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Essentials in DENTISTRY

(A Student's Manual)

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Foreword
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CHAPTER 3

ISOLATION AND SOFT TISSUE PROTECTION IN DENTISTRY

Priyanka Jain

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INTRODUCTION

Dentistry is the art and science to restore and maintain health and functional comfort of the natural dentition along with satisfactory esthetic appearance. All restorations should fulfill the established requirements of physiology and health with regards to both surface and functional characteristics. The components of the oral environment like the tongue, lips, cheek, the facial/lingual sulci and the floor of the mouth present some obstacle to the mechanical treatment of the tooth. Consistent and adequate management and control of the soft tissue is critical. In adhesive dentistry, this control will make the difference between an excellent restoration and a clinical failure.

Effective soft-tissue management is a required skill for any dentist. Successful control of the soft tissue has always challenged dentists in creating indirect restorations. For the purposes of restorative procedures, soft tissue control refers to the clinical management of the marginal gingival tissues, crevicular fluids, and localized bleeding to create a clean and visible operating field. This enables clinically acceptable dental impressions and the successful use of adhesive dental materials. Many ceramic and indirect composite materials require the use of adhesive materials for cementation. No fluids or blood should be present on the tooth preparation because any sort of contamination will negatively affect the bond strength of the material and cause the restoration to fail. Therefore, proper soft-tissue management is critical and essential during cementation.

Good soft-tissue management is also important when placing direct resin restorations, including Class II, Class III, Class IV, and Class V type dental fillings. Because composite resins are held in place by the use of adhesive bonding, no blood or fluids should contaminate the operating field during the placement of the resin material. This chapter will talk about various techniques and materials used in soft-tissue management, which will lead to a better final restoration.

Sources of Moisture in the Clinical Environment

Moisture: These can be from various sources, like:

- Saliva
- Blood—from inflamed gingival tissues and iatrogenic damage
- Gingival crevicular fluid—from inflamed gingival tissues
- Water—from the rotary instruments and water from triplex syringe
- Dental materials—from the materials that we use during treatment like etchant, irrigant solutions, etc.

Control of the Field of Operation

The Tongue

Movements of the tongue should be minimized during treatment so as to avoid injury during the procedure. But the tongue cannot be totally immobilized, hence retraction is done away from the field of operation (Table 3.1). At the same time the retraction of the tongue should not initiate a gaging reflex. Therefore, this may be accomplished with a vacuum tip extension or a mouth mirror. Wooden tongue blade, a cotton roll or an automaton, (a mechanical device designed to clamp under the chin with an extension into the mouth to depress the tongue or to hold the cotton rolls in an attempt to keep the saliva away from the surface of the teeth), may also be used. The selection of the type of retraction required is determined by the length of the procedure, the agility and thickness of the tongue and the strength of the cheek muscles. The selection should be done keeping the patients comfort in mind. Utmost care is required in the placement of the selected device as the soft tissues of the oral cavity can bruise quite easily. The chair side assistant can hold the vacuum tip, and the mouth mirror or the tongue blade firmly in place by exerting adequate pressure without causing any discomfort or harm to the patient.

Table 3.1 Importance of adequate isolation, retraction and moisture control

Patient related factors	*Dentist related factors*
• Comfortable for the patient during the procedure	• Allows greater visibility and accessibility of the operating field
• It also protects the patient from swallowing or aspirating any foreign body/material	• Allows greater convenience and efficiency to the operator and infection control by reducing the aerosol production. It also prevents the contamination of the cavity preparation/root canal
• It also helps in avoiding damage to the soft tissues during the length of the procedure	

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Lip and Cheek Retraction

Retraction of the lips and cheek is very essential for the proper exposure of the operating field. Partial retraction can be accomplished by opening the mouth and stabilizing the mandible but for complete retraction, mechanical aids are required. This provides good visibility and prevents the tissues from being traumatized during the various operative procedures.

Facial/Lingual Sulci and the Floor of the Mouth

Although these areas are relatively stable but sometimes, they do encroach on the operating field. This is most common while working on the cervical areas of the mandibular molars.

METHODS OF ISOLATION

The techniques of isolation in the oral environment can be classified as direct and indirect methods and/or surgical and nonsurgical methods (Table 3.2).

