

## GINGIVAL DILATION – A BOON IN FIXED PROSTHODONTICS

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**Abstract**

Numerous advancements have occurred in impression making for fixed prosthesis in the present century. Use of improvised materials and sophisticated techniques are propagated only with the aim to record the margins and the gingival tissues properly. The gingival retraction is done to displace the tissues laterally to achieve the desired aim of recording the sub-gingival margins. The purpose of this article is to review the latest advancements in the field of tissue retraction and analyse their merits and demerits. Advancements are a never ending process and will continue to advance day by day. It is our responsibility as a dentist to keep an eye on latest developments, choose the appropriate treatment plan and execute it as precisely as possible.

**Key Words:** - Gingiva, Margin, Retraction, Sub-Gingival

**Introduction**

Impression making is one of the key factors influencing the success of any fixed prosthesis. The patient's mouth is a challenging environment to make an accurate impression. The impression must be free of air bubbles, tears, thin spots, and other imperfections that might produce inaccuracies. Except for the polyether, all elastomeric impression materials are hydrophobic or slightly hydrophilic. Any moisture results in voids.<sup>1</sup> The goal of displacing the tissues is to reversibly displace the gingival tissues in a lateral direction so that a bulk of low viscosity impression material can be introduced into the widened sulcus and capture the marginal details.<sup>2</sup> It is imperative that a small amount of impression material flows beyond the prepared margin permitting accurate trimming of the recovered die. If the gingival tissues are healthy and cervical margin is appropriately placed, then, gingival displacement becomes a relatively simple, atraumatic procedure.

**Definition**

*It is defined as the deflection of the marginal gingiva away from a tooth.<sup>3</sup>*

Procedure used to facilitate effective impression making with intra-cervicular margins is gingival displacement.<sup>4</sup>

**Classifications**

- Classified by Thompson MJ<sup>5</sup> as
  1. Mechanical
  2. Chemico – mechanical (mostly preferred)
  3. Surgical
- Surgical techniques are further classified by Miller IF<sup>6</sup> as
  1. Rotary curettage
  2. Electrosurgery
- Classified by Tylmann<sup>7</sup> as follows:
  - Mechanical – The tissue is displaced strictly by mechanical methods.

- Mechanical – Chemical – A cord is used for mechanically separating the tissue from the cavity margin and is impregnated with chemical for haemostasis as impressions are made.
- Surgical – A ribbon of gingival tissue is removed from the sulcus around the cavity margin with electro surgery.
- Classified by Richard G. Klug<sup>8</sup> depending on whether or not a loss of tissue results from the use of the method as: -
  1. Conservative
  2. Radical
- The *conservative methods* obtain adequate gingival retraction by means of mechanical and chemical displacement of the gingival tissues.
- The *radical methods* obtain adequate gingival retraction through the actual removal of gingival tissues, either in whole or in part.

**Techniques****I. MECHANICAL**

Physically displacing the gingiva was one of the first methods used for insuring adequate reproduction of the preparation finish line.

**A .Copper band and tube**

Copper band and tube can both serve as a mean of carrying impression material and mechanism for displacing the gingiva. One end of the tube is festooned, or trimmed, to follow the profile of gingival finish line, which, in turn, often follows the contours of the free gingival margin. The tube is filled with impression compound<sup>9</sup> or elastomers. Use of copper bands can cause incisional injuries of gingival tissues.<sup>10</sup> It is useful in situations in which several teeth have been prepared thus negotiating the need of full arch impression.

## B. Rubber dam

Can accomplish the exposure of the finish line needed. Used when a limited number of teeth in one quadrant are being restored and in situations in which preparations do not have to be extended very far sub-gingivally.

*NOTE –Rubber dam should never be used with polyvinyl siloxane impression material because rubber inhibits its polymerization.*

## C. Plain cotton cord

It is used with elastic impression materials for sulcus enlargement physically pushing away the gingiva from the finish line. Has a limited use as pressure alone will not be able to control haemorrhage.

## II. CHEMICO-MECHANICAL

To obtain the dual benefits of pressure packing along with chemical action, use of this method came to being.

