

Fluid Control and Tissue Displacement

Impression making for fixed partial denture is very important because only an accurate impression can produce a successful restoration. This impression is sent to the lab in order to make a *working cast*, and this *working cast* should be very accurate; a replica of the prepared tooth/teeth in the patient mouth.

The impression materials that can be used are the elastomers; silicon or rubber. The impression material used for fixed partial denture should fulfill the following critical requirements:

1- *Dimensional stability*: It should not be affected by moisture, temperature, etc.

2- *Accuracy*: it should be very accurate to record finer details in the preparation, especially the finish line, and this is essential for fabrication of the prosthesis.

Note: Alginate impression material is NOT used for impression making, that is, the Alginate is not very accurate in recording the wanted details, it does not take every detail, the impression should have details of less than 1 mm in dimension of the finish line, for example.

Today's lecture is about how to prepare a tooth inside the patient mouth with a good isolation in order to make the impression properly.

An *impression* is "a negative likeness/image of the teeth and the surrounding structure necessary to obtain a working cast". There are specific materials that are used to make an impression for the fixed prosthodontic work; mainly elastomers and agar-agar impression material.

Q: How to identify an impression taken for a fixed partial denture?

A: The finish line of the preparation can give you a hint.

When impression making, the replica should record the teeth and the surrounding structures, the whole arch should be included; that is, the working model is going to be articulated on the articulator

later on, to make the final crown that's in harmony with the occlusion.

Most of the impression materials are hydrophobic in nature, and they are very sensitive to moisture, so a well-isolated and dry field is a must to have. No moisture should be in the field or in the preparation. Rubber dam **can't** be used; it isolate the prepared teeth/tooth, but not the rest of the structures; it does not isolate the whole arch that is needed to be recorded.

Challenges

- 1- Moisture control,
- 2- Subgingival margin,

Prerequisites

- 1- *Healthy tissues,*

It is essential that gingival tissue be healthy and free of inflammation before cast restorations are begun. To start tooth preparations in the face of untreated gingivitis makes the task more difficult and seriously compromises the chances for success. Because the marginal fit of a restoration is essential in preventing recurrent caries and gingival irritation, the finish line of the tooth preparation must be reproduced in the impression.

- 2- *Fluid control,* dry operative area.

- 3- *Displacement of the tissues,* to expose the finish line, *finish line exposure,* e.g. using a retraction cord.

Tissues Health

During the preparation phase, trauma to the gingival tissues can happen, e.g. bleeding or ulceration of the tissues, especially if preparation was subgingival. In such situation you can't take an impression. The tissue injury is transient and it heals by it self later, and a temporary restoration is usually fabricated and provided on the same day of the tooth preparation. So, through the presence of this protective temporary prosthesis and maintaining a good oral hygiene by the patient, the tissues will heal by themselves, and in the next appointment you can take an impression.

Note: Provisional Crown, Temporary Crown

The word provisional means established for he time being until a permanent arrangement can be made.

After tooth preparation, a temporary protective/functional restoration is fabricated over the prepared tooth to be used until the fabrication of the final prosthesis. Temporary restorations are usually fabricated and provided on the same day of the tooth preparation.

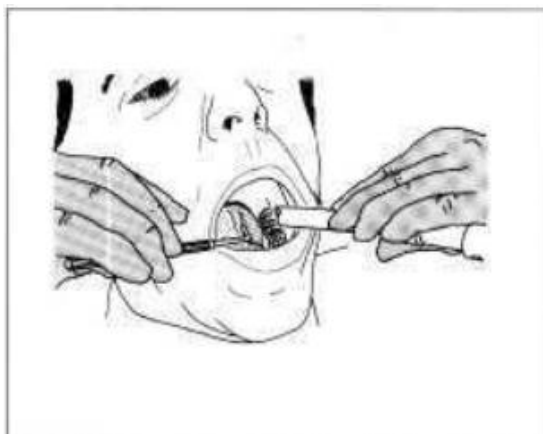
The temporary crown is similar to the final prosthesis but differs in the material that is used in fabrication, that is, it's acrylic but the final crown is made of metal or/and ceramic. It's placed temporarily, with perfect well-adapted margins, properly contoured, and very smooth, resembling the final crown in its all properties.

