Dental materials – Dr hammad

Shteet no :5

Refer to slide :5

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Last lecture we talked about the irrigants ,type of irrigants and properties of ideal irrigants

NO ONE SINGLE IIRRIGANT THAT QUALIFIED AS THE BEST => SO WE USE AMIXTURE OF IRRIGANTS

We have many irrigants , what should we use ?? and when should I use it ??

Sodium hypochlorite used in early stage when cleaning and shaping takes place after any instrumentation, after that when the canal ready for obturation we use liquid EDTA to remove smear layer , if any remaining bacteria in the dentinal tubules we should back for Sodium hypochlorite to remove it , finally CHX used in final stage of treatment(Substantivity)

HOW TO DELIVER THE IRRIGANTS INSIDE THE CANAL ??

In student’s clinic we use a needle with small gauge (large tip)=> it doesn’t go inside the whole depth of canal so it’s a big problem WHY ??? because we have a theory in endo says that : THE IRRIGANTS ONLY GOSE 1-2mm BEYOND THE TIP OF NEEDLE

**Irrigation Delivery and Agitation techniques:**

Agitation: doing movement while irrigants delivery

ADVANTAGES :↑ efficiency of cleaning and ↑delivery of irrigants to tubules

A-Manual Techniques:

1. Syringe irrigation with needles: passively or with agitation. Irrigant delivered distally or laterally.

2. Brushes: for irrigant agitation and debridement of root canal wall.

3. Manual-dynamic irrigation: well-fitted gutta percha cone, after choosing the Master cone wash the canal with sodium and insert the cone and do agitation as it fit very well reaching the apical part .

B-Machine-assisted Techniques:

1. Rotary brushes.

2. Continuous irrigation during rotary instrumentation.

3. Sonic irrigation.

4. Ultrasonic irrigation.

3+4 : you put your irrigants inside the canal and then introduce Sonic or Ultrasonic device that make activation to the irrigants.

🡺Our aim in endo to kill bacteria inside the canals to avoid the infection

So how we kill bacteria ? by irrigants and medicaments

**Medicaments**

If root canal treatment can’t be finished in a single visit, root canals are dressed with medicaments.

 It’s a Chemical material are put inside the canal to keep it disinfected or to disinfect it .

Antimicrobial agent that is placed inside the root canal between treatment appointments in an attempt to destroy remaining microorganisms and prevent reinfection.

Functions of intracanal medicaments:

1. Primary function: antimicrobial activity

2. Antisepsis

3. Disinfection

4. Secondary functions

5. Hard-tissue formation: 7-8 years old child has an upper central incisor with open apex that has broken by trauma , and the tooth become non vital ( necrotic pulp ) ,so HOW to do RCT for open apex ?

In past , they did what is called apexification, by putting non setting calcium hydroxide inside the canal and reach the open apex to form a calcified barrier

6. Pain control

7. Exudation control :if you dry the canal many times , but the canal still wet either by blood or fluid, , before obturation the canal must be dry so we put Medicaments and wait for next visit to control the Exudation

8. Resorption control : treatment of internal and external resorption (coming lectures)

Ideal properties

1. Antibacterial

2. Control exudation or bleeding

3. Biocompatibile.

4. Eliminates pain

5. Induce calcific barrier

6. Radio-opaque : to see where the medicament is(extent and depth) , if it was radiolucent and you take radiograph ,, the canal appear empty.

In lab , they bring bacteria on petri dish and allow them to grow , then they apply Medicaments on them and see if it kills the bacteria. If they were effective of on the bacteria they decide that it is good antimicrobial agent . ON the other hand , they found that the bacteria inside the tooth differ than the bacteria in the lab , the bacteria in the tooth found in the form of Biofilm.

The antimicrobial efficacy of intracanal medicaments on bacterial biofilms still need to be confirmed.

NOTE :

If next visit decided to be after 2-3 weeks or more and the tooth is weak here we don’t use TF ,the GI cement is more durable and better for tooth

☝Calcium hydroxide,( Hypocal ,Altracal, Calcifix )

• (Mostly used )

• Non setting Ca(OH)2

• Aqueous form

• Inject it inside the canal

• Antibacterial (pH>12) BASIC

• Sterile necrosis : tissue near Ca(OH)2 will be necrotic then calcified without infection

• Cheap

• Dentures protein

✌Antibiotics : to kill bacteria

Tetracycline : disadvantages -staining , developing of resistant

We don’t use it nowadays

🖏Steroids

• Decrease inflammation

• Ledermix : ( steroid " triamicinolone " to decrease pain and antibiotic " tetracycline " to kill bacteria )

formacysol show some carcinogenic result in some studies

✍INDICATIONS FOR FORMACRESOL

Indicated as a disinfectant and devitalizing solution used as part of endodontic treatment to kill vital pulp

If we have vital pulp we put asmall amount of formacresol on a small cotton pellets inside the tooth INORDER TO KILL THE PULP and close it with TF

PRECAUTION 🕱🕱

WE DON’T RECOMMEND TO USE IT BUT IT’S THE ONLY MATRIAL EXIST IN OUR CLINIC

This product can cause severe burns of skin and mucosa. Take precautions protect skin, mucosa and eyes during use.