### Advantages<sup>11</sup>

- Enlargement of the gingival sulcus.
- Control of fluid seeping from the walls of the gingival sulcus is more readily accomplished.

### Chemicals used

The purpose of using a chemical along with a cord is to induce temporary shrinkage of the tissues, control hemorrhage and any chances of gingival fluid seepage.

Various chemicals have been tried and evaluated. Some of the most common ones are<sup>12,13</sup>

- Racemic epinephrine  
0.1% solution  
8% impregnated cord
- Alum
- Tannic acid
- Sulfuric acid
- Aluminium chloride  
5% or 25%
- Ferric sulphate  
13.3%
- Zinc chloride  
8% or 40%
- Negatol (45% metacresol sulfonic acid + formaldehyde)
- Monsel's solution (solution of ferric subsulfate)
- Nasal and ophthalmic decongestants
- Tetrahydrozoline HCL 0.05%
- Oxymetazoline 0.05%
- Phenylephrine HCL 0.25%

### Epinephrine

Its use is declining since 1980 due to the controversies regarding its use.

### Advantages

- Effectiveness in gingival displacement
- Haemostasis

- Absence of irreversible damage to gingival tissues.

### Disadvantages

Can be absorbed into systemic circulation through the exposed gingival capillaries and produce 'epinephrine syndrome' characterized by increased blood pressure, increased heart rate, rapid respiration, anxiety and post-operative depression.<sup>14</sup>

### Aluminium sulphate and Aluminium potassium sulphate (alum)

These are astringents which precipitate proteins, but do not penetrate cells, thus affecting the superficial layer only.<sup>15</sup> They cause hemostasis by a weak vasoconstrictor effect in addition to precipitation of tissue proteins with tissue constriction, inhibited trans-capillary movements of plasma proteins, and subsequent arrest of capillary bleeding.<sup>16</sup>

Weir and Williams<sup>17</sup> compared clinical effectiveness of Aluminium sulfate with racemic epinephrine on 120 natural teeth of 58 patients over a period of 6 months and found no significant differences.

### Advantages

- Haemostasis
- Least inflammation of all the agents
- Little sulcus collapse after cord removal

### Disadvantages

- Offensive taste
- Risk of necrosis if in high concentrations.

### Aluminium chloride

Aluminium chloride is an agent that acts by precipitation of tissue proteins<sup>18</sup> but causes less vasoconstriction than epinephrine.<sup>19</sup> It is least irritating of all the medicaments used for impregnating retraction cords but it possesses a vital shortcoming of inhibiting the polyvinyl siloxane and polyether impression materials.<sup>20</sup>

### 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
- Modifies surface detail reproduction
- Inhibits set of polyvinyl siloxane and polyether impressions.

### Zinc chloride, Negatol, Monsel's solution and Tannic acid<sup>12</sup>

Specific problems are associated with these leading to their decreased use. Zinc chloride (8%) can be used satisfactorily without permanent recession if application limits to 3 to 4 minutes. Zinc chloride (40%) is highly caustic and is only

indicated for conditions which require the removal of hypertrophied gingival tissues. Negatol is highly acidic and strictly contraindicated as decalcifies tooth structure. Monsel's solution is also highly acidic. Tannic acid (20%) is less toxic to the tissues but they are not as effective as retraction agent. The tissue recovery with use of Zinc chloride and Negatol is unsatisfactory.

### Ferric sulphate

Owing to its iron content, Ferric sulphate stains the gingival tissue yellow-brown to black colour for few days after use.<sup>21</sup>

### Advantages

Haemostasis

### Disadvantages

Tissue discoloration.

Acidic taste.

Risk of sulcus contamination.

Inhibits set of polyvinyl siloxane and polyether impressions.