Moisture Control

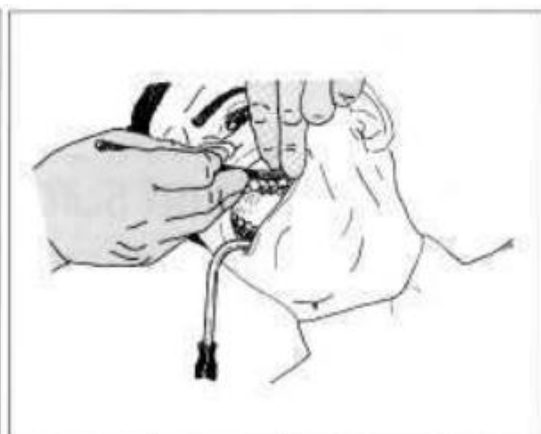
1- *Cotton roll*, placed in the facial and the lingual vestibules, e.g. in the maxilla the cotton roll is placed in the buccal vestibule against the second molar where the parotid gland duct opens (Stenson's duct opening).

2- *High suction volume*, when wielded by a knowledgeable assistant, it makes an excellent lip, tongue or cheek retractor.

3- *Saliva ejector*, e.g. when working on the maxilla, the saliva ejector is placed in the corner of the mouth opposite the quadrant being operated, and the patient's head is turned toward it; saliva then can pour in that area.



The vacuum tip can double as cheek or tongue retractor

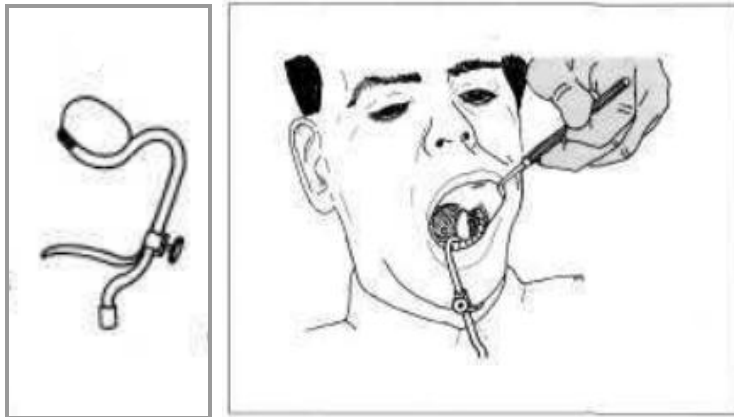


The saliva ejector can be used for evacuation when the maxillary arch is being treated

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4- *Blotting paper*, e.g. placed opposing to the Stenson's duct opening in the maxilla or on the cheeks, and make the area dry completely.

5- *Svedoptor*, it's metal saliva ejector with attached tongue deflector; it's like a clip, a part in the mouth and the other is under the chin. It's used for isolation and evacuation of the mandibular teeth but **can't** be used in cases of *torus mandibularis*.



The Svedoptor can be used on the mandibular arch during the preparation phase

6- *Antisialogogues*, these drugs reduce the salivary flow and they can be prescribed only for patients with excessive salivary flow; they **can't** be given to but for all patients.

Note: local anesthetics that are injected in the area reduce the salivary flow, but it's not an antisialogogues drug.

The antisialogogues drugs are anticholinergic drug; parasympathetic inhibitors, e.g. *Methantheline bromide* (Banthine) and *propantheline bromide* (Pro-Banthine). These are contraindicated in any patient with systemic diseases, e.g. older patient with heart problem, hypertension, glaucoma, or obstructive disease, because the patient may experience drowsiness, blurred vision, etc ...

They have many restrictions and should not be given haphazardly. They are potentiated by antihistamines, tranquilizers, narcotic analgesics and corticosteroid, so here arises the importance of the medical history taken from the patient . They are prescribed 1 hour before the appointment providing the necessary control.