Table 3.2 Classification of the methods of gingival tissue displacement

Nonsurgical/atraumatic	*Surgical*
Mechanical	• Rotary gingival curettage
• Retraction crown	• Surgical methods
– Modified temporary crown	– Gingivoplasty
• Modified impression techniques	– Gingivectomy
– Copper band impression technique	– Periodontal flap procedures
• Mechanical retractor	• Electrosurgery
– Gingival protectors	• Laser
– Matrices and wedges	– CO_2
– Rubber dam	– Diode
• Retraction cord (twisted/knitted/braided) without astringent/vasoconstrictor	– Nd:YAG
• Retraction strips	– Argon laser
• Retraction paste without a hemostatic agent	
Mechanico-chemical	
• Retraction cord with hemostatic agent (vasoconstrictor or astringent)	
• Retraction paste with hemostatic agent (with vasoconstrictor or astringent)	

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Direct Methods

- Rubber dam
- Cotton rolls
- Suction devices—high volume evacuators, saliva ejectors (low volume evacuators)
- Gingival retraction cords
- Lasers
- Rotary curettage
- Electro surgery.

Indirect Methods

- *Comfortable positioning of the patient in a relaxed environment:* The patient should be comfortably seated and the surroundings should be pleasing and relaxed. All these help in reducing the anxiety levels of the patient and thus reduces salivation.
- *Local anesthesia:* This helps in reducing the discomfort for the patient during treatment and controlling moisture by decreasing salivation. The vasoconstrictor also helps in reducing bleeding during the procedure.
- *Anti-anxiety drugs:* These are used in patients to help reduce the amount of salivation in whom no any mechanical form of device is useful.

Aids for Retraction and Protection

Tongue Guards

On application they create a wall between the tongue and the operating field with an adjustable space. They are usually metallic (autoclavable) or plastic (disposable).

Tongue Depressors

These suppress the elevation of the tongue during the actual procedure. They are wooden and disposable. They can be used in combination with a mouth mirror in cases of a large tongue.

Cheek and Lip Retractors

These are designed to fit half of the upper and the lower lip including the corners of the mouth. Their use is two fold. They can be used to retract the lips and the cheek outwards and backwards thus exposing the facial surfaces of the teeth. These are may be used for photographic purposes. For retraction of the facial surfaces of one quadrant only, smaller retractors are also available which fit only one lip and the adjacent corner of the mouth.

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Mouth Props

These are rigid devices made of rubber and are a useful aid during preparations on the posterior teeth. They help the patient in keeping the mouth open comfortably. They have blunt corners and serrations on their surfaces which helps them to stabilize on the occlusal surfaces of the teeth. A mouth prop is inserted in between the teeth of opposite jaws on the non-working side between the maxillary and the mandibular teeth leading to increased mouth opening (as they are placed more posteriorly). They are then stabilized by asking the patient to bite on it. The device should not be pushed too posteriorly as it may put strain the patients masticatory muscles. They should be disengaged periodically to allow the patient to relax his muscles. They can be either as block types or ratchet types.

Ideal characteristics of a mouth prop

- Should be stable
- Should be easily removable
- Should be sterilizable or disposable
- Comfortable for the patient
- Easily adaptable and adjustable

Saliva Ejectors/Low Volume Ejectors

These remove the saliva and water that collects in the floor of the mouth during the procedure but have little capacity in picking up any solids. These may be used in conjunction with cotton rolls and rubber dam. The tip should be smooth and nonirritating. Saliva ejectors are usually single use and are made of disposable plastic which can be shaped by bending with the fingers to improve fluid control. They are placed in a position/area least likely to interfere with the operators work.

Types of Saliva Ejectors

- *Svedopter:* This is a saliva ejector with a tongue retractor and protects the tongue and the floor of the mouth. It does not give lingual access to mandibular teeth and cannot be used if tori are present. If made of metal, it can cause soft tissue bruising and can sometimes initiate gag reflex.
- *Hygrofomic saliva ejectors:* These are used in the same manner as Svedopter but are more comfortable in use and give access to the lingual aspect of the mandibular molars. They are used in conjunction with absorbent cotton.
- *High volume ejectors:* These are used for suctioning water and debris from the mouth when high speed hand pieces are used. They are made of plastic and are disposable. Metal ones are also available which

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may be re-used. They are straight or slightly angled depending on the requirement. The tip of the evacuator is placed distal to the tooth being operated upon so as not to block the operators view. They should be placed before the positioning of the hand piece and the mouth mirror.

Advantages of Saliva Ejectors

- Quadrant dentistry is facilitated
- There is no dehydration of the tissues
- Improved accessibility and visibility for the operator.

Cotton Rolls

These may be used in conjunction with other methods like the saliva ejector. They prove useful and effective to control small amounts of moisture and retract soft tissues at the same time. But cotton rolls only provides moisture control for a short period of time and are not effective if large volumes of fluid are present. They also become ineffective during active tongue movements and in the presence of shallow sulci which makes their placement and retention difficult.

Absorbents

Like cotton rolls, absorbents are helpful for short durations. They have to be used in conjunction with saliva ejectors. They do not prevent contamination of the area and do not prevent debris from accumulating. They need to be replaced when wet and cannot be used with high speed hand pieces. They can be manually rolled or prefabricated.

