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MANAGEMENT OF GINGIVAL TISSUE IN RESTORATIVE PROCEDURES.

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ABSTRACT

Tissue management includes placing the gingival tissues away from the preparation margins so they can be impressed, combined with providing for hemostasis when the gingival tissues are susceptible to bleeding. Gingival tissue displacement is essential for obtaining accurate impressions of the preparation margins, especially when the finish line is at or within the gingival sulcusThe methods of gingival retraction may be either surgical or non-surgical and the purpose of this article is to enumerate the various techniques which can provide adequate gingival retraction.

KEYWORDS: Gingival tissues, Gingival retraction, Restorative dental procedures, Periodontium.

INTRODUCTION

An objective of restorative dental procedures is the placement of dental materials to restore teeth to proper form, function,esthetics, and comfort[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.It is the sum of epithelial and connective tissue attachments which is 2.04mm. Therefore, a minimum width of 3mm (including the depth of the gingival sulcus) must be maintained from the preparation margin of any restoration to the 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]

Indications

Presence of subgingival caries fracture or finish line Cervical abrasion, erosion or abfraction Elastomeric impressions, Decreased crown: root ratio Gingival polyp, Severely attrited teeth requiring a cast restoration.

Contra-indications

Poor oral hygiene, Presence of gingival disease
Gingival recession, Bone loss

Advantages

Better accessibility, visibility and ease of operation Control of gingival crevicular fluid and bleeding Proper contouring, adaptation and setting of restorative materials Better esthetics due to improved angle of emergence Crown lengthening as per the clinical requirement Precautions to be taken so that the procedures prevent any irreversible damage to the periodontium and prevent any hazard to the distant tissues or organs orally, para-orally or systemically.

Pre-requisites for gingival tissue management maintain visibility, manipulation and proper reproduction of details.

A temporary trough should be made in the gingival crevice that is free of fluid, readily accessible and which exposes all the details of the circumferential tie as well as the portion of the unprepared tooth surface apical to it.

These objectives should be accomplished without detaching the apically located epithelial attachment and periodontal ligament.

They should not cause any irreversible damage to the gingiva / periodontium.

They should not cause any hazard to the distant tissues or organs orally, para-orally or systemically.

DISCUSSION

Classification

According to MARZOUK[3] Physico-mechanical means, Temporary restorations like IRM, Rolled cotton or synthetic cords. Heavy weight rubber dam. Chemical means –Cords, Cotton pellets or drawn cotton rolls.

These are impregnated with vasoconstrictors, fluid coagulants or surface layer coagulants
Electrosurgical means by using electrodes in cutting, coagulation, fulguration, desiccation Surgical means- Gingivectomy.

According to TYLMAN, Mechanical- Copper band
Mechanical – Chemical, Cords impregnated with chemicals

Surgical, Electrosurgery, Gingitage, Coming to each technique individually dividing them mainly into 3 major *headings:* Mechanical, Chemical, electrocautery, Surgical, Polymers, and pastes.

MECHANICAL

Absolutely healthy gingivae and a good vascular supply.
A definite zone of Attached Gingivae apical to the free gingiva to be displaced.

Adequate dimension of bone support without any resorption.

The methods are
Use of customized temporary restorations where the gingival ends are blunted and are covered with bulky temporary cements like Zinc-oxide eugenol In this method, results cannot be observed for 24 hours.

Copper bands: Oversized Copper bands are contoured to the gingiva and restricted towards the cavity margin when gently seated over the tooth.

Some other literature also suggest usage of Rubber rings., Leather rings. Aluminium bands. Stainless steel bands

Use of Rolled Cotton or Synthetic Cords which are forcibly introduced into the gingival sulcus. Results are seen within 30 minutes

Use of Heavy Weight Rubber Dam, which gives immediate results.

Disadvantages: Full arch impressions are difficult with this technique. methods use retraction cords, drawn cotton rolls and cotton pellets impregnated with chemicals for stoppage of bleeding and seeping of crevicular fluid.

A variety of chemicals are available and constitute 3 major categories as suggested by Marzouk.

1) VASOCONSTRICTORS

a) Epinephrine b) Nor –epinephrine

2) BIOLOGIC FLUID COAGULANTS

100% Alum, 15-25% Aluminium chloride, 10% Aluminium potassium sulfate, 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% Zincchloride b) Ferric subsulfate (monsel'spowder)
c) 20"% Tannic acid d) 14% Alum

2) chemical cautery
a) 40% Zinc chloride b) Potassium hydroxide

3) vasoconstrictors
a) Epinephrine b) 3% Ephedrine sulfate

Vasoconstrictors

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.