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Another drug that has been shown to be effective as an antisialagogue is *clonidine hydrochloride*, it's **not** an antisialagogue drug, it's an antihypertensive agent, but work effectively in diminishing salivary flow. It's safer and more effective, its

principal side effect, besides a dry mouth, is drowsiness, and because of the sedative effect of the drug, someone should accompany the patient to do any driving. It should be used cautiously in patients who are receiving other antihypertensive medication, because it's an antihypertensive drug.

These drug are used in very rare cases, that is, there is an excessive salivary flow during making the impression.

Note: Rubber dam Is not used for isolation, however it's effective but can't be used when making the impression, because impression making is for the whole arch not for the prepared teeth only, structures such as the finish line, the soft tissues, etc .. should be included in the impression. Another reason that the Rubber dam should not be used is that it will inhibit the polymerization of the impression material due to the fact it contain latex, which contain sulfur, that affecting its setting.

Gingival displacement

Obtaining a complete impression is complicated when some or all of the preparation finish line lies at (equigingival) or apical to the crest of the free gingival (subgingival). In these situations, the preparation finish line must be temporarily exposed to insure reproduction of the entire preparation.

Gingival retraction permits completion of the preparation and cementation of the restoration and helps the operator to make a complete impression of the preparation.

Importance of Finish line exposure

The finish line must be reproduced in the impression due to:

1- Gingival retraction allows the access of the impression material to the finish line and beyond; 1-2 mm apical to the finish line; to contour the prosthesis coronally properly.

2-. The marginal fit is very important in preventing recurrent caries and gingival inflammation (marginal integrity). Hence, the finish

line must be temporarily exposed to reproduce the entire preparation.

3- It ensures a bulk of the impression material in that area, that is, if the material is thin, it will tear upon manipulation.

4- It provides a dry surface, e.g. the retraction cord, that is, it controls the flow of fluids in the sulcus, particularly when a hydrophobic impression material is used, is also necessary, because liquids can cause an incomplete impression of the critical finish line area.

Methods of gingival displacement

1- Mechanical displacement, e.g. retraction cord.

2- Mechanochemically, e.g. retraction cord with agent that aids in homeostasis.

3- Surgical, e.g. laser and electrosurgery.

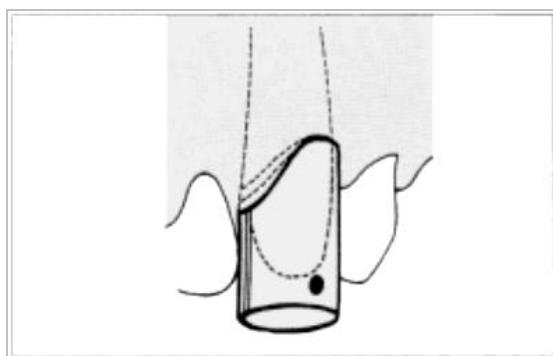
Mechanical displacement

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

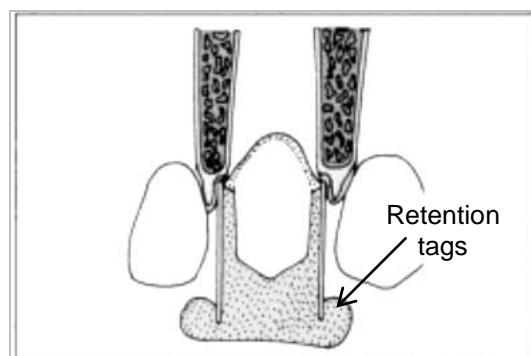
1- *Copper band*

It's like a ring or tube that can serve as a means of carrying the impression material as well as a mechanism for displacing the gingiva to insure that the gingival finish line is captured in the impression.

It's placed around the prepared tooth carefully along the path of insertion of the tooth preparation and follow the profile of the gingival finish line, manipulated and well-adapted, displacing the gingival tissues, to expose the finish line and beyond.



The end of the copper band is trimmed to follow the finish line



Making an impression on using a copper band

Disadvantages: It's a very sensitive technique, that is, it may injure the gingiva. It requires a skilled person, it's not used any more; It's displaced by the retraction cord nowadays.

