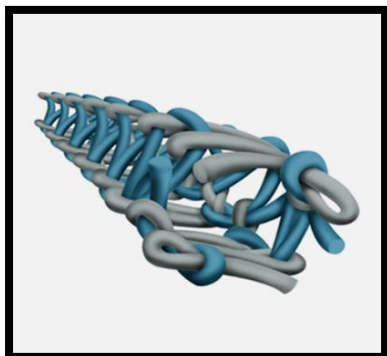
**Knitted cords** have interlocking loops that prevent displacement of the cord when the adjacent segment is being pushed into the sulcus. This configuration enables the cord to passively bend and shape during placement in the gingival sulcus. However, these cords have a tendency to compress while being 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<sup>15,16</sup>.



**Twisted cords** tend to untwist and fray during placement in the sulcus. Thus, they are least indicated compared to the other types<sup>15,16</sup>.

**Braided cords** have a tight weave that favors easier to place into the gingival sulcus without fear of

fraying. When pressure is applied along one segment, these cords have a greater tendency to push out of the sulcus from another point<sup>15,16</sup>.



Depending on the thickness they are color-coded: Black-000, yellow-00, purple-0, blue-1, green-2, and red-3

**CHEMO-MECHANICAL METHODS:**

In this method, the retraction cords are used with chemicals or a medicament<sup>17-20</sup>. Various chemicals used are listed in (table 1).

TYPE OF AGENT	ADVANTAGES	DISADVANTAGES
Epinephrine	<ul style="list-style-type: none"> <li>✓ Vasoconstrictive</li> <li>✓ Hemostatic</li> </ul>	<ul style="list-style-type: none"> <li>✓ Systemic effects: epinephrine syndrome</li> <li>✓ Risk of inflammation of gingival cuff</li> <li>✓ Rebound hyperemia</li> <li>✓ Risk of tissue necrosis</li> </ul>
Ferric sulfate	<ul style="list-style-type: none"> <li>✓ Hemostasis</li> </ul>	<ul style="list-style-type: none"> <li>✓ Tissue discoloration</li> <li>✓ Acidic taste</li> <li>✓ Risk of sulcus contamination</li> <li>✓ Inhibits set of polyvinyl siloxane and polyether impressions</li> </ul>
Aluminum sulfate and aluminum potassium sulfate (ALUM)	<ul style="list-style-type: none"> <li>✓ Hemostasis</li> <li>✓ Least inflammation of all agents</li> <li>✓ Little sulcus collapse after cord removal</li> </ul>	<ul style="list-style-type: none"> <li>✓ Least inflammation of all agents</li> <li>✓ Little sulcus collapse after cord removal</li> </ul>
Aluminum chloride	<ul style="list-style-type: none"> <li>✓ No systemic effects</li> <li>✓ Least irritating of all chemicals</li> <li>✓ Hemostasis</li> <li>✓ Little sulcus collapse after cord removal</li> </ul>	<ul style="list-style-type: none"> <li>✓ Less vasoconstriction than epinephrine</li> <li>✓ Risk of sulcus contamination</li> <li>✓ Modifies surface detail reproduction</li> <li>✓ Inhibits the setting reaction of polyvinyl siloxane and polyether impression materials.</li> </ul>
Tannic acid	<ul style="list-style-type: none"> <li>✓ Good tissue recovery</li> </ul>	<ul style="list-style-type: none"> <li>✓ Less effective than epinephrine</li> <li>✓ Minimum Hemostatic efficacy</li> </ul>
Zinc chloride and silver nitrate	<ul style="list-style-type: none"> <li>✓ Hemostasis</li> </ul>	<ul style="list-style-type: none"> <li>✓ Soft-tissue injury</li> <li>✓ Tooth injury</li> </ul>
Negatalol solution (metacresol sulfonic acid and formaldehyde)	<ul style="list-style-type: none"> <li>✓ Better retraction than epinephrine</li> </ul>	<ul style="list-style-type: none"> <li>✓ Tissue recovery is poor.</li> <li>✓ Highly acidic</li> <li>✓ Decalcifies teeth</li> </ul>



**SURGICAL METHODS 21-24: (Table-2)**

**Lasers:**

Most commonly diode lasers are used for gingival retraction around natural teeth because result in less bleeding and gingival recession. The other lasers include neodymium: yttrium-aluminum-garnet (Nd-YAG) lasers, erbium: yttrium-aluminum-garnet (Er:YAG) lasers, and CO2 lasers.

**Electrosurgery:**

This technique involves a small electrode that is oriented parallel to the long axis of the tooth to enlarge the gingival sulcus so that only tissues from the inner wall of the sulcus are removed.

**Rotary curettage:**

This technique uses a torpedo bur for removing the epithelial lining of the sulcus and simultaneously forming a chamfer finishing line.