Most commonly used agents are 8% racemic epinephrine and non-epinephrine

Contraindications

Cardiac arrhythmias. Severe cardiovascular diseases. Diabetes.

Uncontrolled hyperthyroidism. Patients receiving drugs such as β-blockers, anti-depressants or rauwolfia drugs.

Epinephrine syndrome /epinephrine reaction
1)tachycardia 2) Increased Blood Pressure 3) Nervousness 4) Anxiety 5) Increased Respiration 6) Post-operative Depression
These Effects May Appear After Cord Has been In Place For a Few Mins/sometime After Removal Of Cord.

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.

Eg.:100% alum, 15-25% aluminium chloride,10% aluminium potassium sulphate, 15-25% tannic acid.

100% Alum is used most commonly instead of epinephrine. Aluminum chloride 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 cords, but it possesses a vital shortcoming of inhibiting the polyvinyl siloxane and polyether impression materials. Surface tissue layer coagulant, These coagulates surface layer of sulcular and free gingival epithelium as well as seeped fluid thus creating a temporary impenetrable film for underlying fluids including blood

Disadvantages of chemicals
Ulceration., Local necrosis., Changes in dimensions and location of free gingiva.

1) Retraction cord
Retraction cord is used for the isolation and retraction in direct procedures of treatment of cervical lesions,facial veneering or indirect procedures involving the gingival margin.

These are available in 2 types
- Ready made cotton.
- Synthetic woven cords.

Some cords have a metallic wire or a resin wire around them for compactness immobility and for a non-shredding property.Cords may be available in different size and numbers arbitrarily given by the manufacturers or may be supplied as already impregnated with the chemical or the chemical may be added before insertion of the cord after insertion while the cord is within the sulcus.

Advantages: They are fairly non-adhesive to the affected tissues because of their compactness.

Disadvantage: It is difficult to insert it within sulcus.

2) Drawn cotton rolls
Soft, loose cotton rolls can be readily rolled to a desired diameter to be introduced into the sulcus.

Advantages: Because of its looseness, it can be compacted in the sulcus easier than the cords.

Disadvantages: part of the coagulated surface layer may get deeply incorporated in cotton and when the cotton is removed, the coagulated sealing membrane may be pulled out initiating bleeding and fluid seepage called as "cotton roll burn".

The cotton rolls are very efficient in widening the trough and generating more shrinkage within the gingiva therefore they can accommodate more chemicals than cords.

3) Cotton pellets
These are used to carry the chemicals to the already compacted, inserted cords or drawn cotton rolls.If they are allowed to remain on top of the cord/cotton they provide a continuous source of chemical.

Electrosurgical means
Sometimes even if the general condition of the gingiva in the mouth is healthy, areas of inflammation or granulation tissue may be encountered around a given tooth as a result of space created because of physiologic tooth movement or caries resulting in cavitation which cannot be successfully handled by retraction methods.

Keeping this in mind a treatment modality using a high frequency electrical current of 1.0MHz (million cycles per second) or more to produce controlled tissue destruction to achieve a surgical result was devised.

D'Arsonval in[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. The electrosurgical unit is a high frequency oscillator or radiotransmitter which uses either a vacuum tube or a transmitter. The concept is similar to diathermy or a microwave. Current flows from a small cutting electrode which produces high current density and a rapid temperature rise at the contact point.

The cells directly adjacent to the electrode are volatilized by increased temperature.

The current concentrates at point and bends therefore cutting electrodes are designed to take advantage of this property.

CURRENTS
There are 4 main types of currents used for electrosugery depending on the type of machine and circuit.

unrectified, damped current
Characterized by recurring peaks of power which diminish rapidly.

Gives rise to intense dehydration and necrosis.

Considerable coagulation., Healing is slow and painful., Not routinely used.

partially rectified damped
Waveform with damping in second half of each cycle
Advantage: Good coagulant and hemostasis.

Disadvantage: lateral penetration of heat and slower healing., Tissue destruction is more.

fully rectified current
Continuous flow of energy, Advantages: Good cutting characteristics. Hemostasis is achieved., Better gingival enlargement is observed.

fully rectified filtered
Continuous wave., Excellent cutting.,Histologically healing was not as better as the fully rectified current.

The whole circuit is grounded by a ground electrode.

electrodes used
Selection of electrodes vary depending on the tooth,arch position and form of action.