Note: after the placement of the copper band, the tube is then can be filled with the impression material, and at the same time, an overall impression for the rest of the structures can be made. it's useful in multiple teeth. Retention tags, within the band, can be used, to retain the band in the overall impression.

2-Rretraction cord

It's made of silk, cotton, wool, synthetic fibers etc ... , and has many shapes with multiple sizes. The size used depends on the clinical situation. Pressure packing the retraction cord into the sulcus provides sufficient gingival retraction. They are inserted into the gingival sulcus with special instruments. This is referred to *packing of the retraction cord*.

Types of the Retraction cord

1- *twisted retraction cord*, it easily separates when packing; the instrument can penetrate inside the cord when packing. It can be modified to accommodate any size needed; by removing one of the fibers.

2- *braided retraction cord*, it can be packed easier because the instrument will not penetrate the cord; it's more safe.

It's of 2 types: the filled cord and the hollow cord; the filled cord makes a better displacement of the tissues, in contrast to the hollow cord because it's more flexible.

Role: The more rigid the cord is, the more displacement or retraction result. The more rigid it's, the more difficult to pack, and it could rebound, this rebound is due to the forces exerted by the circumferential gingival fibers,

3- *knitted retraction cord*, it's fabricated in such a way that it has a very high volume that can hold homeostasis agent when impregnated with; it can contain a liquid of a homeostatic agent 2.5 more than the other cords (mechanicochemical displacement). It's

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more compressible, makes less tissue displacement and less rebound of the tissues.

The size of the retraction cord chosen depends on, the volume and depth of the sulcus, and it varies among people, e.g. triple 0, 0,1, 2, 3, 4 etc...

Role: use the smallest cord necessary to create adequate space for the impression material, not a larger one, because it will cause tearing to the tissues in the area.

Q: If you put a cord and it rebounds every time you insert it, What to do?

A: It's larger than the size of the sulcus; so we need a smaller one, but initially we try to pack it **not** with a more force; because you may result of destroying the gingival attachment, you put it and you maintain a little time, then you check it, if it rebounds go for a smaller size, if not it's acceptable.

The retraction cord can be *impregnated* or *non-impregnated* with a homeostatic agent to improve the homeostasis.

The packing instruments can be used: blunt instruments, not necessary a plastic but it should be blunt, e.g. spatula, cord packer. The instruments are classified according to there ends:

1- *Serrated*, best used with the firm cords, e.g. the **braided** and the **knitted** cords, that is, in the firm cord you need something to hold the cord tightly and pack it properly. It helps in further packing, and has a less chance to slip, providing more control, but if it slips it may injure the gingival tissues.

If it's used with the twisted cord it can catch it when removing your instrument after packing, and the cord comes out of the sulcus,

2- *Non-serrated* (smooth-ended), best used with the **twisted** cord. If it slips it can cause trauma, e.g. slight bleeding, but less traumatic than the serrated instruments.

Technique

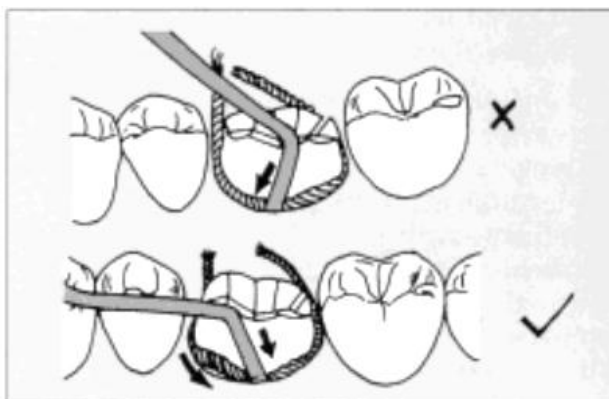
1- The operating area should be dry. Fluid control should be done with an evacuating devices and the quadrant containing the prepared tooth is isolated with cotton roll.