Throat Shields

These are indicated when rubber dam is not being used to prevent the patient from swallowing/aspirating any foreign object. This is very important while working on a tooth in the maxillary arch. Gauze (5 into 5 cm) is spread and unfolded over the tongue and the posterior part of the mouth which helps in recovering small objects.

Cellulose Wafers/Parotid Shield

These are used in conjunction with cotton rolls in cases of the facial aspect of the posterior teeth to absorb the saliva excreted by the parotid gland.

Rubber Dam: Rubber dam was first introduced in 1864 by SC Barnum, a New York dentist. Rubber dam ensures appropriate dryness of the teeth and improves the quality of clinical restorative dentistry.

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Advantages

The rubber dam is the most successful mode of isolation of the operating field. Its salient advantages are:

- It provides a totally dry and clean field.
- It also provides maximum access and visibility by the control of moisture and retracting the soft tissue.
- It prevents the moisture contamination of the restorative materials used during treatment thus improving the functional properties of these materials.
- It prevents the patient from swallowing/aspirating small instruments, burs, debris during the procedure.
- Rubber dam increases the operator's efficiency and productivity.

Disadvantages

- Time consuming and patients may object at times
- Cannot be used in case of extremely malpositioned teeth
- Cannot be used in children suffering from asthma, some upper respiratory infections or mouth breathing problems.

Rubber Dam Set

Rubber dam may be presented as a *raincoat* that keeps the tooth dry and held on by a *button* (clamp) and kept straight by a *coat hanger* (frame). It is advisable to administer local analgesia where a clamp may impinge on the gingiva.

Rubber Dam Sheets: These come in different colors according to the thickness of the sheet like green, blue and black to provide good contrast with the surrounding and may be flavored for the children. They are made from natural latex . A rubber dam sheet has a shiny and a dull side, the shiny side is less reflective and faces the occlusal surface. The sheet thickness varies from thin, medium, heavy, extra heavy, special heavy. They are available as rolls or sheets in thickness of 0.006"to 0.01" (thin, medium, heavy, extra heavy) (Table 3.3).

Table 3.3 Rubber dam sheets

Gauge	*Thickness*
Thin	0.0006 inch
Medium	0.0008 inch
Heavy	0.010 inch
Extra heavy	0.012 inch
Special heavy	0.014 inch

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Rubber Dam Template (Stamp): These have positions of the teeth marked on them and are used to transfer them to the rubber dam sheet for holes to be punched.

Rubber Dam Punch: This is used for making holes in the dam. It has a rotating metal disc bearing 5 to 6 holes of different sizes according to size of teeth and a sharp pointed plunger .5–2.5 mm in diameter.

Rubber Dam Clamps: These are used for anchoring and securing the sheet to the teeth to be isolated. They come in different shapes and sizes according to the teeth and also come differently for deciduous and permanent teeth. They can either be with wings or without wings (used mainly for the deciduous dentition). The clamp has four prongs that rest on the mesial and distal line angle of the tooth and two jaws connected by a bow.

Types of Retainers/Clamps

- *Winged retainers:* These are clamps with wing like projections on the outer aspect of their jaws to provide extra retraction of the rubber dam from the field of operation (Table 3.4). The wings are passed through the punched holes in the dam and the dam and the retainer are placed together on the concerned tooth. After placement, the dam is slipped carefully over the wings onto the tooth.
- *Wingless retainers:* These are clamps having no wings. The retainer is first placed on the tooth and the dam then stretched over the clamp onto the tooth.

Rubber Dam Clamp Forceps: This is used for the placement and removal of the retainers from the tooth. There are two types of retainer forceps available namely Stokes brewer and Ash type.

Rubber Dam Frame/Holder: This supports the edges of the rubber dam sheet. A rubber dam frame can either be plastic or metal. They are used to maintain the borders of the rubber dam in position.

Types of Rubber Dam Holder

- *Young's holder:* This is a U-shaped metal frame with small metal projections for securing borders of the rubber dam.
- *Ash pattern:* Most suitable for children.
- *Swenska N-Ø frames:* Are suitable for taking radiographs with the dam.

Table 3.4 Clamps

Recent advances in rubber dam clamps
• Handi dam • Cushioning metal clamp jaws • Insta dam • Fiber optic clamps • Liquid dam

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Rubber Dam Napkin: This is placed between the sheet and the patient's skin to prevent direct contact with the rubber dam sheet thus reducing the risk of allergies. This also acts as a cushion, and absorbs saliva at the corner of the mouth.

Waxed Dental Floss: This is tied around the clamp before it is carried to the oral cavity to prevent accidental aspiration of the clamp.