Example
1) Cutting electrodes diamond loop, round loop and small loop are used for planing tissue.
2) Coagulating electodes which are small ball,large ball and bar electodes.

4 types of action can be produced at the electrode end.

(i) cutting also called Electrosection/Electrotomy / Acusection
This procedure is - Extremely precise, bloodless, minimal tissue involvement, requires unipolar electrode
There are different electrode tips used for this purpose.

The most commonly used ones are the:, diamond loop, small loop, straight wire
variable tip, Posner's AP 1½

After using a diamond or a continuous loop electrode a small amount of tissue tag remains which can be removed by a straight single wire tip or variable tip.
Variable tip electrode wire can be adjusted to a desired length.
Posner's AP 1½ indicates that the working tip extends 1½ mm beyond the insulation. This offers a precise, uniform depth of sulcus which is adjustable too.
The angle of working electrode is kept approximately 15-20 degrees. Holding it more angled results in loss of gingival height.
Whereas in anterior quadrant where the gingiva is thin, the angle of working electrode is nearly parallel to long axis of tooth
.
Note: -The depth of tissue removal is determined by the morphology of the tissue and biologic width. The tissue trough should extend 0.3-0.5mm below the finish line.

-It is always better to remove the inner wall of sulcus rather than the crest of gingiva to prevent recession.
-Cutting of attached gingiva result in permanent destruction of gingival height because it is important to know the difference between anatomic crown height and clinical crown height, especially in anterior quadrant where esthetics is of prime importance.

(ii) Coagulation
It causes coagulation of surface tissues, fluids and blood.
It destroys necrotic tissues and is used to remove granulation tissue.

Electrodes used are: Bar, small ball and large ball.

It is caused due to thermal energy introduced by electrode tips.
Partially rectified, partially damped output is used.
Overuse of tip causes carbonization of tissues creating a sealing film on the tissues.

(iii) Fulgeration
has greater energy because it can be used in deeper tissues.
Always accompanied by carbonization.
It has less after-effects than cutting and coagulation.
It requires bipolar electrode.
The tip remains above tissue. Current sparks are sprayed to the tissue in circular motion till the tissue becomes blackened or carbonized.
Dehydration of tissue occurs.

(iv) Dessication
This includes massive tissue involvement both in terms of depth and surface area.eg: Bipolar electrodes.

Disadvantages
It is most unlimited and uncontrolled.
Tissue reactions are unpredictable.
1800° heat generated.
Deeply penetrates causing permanent deformation.

Not frequently used.
General rules to be followed during electrosurgery Operation area should be moist because moist tissue cuts best.Use only fully rectified, undamped current with minimum energy output required for desired purpose.

If sparks appear it means that electricity output is too much.

If tip drags and collects streads of tissue clinging it indicates that the output is too low.

For cutting use light pressure touch and rapid deft strokes with a 5 seconds lapse between two strokes.

Never involve: → free gingiva.→ Crest of gingiva(recession).→attached gingiva (permanent separation).

Always keep cutting electrode in the internal wall of sulcus and maintain biologic width.

Metallic restorations should not be touched as they can create a short circuit and damage the surrounding structures.

Always clean debris on the electrode tip with alcohol soaked gauge.

After the impression / restoration procedure create a blood clot with curetting.
It is contraindicated in patients with pacemaker.

Oringer's solution – after the procedure of making final impression or retraction during restorative procedures, a tincture of myrhh 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.

Matrix Impression System[4,5]
In [1983], Livaditis introduced a new system that requires a series of three impression procedures, using three viscosities of impression materials. A matrix of occlusal registration elastomeric material (semi-rigid) is made over tooth preparations before gingival retraction is done. The matrix is trimmed to prescribed dimensions and after the retraction cord is removed, a definitive impression is made in the matrix of the preparations with a high viscosity elastomeric impression material. After the matrix impression is seated, a stock tray filled with a medium viscosity elastomeric impression material is seated over the matrix and the remaining teeth to create an impression of the entire arch.

This system effectively controls all the four forces that impact on the gingival during the critical phase of making the impression when attempting to register subgingival margins. The design of matrix gently forces the high viscosity impression material into the sulcus, which does not allow it to collapse as the medium viscosity material in the stock tray is seated for the pick-up impression. The sulcus is also cleaned of unwanted debris. Tearing is virtually eliminated because of improved configuration of sulcular flange and by elimination of voids or contaminants in the sulcus. Matrix impression system (MIS) maintains retraction by trapping a highly viscous material in the sulcus when the matrix is fully seated. This system possesses only one noticeable drawback which is increased chairside time.