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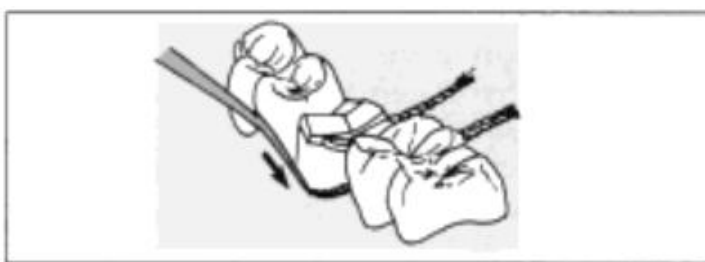
2- cut a length that is equal to the circumference of the prepared tooth, if the isolation is meant to be *Mechanicochemically*, you dip the cord in a homeostatic agent, you squeeze it, and then you loop it around the prepared tooth and pack it using a packing instrument.

Packing into the gingival sulcus starts *interproximally* because it's an easy point to start with, and the cord easily can be packed into the sulcus in that area. Then you complete the packing around the tooth.

The packing pressure should be applied always toward the packed part and toward the tooth; the instrument should be angled always toward the tooth not to the outside toward the gingiva, and toward the packed part, to prevent the dislodgment of the cord from the previously tacked areas.



The cord should be tucked into the sulcus progressively. The instrument should be held toward the packed parts to prevent the dislodgment of the previously packed parts.



The instrument should be angled toward the tooth to facilitate the placement of the cord.

Using Single cord or the Double cord?

If the sulcus is too deep, e.g. very large V-shaped sulcus, and even we take a larger cord it does not have a satisfying result, a double cord can be used; putting the **smaller** one **first** then the larger one, so that a better visibility of the finish line and more access of the impression material when injected.

The larger one is removed when the impression is made and the small one still in its place, to prevent the crevicular fluid from going

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out side and to control bleeding if present. The smallest cord should be removed at the end of the impression making before the patient leave the clinic.

Evaluate the retraction cord if it's packed and placed properly, occlusally, the finish line is exposed from all side, the gingiva is displaced evenly. If the cord is not correctly packed then your impression is not correct and the final crown as well.

You may inject a paste sometimes, around your gingiva to help in your hemostasis and displace the tissue a little bit, but you should use the retraction cord with it.

Chemicals Used for Homeostasis

These used in combination with the retraction cord, to improve retraction and homeostatic effect, these used in *Mechanicochemically* displacement, they control bleeding but do not displace your tissues; to displace the tissue you need a mechanical means. The three criteria for a gingival retraction material are:

- 1- effectiveness in gingival displacement and homeostasis.
- 2- absence of irreversible damage to the gingiva.
- 3- paucity of untoward systemic effects.

They are of 2 types: *vasoconstrictors*, shrinks the vessels and diminishes the blood supply to the area, or the *astringents*, shrinks the tissue and decrease the amount of fluid generated from the area.

Vasoconstrictors,

e.g. epinephrine. It's concentration differ from the one that used in the anesthetic solution; it's 0.1- 8 % solution. It's placed 5-10 min on the area.

It's contraindicated to patient with heart problems, hypertension, hyperthyroidism, and hypersensitivity. They are **not** used frequently in contrast to the astringents, because they are safer agents to be used. Another reason, that if the tissues are lacerated, it can be absorbed and unwanted systemic effect may result.

Astringents

i- can be used on lacerated tissues.

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ii- they have longer period of homeostasis.

iii- they do not have any systemic effect.

However, they can leave debris on the tooth surface while using it; results from the disintegration of the cord itself, so what you have to do is washing the preparation with water before taking the impression.

They are metallic salts:

1- *Aluminum sulfate*, in combination with aluminum potassium sulfate, *alum*. It's concentration 7% solution. It's less effective than epinephrine, with limited homeostatic activity.

It's toxic to the gingival tissue so it's administered not more than 10-20 min. It is the **most** toxic astringents. Since it contains sulfate it inhibits the setting of the impression material.

2- *Aluminum chloride*, more common than the aluminum sulfate, it's concentration 5%-25 %. It has a moderate homeostasis and tissue displacement. It's placed for 10 min.

Note: If you increase the concentration of the agent, more homeostatic effect on the tissues, and also may cause a slightly crystal bone loss; it's toxic.