Wedget: This is an elastic used to secure the dam around the teeth farthest away from the clamp to improve the interdental contacts and to prevent aspiration of the clamp.

Certain Factors to Keep in Mind During the Application of Rubber Dam

- The proximal contacts should be tested with the help of dental floss before the application of the ruler dam sheet.
- The retainer selected should be stable as the movement of the retainer can injure the gingiva and the tooth resulting in postoperative pain and sensitivity.
- To prevent gingival trauma, the jaws of the retainer should not extend beyond the mesial and the distal line angles of the tooth.
- The retainer should be tied with the dental floss to prevent its aspiration.
- While punching holes in the rubber dam sheet, they should be placed at an adequate distance from each other. Insufficient spacing between the holes can force the narrower dimension of the sheet to slip to the mesial or distal of the papilla rather than encompassing it which can interfere in the field of operation.
- A lubricant (petroleum jelly) should be used to protect the lips and the corners of the mouth from the abrading action of the rubber dam sheet.

CONTROL OF THE OPERATING FIELD IN DIFFERENT QUADRANTS

Mandibular Right Quadrant

The assistant can control the tongue movements with the help of a suction tip used for evacuating saliva. The tip is usually beveled and the bevel faces the tooth under treatment. The tip should be placed at the lingual/palatal surface of the teeth slightly posterior to the tooth under treatment. The extension of the same suction tip will additionally aid in depressing the tongue. In cases where the tongue is very agile or large, the dental assistant can use a mouth mirror in his left hand and lay it firmly on the tongue or place it under the right side of the tongue to retract it to the opposite side of the mouth. The operator can approach the oral cavity from the 8 o'clock to

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9 o'clock position thus utilizing the area at the right anterior of the mouth and at the same time using a mouth mirror in his left hand with positive pressure away from the teeth, to control the lips and the cheek movements.

Mandibular Left Quadrant

The suction tip may be placed at the extreme left corner of the mouth, with the beveled surface facing the buccal surface of the teeth thus aiding in the retraction of the lips and the cheek away from the operating field. A cheek retractor may be used in cases of cheeks with excess buccal pad of fat or strong musculature. The operator can approach the operating field (using the reverse mirror position) from the 11 o'clock position. For easier access the patients head can be turned slightly towards the right.

Maxillary Right Quadrant

A vacuum tip may be positioned on the palatal surfaces of the right maxillary teeth. The mouth mirror can be rested against the tongue and the mandibular incisors to aid the patient in keeping the mouth open. The tongue should be pressed downwards with slight pressure to prevent its elevation during the procedure. The dentist can hold the mouth mirror in his left hand for vision while the instruments to be used during the procedure are held with the thumb and the two fingers. The tips of the third and the fourth are used for support and to retract the cheek if and when required.

Maxillary Left Quadrant

The suction tip may be placed on the occlusal surface anterior to the tooth being worked on. The assistant can rest the mouth mirror on the mandibular anterior to aid in keeping the mouth open. The mouth mirror is held in the left hand while the right hand holds the instruments with the thumb and the first two fingers as the case with the mandibular right quadrant. But in cases where access is very difficult like with the facial surfaces, the mirror may be used to retract the cheek to facilitate direct vision.

Maxillary Anterior Teeth

The suction tip may be placed at the palatal surface of the teeth anterior to the one being operated upon with the beveled side against the palatal surfaces near the incisal edges of the teeth being prepared. The approach is from the 11 o' clock position using indirect vision with the mouth mirror placed in a reverse manner for a palatal view of the surface. If the facial surfaces are to be treated, then 9 o' clock approach is recommended with the suction tip on the facial surface of the anterior teeth or on the palatal, depending on the flow of the water supply.

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Mandibular Anterior Teeth

The suction tip may be placed in the trough formed by the lower lip and the facial surfaces of the lower anterior teeth. The lower lip is gently stretched out and away from the teeth to form the desired trough. In cases where the facial surfaces are desired for the procedure, the suction tip is placed on the lingual side of the teeth, thus retracting the tongue at the same time.

During the dental treatment procedure, the main concern is to keep the tongue and the cheek away from the field of operation and to prevent the water from accumulating and hindering the vision and causing discomfort to the patient. The assistant should avoid placing the suction tip near the soft palate as this may stimulate a gag reflex. A firm placement of the tip on the gingiva, or tongue is probably the best rule to follow.

GINGIVAL RETRACTION

Atraumatic/Nonsurgical Methods

Harmony and compatibility between a restoration and the periodontium that surrounds the teeth is essential and crucial to the success of any restorative procedure. Displacement of the gingival tissue is essential for obtaining accurate impressions for the fabrication of fixed restorations, particularly when the finish line is at, or just within, the gingival sulcus. This is also true when dealing with the restoration of the cervical lesions due to their proximity to the periodontal tissue. For all the above mentioned operative procedures, the most important in soft tissue management is the gingival displacement (Table 3.5).