### Nasal and Ophthalmic Decongestants

Visine (Tetrahydrozoline HCL 0.05%), Afrin (Oxymetazoline (0.05%), and Neosynephrine (Phenylephrine HCL (0.25%)) are newly introduced retraction agents. They are sympathomimetic amines acting directly on  $\alpha_2$  agonists having most prominent local constrictor actions with minimal systemic effects.<sup>15</sup> Studies compared visine with epinephrine and found visine to produce around 50% more tissue displacement and slightly better control of crevicular fluid with no detectable side effects.<sup>22</sup>

Woody, Miller and Staffanou<sup>23</sup> compared pH of hemostatic agents used in retraction procedures and found pH of visine (6.2) and of afrine (6.3) that was greater than other agents tested and also close to neutrality.

### Techniques of Gingival Displacement<sup>24</sup>

Gingival displacement can be accomplished using different techniques. Common to all is use of a chemical agent along with a retraction agent.

### Single Cord Technique

It is most common method of achieving gingival displacement. It is relatively simple and efficient technique which is primarily indicated when making impressions of one to three teeth with healthy gingival tissues. Cord is placed for 8-10 minutes in the sulcus.

### Double Cord Technique

This technique is routinely used when making impressions of multiple prepared teeth and in case where tissue health is compromised.<sup>25</sup> It is especially useful with multiple preparations where gingival fluid exudate can seep over the prepared cervical margins of the last teeth to be impressed after removal of cord.

### The Infusion Technique<sup>25</sup>

The Infusion technique overcomes the common problem of dislodging of the coagulum on rinsing of margins before impression making. This technique uses an instrument Dento-Infuser along with 20% ferric sulphate and has proved to be an ancillary technique for control of hemorrhage when using the single cord technique.

Dento-Infuser consists of a hollow metal or plastic tube with a padded tip at one end. The padded tip is shaped such that it approximates closely to the tissues thus creating a partial seal with the tissues.



Figure 1: - Astringent solution and Dento-Infuser applicator.

Note: The cord is left only in the sulcus only for 1 to 3 minutes. This may not provide adequate lateral displacement which is a drawback of the technique.

Patients should be forewarned that the tissues may be temporarily darkened. The tissues take on a blue-black appearance that usually disappears in a few days.

### The "Every Other Tooth" Technique<sup>26</sup>

This technique is preferred in high aesthetic zones. In teeth with root proximity, retraction cord placed simultaneously around all prepared teeth may result in strangulation of the gingival papillae and eventual loss of the papillae. This creates unaesthetic black triangles in the gingival embrasures.

This undesirable outcome can be prevented with the "every other tooth" technique. Retraction cord is placed starting with the most distal prepared tooth with no cord. Retraction procedures are performed on alternate teeth. The impression is made: gingival displacement is accomplished on teeth which were left in earlier step and a second impression is made. A subsequent pick-up impression allows fabrication of a master cast with dies for all the prepared teeth.

## III. SURGICAL

### A. Rotary Curettage

Also called as Gingetage<sup>27</sup>

Rotary curettage is a "troughing" technique, the purpose of which is to produce limited removal of epithelial tissue in the sulcus while a chamfer line is being created in the tooth structure. The concept of using rotary curettage was introduced by Amsterdam in 1954 and subsequently



enlarged upon by Ingram. Gingetage involves simultaneous sub-gingival tooth preparation and intentional rotary diamond instrument curettage of the inner lining of the gingival sulcus. Gingival curettage performed with a rotating pencil point diamond stone operating at approximately 7500 rpm removed the pocket epithelium successfully in five of six patients.

Blass and Lite<sup>28</sup> did microscopic study of healing process in healthy patient following rotary curettage and found complete healing within 10 days.

#### Requirements

- Absence of bleeding upon probing.
- Sulcus depth less than 3.0mm.
- Presence of adequate keratinized gingival.

#### Advantages

- Fast Procedure.
- Ability to reduce excessive tissues.
- Ability to re-contour gingival outline.

#### Disadvantages

- Causes considerable haemorrhage
- High risk of traumatizing epithelia attachment
- Poor tactile sensation when using on sulcular walls.

*Note: The technique is highly sensitive and also has the potential for destruction of periodontium if used incorrectly; making this a method that is probably best if used only by experienced dentists.*

### B. Electrosurgery

Also, known as surgical diathermy.