Technique	Advantages	Disadvantages
Lasers	<ul style="list-style-type: none"> <li>✓ Excellent hemostasis: carbon dioxide laser</li> <li>✓ Reduced tissue shrinkage</li> <li>✓ Relatively painless</li> <li>✓ Sterilizes sulcus</li> </ul>	<ul style="list-style-type: none"> <li>✓ Er:YAG laser is not as good at hemostasis as CO2 laser</li> <li>✓ CO2 laser provides no tactile feedback, leading to a risk of damage to the junctional epithelium.</li> </ul>
Electrosurgery	<ul style="list-style-type: none"> <li>✓ Efficient</li> <li>✓ Precise hemostasis while incising the tissues</li> </ul>	<ul style="list-style-type: none"> <li>✓ Contraindicated in patients with pacemakers</li> <li>✓ Cannot be used concomitantly with nitrous-oxide oxygen sedation as nitrous oxide is a flammable agent</li> <li>✓ Cannot control hemorrhage once it starts</li> <li>✓ An adequate band of healthy attached tissue is necessary.</li> </ul>
Rotary curettage	<ul style="list-style-type: none"> <li>✓ Fast</li> <li>✓ Ability to reduce excessive tissue</li> <li>✓ Ability to recontour gingival outline</li> </ul>	<ul style="list-style-type: none"> <li>✓ Causes considerable hemorrhage</li> <li>✓ High risk of traumatizing the epithelial attachment</li> </ul>

**RECENT ADVANCEMENTS:**

**Expasyl retraction system(1-2min):**It is a viscous synthetic paste containing 10% aluminum chloride, and 80% kaolin, with water and modifiers.It is available as reusable capsules that can be decontaminated and the small cannula tip helps to inject the material into the sulcus<sup>25</sup>.



**Merocel:**

It is a synthetic polymer that has a sponge-like texture and is cut into 2 mm strips. It is composed of hydroxylated polyvinyl acetate, which is a biocompatible polymer.Once placed in the

gingival sulcus, it absorbs fluid and, swells up occupying the gingival sulcus<sup>26</sup>.



**Magic foam(5 mins):**

It is polyvinyl siloxane-based material that has the ability to expand and displace the gingival tissues once placed in the sulcus.It is used in combination with a compression cap on which the patient is allowed to bite for retraction. It is an atraumatic method, with no hemostatic chemicals that tend to contaminate the impression site<sup>27</sup>.

**GingiTrac:**



It is available as a preloaded syringe with a paste form containing an astringent, aluminium sulfate. Often used in combination with compression caps<sup>25</sup>.



#### Racegel:

It is available as a gel form containing hemostatic agents like 25% aluminum chloride, oxyguinol, and excipients. Due to its thermodynamic behavior, it becomes more viscous on tissue contact and can be easily rinsed, without causing any irritation to the surrounding tissues. It can be used with or without retraction cords<sup>25</sup>.



#### Retraction capsule:

It is an astringent retraction paste is available as capsules with a long, slim nozzle and a soft edge that allows the direct delivery of the high viscosity astringent paste into the gingival sulcus. It is composed of 15% aluminum chloride. The nozzle is provided with an orientation ring marked in white that prevents excessive impingement in the gingival sulcus<sup>25</sup>.



#### Stay-put retraction cord:

It is a special retraction cord with a thin wire incorporated into the center. This cord can be pre-shaped and its pliability makes it easier to be placed in the sulcus. They are available in four sizes, according to width (0–3) and also as plain and pre-impregnated<sup>27</sup>.

#### GINGIVAL DISPLACEMENT IN IMPLANTS:

Few situations in the restorative phase of implants require the fabrication of customized abutments with subgingival margins, especially in esthetic regions. However, the peri-implant tissues are delicate with an increased chance of damage and recession, when they experience any trauma resulting from retraction procedures. Rotary curettage increases the risk of the bur damaging the implant surface as well as exposing implant threads due to tissue retraction. Due to the risk of arcing, electrosurgery is contraindicated with an implant. CO<sub>2</sub> lasers absorb little energy with a minimal rise in temperatures (<3°C) and minimal collateral damage. These lasers do not usually alter the structure of the implant surface.

However, they result in large defects if used deeply around the implants. The injectable matrix technique sounds promising for implant situations yet require further development<sup>28, 29</sup>.

**G-Cuff:** A gingival cuff is a dental device comprising a tubular-conical shape collar used for impression making during the restorative phase of a dental implant. The main purpose of it is to displace the peri-implant soft tissue allowing the impression material to access the surface of the abutment for optimal restoration<sup>30</sup>.





### GINGIVAL DISPLACEMENT IN DIGITAL IMPRESSIONS:

Digital computer-aided design/computer-aided manufacturing (CAD/ CAM) impressions require a clean gingival sulcus. Retraction cord fibers that remain in the sulcus may affect the accuracy of the impression resulting in artifact-generated errors. An injectable matrix with 15% aluminum chloride reduces these artifacts by leaving a clean sulcus on removal<sup>31</sup>.

### CONCLUSION:

Gingival retraction is considered to be a critical step during impression making as it greatly influences the restorative outcome. The recent advancements enabled a minimally invasive retraction of the gingival tissues. However, the selection of technique and material is entirely the clinician's choice based on the situation.

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