Gingival displacement may be defined as the deflection of marginal gingiva away from the tooth. This is performed to create sufficient lateral and vertical space between the prepared finish line and the gingival tissue to allow the injection of adequate bulk of the impression material into the expanded crevice. The displacement of the gingiva is also required during the preparation of the tooth cervically and even while placing and finishing the restoration located cervically. This is done to avoid trauma to the periodontal tissue. This can be accomplished by means of:

- Chemical–hemostatic medicament
- Mechanical methods
- Surgical methods-electro surgery and gingival curettage
- Lasers.

Mechanical Retractors

Gingival Protector

This can be used to displace soft tissue to protect gingiva from rotary instruments during tooth preparation and finishing. A crescent-shaped

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Table 3.5 Recommendations for nonsurgical gingival displacement in different clinical situations

Procedure	*Factor*	*Situation*	*Technique*
Tooth preparation	Location of the margin	• Removal of caries extending subgingivally	• Using gingival protector or cervical rubber dam clamp. In case of deep inaccessible subgingival lesions surgical gingival retraction can be done
		• Subgingival margin encroaching the biological width	• Re-establish the biological width surgically/ orthodontically
Impression taking	Gingival condition	• Gingival bleeding	• Use astringent applicator to control the bleeding
		• Gingival sulcus depth	• Single-cord technique is preferred if the gingival sulcus is shallow. Double-cord retraction technique is preferred in cases with deep gingival sulcus
		• Gingival thickness	• Excess gingival bulge or hypertrophied gingival tissue may be removed with electrocautery/laser
	Number of prepared teeth	• Single	• Single-cord impression technique can be used
		• Multiple	• Double-cord impression technique/retraction paste technique can be used
	Impression material	• PVS/polyether	• Thoroughly wash the gingival sulcus after the use of aluminum sulfate compounds, aluminum chloride, ferric sulfate, as they are may alter the setting of the impression material

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tip on an adjustable ball-joint is attached to a metal handle which can be rotated to an angle according to the required tooth's surface, thereby achieving gingival fit. Such protectors can be used for veneer preparations, finishing veneer margins (porcelain/resin), cervical (facial) subgingival caries, and/or for the removal and checking the marginal fit of crowns. These tips are autoclavable thus preventing cross-contamination.

Wooden Wedges

Wooden wedges can be placed interproximally to mechanically depress the gingiva, thus providing retraction. Matrices with gingival extension can also displace the gingival tissue when placing interproximal restorations.

Rubber Dam

Heavy, extra heavy and special heavy gauges of rubber dam with proper interseptal dimensions may be used when a limited number of teeth in one quadrant are being restored or in cases where the preparations do not extend very far subgingivally. During impression taking, the sulfide compounds utilized in the manufacturing of latex can inhibit the polymerization of polyvinyl siloxane (PVS) impression material. Hence, rubber dam should be avoided when this material is used.

Retraction Strip

The material used in a retraction strip is chemically extracted from a biocompatible polymer (hydroxylate polyvinyl acetate) that creates net-like strips without debris or fragments. These can be easily shaped and adapted into the sulcus without local anesthesia, and are highly effective for absorption of intraoral fluids such as blood, saliva, and crevicular fluid. These sponge-like strips expand with absorption of fluids and exert pressure on gingival tissues to cause displacement.

Retraction Cords

Cords can be fabricated from cotton yarn or purchased commercially in a variety of forms. Unfortunately, their effectiveness is limited because the use of pressure alone will not control sulcular hemorrhage. Therefore, they usually have some hemostatic agent (vasoconstrictor or astringent) premixed in them to prevent bleeding (Table 3.6). The chemicals used along with retraction cords (gingival displacement medicaments) can be broadly classified into vasoconstrictors and astringents. If properly used, these can be used for isolation especially in cases of treatment of mandibular cervical lesions (Table 3.7). They improve the accessibility and visibility and also restrict the use of excess restorative material. Most importantly, they produce the lateral displacement of gingiva without blanching it. They are manufactured in three forms:

1. Braided
2. Twisted
3. Knitted.

Choice of the type of retraction cord to use depends on the operator's preference. The cord may be packed with a special instrument called FISCHER packing instrument. Sufficient diameter of the cord should be used for adequate displacement.