Electrosurgery is removal of inflamed, irritated and angry tissues that has been proliferated over preparation finish lines.<sup>29</sup> An electrosurgery unit is a high frequency oscillator or radio transmitter that uses either a vacuum tube or a transmitter to deliver a high frequency electrical current of at least 1.0 MHz.

#### Types of Current<sup>11</sup>

There are different forms of currents generated for electrosurgical use which can be viewed on an oscilloscope.

- Unrectified damped current
- Partially rectified damped current
- Fully rectified current
- Fully rectified, filtered current

Unrectified damped current is characterized by recurring peaks of power that rapidly diminishes. It is the current produced by spark gap generator, and it gives rise to intense dehydration and necrosis. It causes considerable coagulation and healing is slow and painful. Not routinely used now a days.

Partially rectified damped current produces a wave-form with a damping in the second half of each cycle. There is lateral penetration of heat, with slow healing occurring in deep tissues. The damping effect produces good

coagulation and hemostasis, but tissue destruction is considerable and healing is slow.

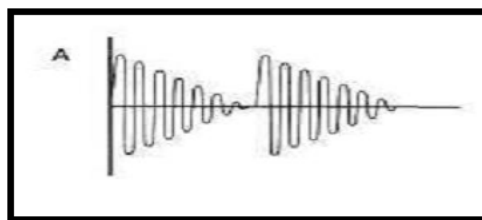


Figure 2: -Unrectified damped current

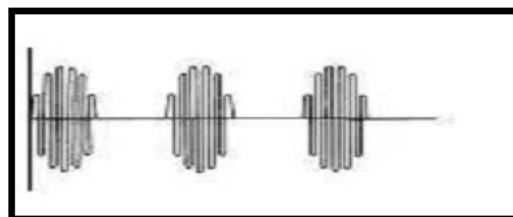


Figure 3: - Partially rectified damped current

Fully rectified current is better current for enlargement of gingival sulcus which produces a continuous flow of energy. Cutting characteristics are good and there is some hemostasis.

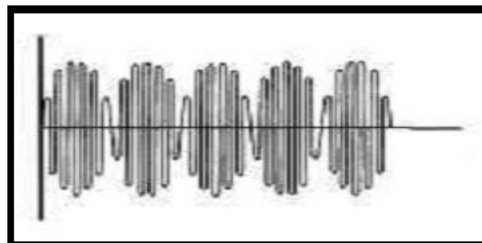


Figure 4: - Fully rectified current

Fully rectified filtered current is a better current that produces excellent cutting. The healing of tissues cut by continuous wave current will be better than that of modulated wave. Filtered current produces better healing in situations requiring an incision and healing by primary intention, because of less coagulation of the tissues in the walls of the wound.

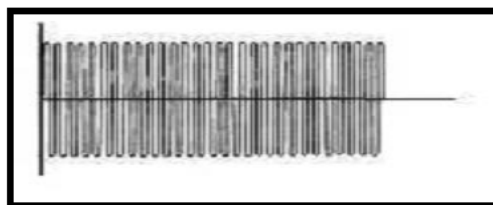


Figure 5: - Fully rectified filtered current

#### Contraindications for Electrosurgery

It should not be used in patients with cardiac pacemakers nor should be used in presence of flammable agents as produce sparks during use. There is also danger associated with use of nitrous oxide with electrosurgery as of potential risk of fire because of the enriched oxygen atmosphere that will be present in the oral cavity and nasopharynx.

## Conclusion

Gingival Dilation is an important factor determining success and functioning of the fixed prosthesis. It is relatively simple and effective provided proper knowledge, technique, selection and application is there. No scientific data has stated one technique to be adequate for all the cases so it is in hands of the operator to carefully analyze the clinical situation and decide which technique would be best suited for the patient. Selection of the Hemostatic Agent should be highly precise and if possible Epinephrine should be avoided as of complications. Since the modern dentistry is more inclined towards preventive mode of treatment, the use of recent techniques and retraction with the help of cords impregnated with hemostatic agents should be encouraged. Use of invasive procedures such as electrosurgery should be carried out only if deemed necessary.

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