3- *Ferric sulfate*, **most** common used in our field, and produce excellent homeostasis to the tissues with moderate tissue displacement. It has less gingival toxicity than aluminum sulfate. It's applied 1-3 min and up to 30 min is safe.

These 3 type of astringents can be used in combination with each other, but **not** with epinephrine. Using the retraction cord with or without the astringents, you still can get a proper displacement and homeostasis.

Presence of sulfur inhibits the setting of the impression material, specially the addition silicon, so the prepared tooth should be toughly raised from the astringents before taking the impression.

The cord must be placed in the sulcus 10 minutes to produce it's effect, and the rebound and recovery of the tissues to it's normal condition occurs within 1/2 min-1 min . so the retraction cord is not removed but at the instant you make the impression that is the circumferential fibers of the gingiva recover fast.

The Surgical Method

This method acts on the tissues themselves; physically remove the tissues, to widen the sulcus more, that is if the amount of the tissues are huge and using the cord alone does not produce a proper retraction, the surgical is used first then the mechanical displacement is second. They are **not** used instead of the retraction cord.

- 1- *Electrosurgery*, that remove or kill the sulcular epithelium.
- 2- *Rotary curettage*, using a bur to alter the tissues.
- 3- *Laser*, good homeostasis and good displacement.

The Electrosurgery

It's is the most commonly used. It consists of an electrode with a high frequency current that cut the tissue it passes on. It removes the gingival sulcus inner epithelium via induces a localized polarity changes that causes cell breakdown, improve the access and control the bleeding at the same time.

These methods may result in a gingival recession and the margin of the restoration is then shown and this is not accepted esthetically specially in the anterior teeth.

The circuit is completed by contact between the *active electrode* within the patient mouth and another electrode, the *passive electrode*, that is positioned on the ground.

The electrosurgery unit has different waves used, the preferred wave is *unfiltered fully rectified wave*. This kind of waves is needed for the crown and bridges preparation because this wave is used to give good homeostasis and good incision.

The *filtered fully rectified waves*, induce a very nice smooth incision, but not homeostasis. The *partially rectified* only for coagulation, but not for incision.

The tip of the active electrode is made of tungsten, with different form of the cutting tips.

Considerations

1- The tissue should be moist not dry, but no pooling of saliva. High suction volume should be provided, due to the bad odors that result from the cutting.

2- The patient is given local anesthetic and the tip of the electrode should not be placed adjacent to the metallic filling if found.

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The tip of the active electrode is passed over the tissues and the current cuts, we don't pass the current over the area again we have to wait 5-10 seconds, so that the fluid can accumulate in the area, when the tip of the electrode is dragging, that means that the tip is not cutting well, so the electrical current should be increased. If the power setting is too high, sparkling can be found, so you decrease the setting.

3- The gingival tissues should be healthy and thick, avoid cutting the thin marginal gingival tissues, because once you cut them recession occurs.

4- Profound anesthesia is important. it's contraindicated in patients with systemic complains such as those with peacemaker.

After the procedure, the gingiva is swabbed with 3% of hydrogen peroxide, postoperatively to remove the debris of the dead tissues. Then retraction cord should be used afterwards to complete the retraction.

The Rotary Curettage

During the preparation phase of the finish line, you cut the inner epithelial cells by using a high speed bur, *torpedo*, with copious water, it cuts from both way; prepare the finish line from side and cut the tissues from the other, should be done carefully.

The **most** aggressive method is the rotary curettage, so it needs much control. It's the least method used.

You have to ensure that:

- i- The tissues should be health.
- ii- The sulcus depth is less than 3mm.
- iii- Presence of adequate keratinized tissue; thick gingival tissue, not thin gingival tissue.

Laser

It can provide good homeostasis, and good surgical displacement of the tissues. After the use of laser you should use the retraction cord.

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Note: Healing of the gingival tissues after the all the retraction methods used, occurs within 2-3 weeks, provided that the patient maintain a good oral hygiene and placement of a good temporary crown. the provisional restoration should be smooth to ensure a good healing of the tissue the next appointment.

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