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Table 3.6 Retraction cords

Desirable qualities of a cord include
• Dark color (to maximize contrast with the tissues, tooth, and cord)
• Be absorbent (to allow the uptake of the liquid medicaments) and
• Be available in different diameters (to accommodate the varying morphologies of the gingival sulcus)

Table 3.7 Various retraction cords

Braided cords	*Knitted cords*
• Easier to place	• Easy to place too
• Impregnated with astringent and is stable	• Expands when wet
• Minimal soft tissue damage and no tear during placement	• Minimal tearing at the cutting ends
• Serrated in nature	

Advantages of Retraction Cords

- Effective in controlling gingival hemorrhage and retracting gingival tissues at the same time
- Can be used as an adjunct to other methods
- Can be used in cases where rubber dam application is not possible like in cervical preparations.

Disadvantages of Retraction Cords

- Only effective in controlling small amounts of fluids
- May need local anesthetic prior to placement
- Can be difficult to insert
- Can cause gingival damage if not inserted properly.

Vasoconstrictors

These include epinephrine and sympathomimetic amines . Epinephrine-impregnated retraction cords contain 0.2–1 mg of racemic epinephrine per inch of cord depending on the diameter and the brand. The epinephrine is used in the concentration of 0.1% and 8%. The amount absorbed depends on its concentration in the cord, length of cord used, amount of vascular bed exposed, and duration of the cord application. For patients falling under the category of contraindications for epinephrine, a cord impregnated with some other agent must be substituted.

Sympathomimetic amines capable of producing local vasoconstriction with minimal systemic side effects include tetrahydrozoline HCl, (0.05%); oxymetazoline, (0.05%); and phenylephrine HCl, (0.25%). Retraction cord

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can be dipped in these to assist in hemostasis. Newer hemostatic agents such as the tetrahydrozoline and oxymetazoline have a more acceptable pH and are recommended.

Astringents

These act primarily by precipitation of protein and inhibiting transcapillary movement of plasma proteins. They have relatively low cell permeability and act generally as irritants in moderate concentrations and as caustics in higher concentrations. These are:

Aluminum Sulfate Compounds (Aluminum Potassium Sulfate [Alum] and Aluminum Sulfate): Alum is safer and has fewer systemic effects than epinephrine. Cords saturated with 100% alum can be safely left in the sulcus for as long as 20 minutes without any adverse effect. The concern in using aluminum sulfate (it differs from alum) is that they can inhibit/retard the setting reaction of additional reaction impression materials.

Aluminum Chloride: This is one of the most commonly used astringents in the concentration of 5–25%. Aluminum chloride is the least irritating of the medicaments used for impregnating retraction cords, but they are capable of disturbing the setting of PVS impression materials . The inhibitory effect can be greatly reduced by thoroughly rinsing the preparation with water after the treated cord is removed.

Ferric Sulfate: This provides good hemostasis on exposed connective tissue. This astringent is provided in solution form only, generally in the concentration of 13–20%. During tissue hemorrhage, the solution should be rubbed into the bleeding areas with an applicator (dento-infusor) or a soaked cotton pellet. Ferric sulfate can also modify the accuracy during impressions because it disturbs the setting reaction of polyvinyl siloxanes. The drawback of using this agent is that due to its iron content, ferric sulfate stains gingival tissues a yellow-brown to black color for several days after being used as a retraction agent.

Techniques for Retraction Cord Placement

Two procedures widely used for placing the retraction cord are the single-cord and the double-cord techniques. The technique to be used is based on the clinical situation.

Single-Cord Technique

This technique is indicated when making impressions of one to three prepared teeth with healthy gingival tissues, especially when the prepared margins are at or above the tissue. In this technique, a single cord is placed in the sulcus and removed before the impression is taken. This provides

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displacement about the width of the cord. The main disadvantage of this is that in a deep sulcus, however, the tissue can collapse over the top of the cord. This often causes the impression material to tear on removal. Though commonly practiced, this technique is often unsatisfactory.

Double-Cord Technique

This technique can be used with single or multiple preparations. It is especially useful for making impressions when tissue health is compromised. The double-cord technique employs two cords, one placed above the other. A thin cord such as silk suture is first packed under the preparation margin to control gingival seepage and hemorrhage. This cord is typically left in place for the impression. The second, larger cord is impregnated with hemostatic agent and placed above the first cord for a minimum of 4 minutes and removed before the impression is taken.

The main advantage of this technique is that the first cord remains in place within the sulcus, thus reducing the tendency of the gingival cuff to recoil and displace partially set impression material. This not only helps to control gingival hemorrhage and exudates but also overcomes the problem of the sulcus impression tearing because of inadequate bulk. Another advantage of the double-cord technique is that the first cord acts as a sulcus liner, preventing tearing of the epithelium and subsequent bleeding. However, the main disadvantage of this technique is that failure to remove the first cord can cause gingival inflammation. Furthermore, if the deeper cord is left in place the impression material may stick to it and cause the impression to tear upon removal.