Cryosurgery
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 -15^0 C cell death due to cryonecrosis occurs.
Advantages:
Minimum blood loss.
More conservative treatment.
Less post operative pain and cosmetic deformity.
Limitations:
No way of determining adequacy of margins and depth of tissue destruction.

Pastes and polymers in an injectable matrix[6,7,8]
Expasyl.[9,10,11] Some dentists advocate use of displacement pastes as alternatives to cord. Newly advanced materials in the form of retraction pastes like Expa-syl or magic foam cord were found to be better than cord as assessed histologically as they respect the periodontium. Improved displacement may be achieved if the paste is directed into the sulcus by applying pressure with a hollow cotton roll.

When Expasyl paste is left in the sulcus for 1 minute, the pressure is sufficient to obtain a sulcus opening of 0.5 mm for 2 minutes. This injectable matrix contains white clay to ensure the consistency of the paste and its mechanical action, while aluminum chloride enhances the hemostatic action. Application of air and water spray will remove the paste from the sulcus. Advantages- Nontraumatizing to junctional epithelium.

Disadvantages- More expensive and less effective with very subgingival margins.

Magic Foam Cord
First expanding poly vinyl siloxane material designed for easy & fast retraction of sulcus without potentially traumatic packing or pressure.

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.

Advantage
Not technique sensitive (flows directly into sulcus), Atraumatic.

Disadvantage
No hemostatic action, Racegel
As a buffered glycol-based 25% aluminium chloride gel which exhibits reversible temperature-responsive gelling behaviour, Racegel is easy to apply without streaking or agglutination. On application to the tooth substance and the marginal gingival tissue, the thermal activation that occurs during adaptation to the temperature conditions in the oral cavity brings about a change in the viscosity of this material allowing its targetted application– since it is initially free-flowing– in a thin strand even to hard-to-access cervical cavities and preparation areas. Then, due to the thermally induced gelling, it remains securely in a dimensionally stable form at the site of the wetting of the periodontium.

Since this product is rapidly and completely liquefied at low ambient temperatures for tissue management, it can be completely removed rapidly and without problems by means of a water spray. The marginal gingiva have perfect haemostatic conditions and we can also identify a marked contraction of the gingival sulcus tissue. The

exposure time required for optimum haemostasis is 2 minutes per application.The pronounced haemostatic effect is accompanied by a clear astringent effect. In suitable cases, this enables mechanical retraction of the free gingiva. Merocel.[12] A synthetic material that is chemically extracted from a bio-compatible polymer (Hydroxylate Polyvinyl Acetate) which creates a net-like strip of 2mm thickness capable of atraumatic gingival retraction.The strips expand with absorption of selected oral fluids. Commonly used in E.N.T, gastric, thoracic & otoneurosurgical procedures.

Advantages

1) Chemically fure, 2) Easily shaped, 3) Effective absorption of intra oral fluids, 4) Soft & adaptable to surrounding tissues, 5) Free of Fragments, 6) Not abrasive, Retrac Condensation silicone formula with potassium aluminium sulfate,this mate rial causes atraumatic retraction of gingiva.

Non-Prescription Nasal Decongestants & Eye Washes TetrahydrazolineHCl0.05%,Oxymetazoline HCl0.05% and PhenylephrineHCl0.25% show promise as gingival retraction agents.

Visine & Afrin produced greater gingival displacement than any other agents(alum , racemic epinephrine & phenylephrine).

SURGICAL

In other terms surgical means can be referred to as "GINGIVECTOMY".

Gingivectomy means exicision of the gingiva.It is done by using a cold shape knife called the Kirkland knife or the Bald-Parker blades No.–11 and 12 and a pair of scissors.

Indications

Interfering or unneeded gingival tissue during any impression / restorative procedures.

In cases of gingival polyps seen in proximal caries.

In a Class V restorative procedures.

For crown lengthening during or cast restoration crown procedures.

For apical repositioning of whole periodontal attaching apparatus to create a healthy, safely manipulated, easily retractable free gingiva.

LASER GINGIVECTOMY

Most commonly used lasers are the CO_2 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.

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.

CONCLUSION

While making impressions of prepared teeth or restoring them it is necessary to expose the margins. Proper tissue management is a key factor in accurately duplicating subgingival margins. At the same time the health of the gingival tissues is crucial for success as opposed to inflamed redundant tissue as a liability. Therefore the dentist must recognize the importance of using a systematic approach right from diagnosis till completion of the restoration with adequate emphasis on correct handling of the gingival tissue.

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