Retraction Paste

These are the cordless retraction materials. They are available in a paste-like form and supplied with a specialized dispenser. These cordless retraction materials displace the gingiva when injected into the sulcus. Because of the passive technique used to place these pastes, they are significantly less traumatic to the tissue than the conventional retraction cord. The main drawback of these is that the amount of retraction offered by these pastes is limited, especially with extremely subgingival margins and its high cost. These pastes are also available with hemostatic agents such as aluminum chloride and a mild, natural astringent to control the seepage of fluid.

SURGICAL METHODS OF GINGIVAL RETRACTION

Rotary Curettage

This is a troughing technique, wherein a portion of the epithelium within the sulcus is removed to expose the finish line. It should be done only on the

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healthy gingival tissue. No bleeding on probing, and a minimum of 3 mm deep sulcus are the main criteria for this technique. The main drawback of this technique is that due to poor tactile sensation while doing this, this can prove to be potentially damaging to the periodontium.

Electrosurgery

This is the surgical retraction of the sulcular epithelium using an electrode to produce gingival retraction. This technique may be used in areas of inflammation in gingival tissue where the retraction cord cannot be used and in cases where there is gingival proliferation around the prepared finish line. It cannot be used in patients with cardiac pacemakers.

Lasers

A laser is a device that converts electrical power from the wall into coherent, monochromatic and collimated light capable of changing a target substance, such as human tissues. The tissues are modified due to thermal effects produced by the light. *LASER* is an acronym for **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. The first laser in dentistry was introduced in 1982 by the Directed Energy, Inc. and Pfizer who introduced the carbon dioxide (CO_2) gas laser for dentistry. Lasers are identified by the active medium that they use to create their energy, such as gases, types of rods, dye types, or the wavelength of the diode they use. They are of three types:

1. *Solid State (rod style):* Er:YAG, YSGG
2. *Gas:* Carbon dioxide, Argon
3. *Semiconductor:* Diodes.

Laser procedures are divided into two categories: soft tissue procedures and hard tissue procedures (Table 3.8). Soft tissue procedures consist of certain treatment procedures for the gingiva, such as muscle attachment, reshaping of gingival tissues, and crown lengthening. Hard tissue laser procedures incorporate tooth decay procedures and dental fillings, etc.

The main types of lasers used in dentistry are:

- Diode laser (810 nm–980 nm)
- CO_2 (carbon dioxide, 10600 nm)
- YAG family (2100 nm–2940 nm) i.e. Er:YAG (erbium yttrium aluminum garnet), ErCr:YSGG (erbium chromium yttrium selenium gallium garnet), and Hol:YAG (holmium yttrium aluminum garnet). These feature predominantly as hard tissue lasers. Nd:YAG (neodynium, yttrium aluminum garnet) is an effective dental laser wavelength in soft tissue procedures.

These lasing media produce wavelength specific light, which is selectively absorbed in certain tissues. YAG lasers have an absorption peak in water; therefore the water component of tissues is volatilized before breakdown of structure. Diode and Nd:YAG lasers have an absorption peak

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Table 3.8 Use of lasers in dentistry

Soft tissue procedures for which lasers can be used
• Gingivectomy, Gingivoplasty, Operculectomy
• Recovering dental implants
• Treating inflammation around implants
• Troughing for impressions
• Treating aphthous ulcers
• Incising and draining abscesses
• Fibroma removal and biopsies
• Sealing lymphatics in the surgical area
• Frenectomy
• Reducing sulcular oral bacteria and other flora
• Recontouring interproximal tissue
• Accelerating healing for split lips
• Soft tissue debridement
• Reducing hyperplasia

in pigmented tissue and, therefore, are good for periodontal tissue lasing and coagulation.

The YAG range is recommended for cavity preparation and hard tissue removal, whereas the diode CO_2 and Nd:YAG lasers are useful for soft tissue procedures.

A hard tissue laser is wavelength specific to water and, therefore, can be used clinically on both hard and soft tissues. However, care must be taken to avoid unwanted interactions on root surfaces. For many cosmetic and periodontal indications, a soft tissue laser is more efficient. Treatment with soft tissue laser is different from conventional methods because the patient's acceptance is greater. The laser is more efficient and sometimes faster. There is less postoperative discomfort for the patient, and the bacteria levels in affected areas are reduced. Additionally, there is virtually no collateral damage to healthy tissue, and anesthesia is not necessarily required. Overall, laser dental procedures are safer, and there is a decreased healing time.

Advantages of Lasers

Laser has many advantages over traditional surgical instruments. Dental laser surgery has also proven to be highly effective and pain-free. The use of

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laser technology prevents infections and protects the surrounding healthy tissues. In addition to this, the duration of this procedure is very short as compared to traditional surgery and there are absolutely no risks associated with this type of dental treatment. The operator can control the energy applied to the optical resonator, and can vary the beam diameter on the target tissue. The operator can also control pulsing or continuous lasing, pulse duration and pulse relaxation times. These will all control the target tissue effects. Laser dentistry facilitates minimal healing time after complicated operations. Some other minor problems such as benign tumors can also be treated with the help of laser. The treatment is highly precise and totally effective.

Laser dentistry is now applied to many dental procedures including implants and tooth extraction. Different parameters are used for different types of procedures to prevent complications. Laser dental surgery is a highly accurate treatment which causes little or no pain. Implants are especially well-placed using this technique with greatly reduced chances of developing infections or other complications.

SOME CLINICAL APPLICATIONS

Soft Tissue Management for Direct Resin Restorations and Bonded Indirect Restorations

All the materials and techniques described above can be used when placing a direct composite restoration and during cementation of a bonded indirect restoration. The clinician must identify the area and the places where tissue/fluids may present an issue during a bonding procedure. Retraction cord may be used for Class III and Class V composite resin restorations as the nature of the decay associated with these restorations brings them in close proximity of the gingival tissues. During cementation of the porcelain veneers and/or anterior all ceramic crowns, gingival tissues must be retracted again to properly isolate this area so that the restoration is bonded correctly.

Soft Tissue Management for Final Impression Taking

Double-Cord Technique

This is used for deflection of the soft tissue to get the accurate details of the margins of the tooth preparation (refer to retraction cord placement).

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Single Retraction Cord Technique

This technique can work well with tooth preparations that terminate supragingivally or at the tissue height. Often, this technique will work well, provided the soft tissue and the related fluids in the area are controlled and the prepared teeth have healthy gingival tissues.

Soft Tissue Control via Soft Tissue Alterations

In clinical where the soft tissue is too bulky and/or too inflamed to enable visualization of the preparation margin, the use of electrosurgery or laser surgery enables the clinician to see where to place the margin of the final restoration. Gingivectomy with either an electrosurgery or laser can be the solution while dealing with excessive and/or irritated soft tissue.

Chemical Management of Soft Tissue and Crevicular Fluids

Bleeding is managed chemically in most of the cases. Ferric sulfate, aluminum chloride, and epinephrine are the most commonly used. Since ferric sulfate may leave a black organic residue on the tooth preparation, it may prove to be a problem while placing an all-ceramic restoration or composite resin restorations. Therefore, aluminum chloride, while not quite as effective as ferric sulfate can be used for controlling localized bleeding. Aluminum chloride leaves no dark residue on the restoration. This makes it the chemical of choice when the final restoration is made of an all-ceramic or indirect composite. Epinephrine stops localized bleeding through vasoconstriction. When used with a local anesthetic in a 1:50,000 concentrations, it can be highly effective at controlling localized bleeding for a short period by directly infiltrating into the desired area.

Soft Tissue Management for Various Procedures

Intraoral Examination Procedure

Low volume suction may be used to remove the saliva build up, gauze can be used to dry the teeth and soft tissue to visualize them better. Triplex syringe can be used to dry small amounts of moisture from the tooth surfaces.

Prophylaxis

Low volume suction may be used to remove the saliva build-up during the procedure.

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Topical Fluoride Application

During fluoride application, low volume suction may be used to remove the saliva build up during and after the procedure.

Fissure Sealant Application

During this procedure, rubber dam is the first choice for optimal moisture control and to isolate the working field. Cotton rolls are the second option to isolate the working field. Triplex syringe may be used to dry small amounts of moisture from the tooth surfaces and high volume suction may be used to remove the water which is used to wash away the etchant during the procedure.

Simple Restorative Procedures

As during the fissure sealant application procedure, rubber dam is the first choice for optimal moisture control and to isolate the working field. Cotton rolls are the second option to isolate the working field. Triplex syringe can be used to dry small amounts of moisture from the tooth surfaces and high volume suction is used to remove the water used during the procedure.

Endodontic Procedures

Rubber dam is the only choice for complete and optimal moisture control and to isolate the working field. High volume suction is used to remove the solutions used to rinse the root canal(s) during the procedure.

Alginate Impression Taking

Low volume suction and the triplex syringe are used.

CONCLUSION

A healthy relationship between restorations and their surrounding periodontal structures should be the goal of a dentist. Several techniques have proven to be relatively predictable, safe, and efficacious in the management of the gingival tissue in restorative dentistry. No scientific evidence has established the superiority of one technique over the other. The selection of any one of the various methods of soft-tissue management to control the operative site may solely depend on the clinical situation and the preference of the operator.

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