✌✌CHX:

We use it as irrigants and as a medicaments because of its substantivity up to 3-4 weeks

 gel form inside the canal.

from slide : Owing to the greater activity against Gram-positive than Gram-negative organisms, application of CHX as intracanal medicament is preferred in retreatment case compared with initial endodontic infections.

soThe two major qualities that we need when choosing an irrigant are:
1) tissue dissolving effect
2) antimicrobial effect

**\* Qualities of obturating materials:**
1) Antimicrobial; kills the remaining bacteria in the canal)
2) Biocompatible (not toxic)
3) Good flow( hermetic seal –air tight seal ) ; the canal is irregular in shape so we need a material that has good flow to reach the irregular spaces, so it fills the spaces
4) Adhesive; for two main reasons:
- Prevents the micro-leakage
- Prevents fracture of the root. When gutta percha bonds (sticks) it might strengthen or reinforce the canal.
5)radio-opaque

6)not affected by moisture and dimensionally stable

7) gd handling

8) easily to remove –cheap-doesn’t stain dentine
\* Gutta percha is essentially a rubber material taken out from trees. It's a polymer of isoprene(C5H8). Gutta percha points that we use in the clinic are not mainly made from gutta percha, but from zinc oxide:
- gutta percha 20%
- zinc oxide 60-75%
- metal sulfides, waxes, resin and opacifiers

**\* Gutta percha has two main phases:**
1) The runny material that comes out when you cut the gutta percha tree is the gutta percha in the alpha phase
2) After manufacturing, the rubber points are the beta phase
☺ Advantages of gutta percha**:**
- Very biocompatible (does not harm tissues)
- Dimensionally stable; gutta percha points do not expand or shrink. If it shrinks, we'll have voids and spaces and then microleakage.
- Compactable; you insert a cone then a spreader to compact the point to one side then you remove the spreader and introduce another cone to where the spreader was (lateral condensation/compaction).
- Easily removed
- Cheap

**☹** Disadvantages of gutta percha:
- Does not adhere to dentine
It's important to have adherence to the dentine to prevent the microleakage and to strengthen the root.
- Lacks rigidity, and to overcome this problem we move away from sizes 15 & 20, the other thing is when introducing the sealer we add sealer to the apical 1/3 of the master cone and then whenever we introduce an accessory cone we add sealer to its tip. Sometimes puting sealer on the tip of a small sized gutta percha cone might cause it to bend, so it's better to put it on the tip of the spreader then introduce the cone, and this can also act as a lubricator for the spreader.

In the past they used to obturate the canals with "metal points" usually made out of silver. Metal points are very rigid, so even if there is an obstruction in the canal or a slight curvature or the canal is not well shaped you can introduce the metal point deep because it's very rigid and you can push it to the length you want.
So some of the properties of the metal points:
- They can go straight to the length with some pressure
- They don't need a lot of preparation

\* Problems of metal points **💣**
1) The canal is not well shaped or irrigated and still contains bacteria
2) When you have a canal with irregular shape and you introduce only one metal point it will not be enough to properly obturate the canal even if you add sealer or cement.

They stopped using these metal points 30 or 40 years ago. You might see old patients with their canals obturated with silver points. **How to differentiate between gutta percha and metal points in the radiograph?**
- Metal points are very radiopaque (like amalgam)
- It looks like a point; no taper

As we know, when obturating a canal we use gutta percha points and sealer, **but why do we use sealer ??**Gutta percha points do not flow and the canal is irregular in shape, so:
- we need the sealer to close the spaces that the gutta percha can't close (e.g. lateral canals)
- the sealer acts as a bond between the gutta percha and the dentine (adhesive)
\* So Functions of sealer:
1) Cementing
2) filling the discrepancies
3) Sometimes acting as a lubricant
4) sometimes acting as a bactericidal (kills bacteria)

Unfortunately, A lot of the sealers that we use are toxic when freshly mixed. Toxicity occurs in high levels in the first 24 hours. After the sealer sets the toxicity level becomes zero or decreases to a very minimal degree.
Sealers are available as powder-liquid or two paste system. There are different families of sealers. The most common type of sealers is the **zinc-oxide eugenol sealer (Grossmans or Tubliseal)**.

☺Advantages of the zinc-oxide sealer:- Antibacterial
- Radio-opaque
- Easily used
- Good flow

\* Problems:
- Does not bond/adhere
- Soluble; can be resorbed by the body.

The second family of sealers is the **calcium hydroxide based (Sealapex, Apexit)**.
- Very radio-opaque
- Biocompatible
 Antimicrobial; because it's alkaline. Its PH is very high, so it has an antimicrobial effect.-
\* Problems:
- Soluble
- Does not adhere

\*\* **Resin based sealers** are sealers containing resin like that in the composite. It has many commercial types: AH26, AH plus, Endorez, Epiphany, Realseal.
The main advantage of using them is that the resin materials are adhesive in nature (they bind), so they can prevent the microleakage and resist the fracture of root, some studies reported that this type of sealers provide zero microleakage!

As we know, the main disadvantage of resin based materials is setting shrinkage, so we won’t have full sealing which leads to micro leakage. However, many researches demonstrate that resin based sealers would not strengthen the root. One of these researches said that if we want to reinforce the root, the obturation material should have an equal or higher strength than the root. Until now, we don’t have any material which have this property.

Mono-block theory (الوحدةالواحدة): the concept of creating mechanically homogenous units with root dentin, so if I use resin based adhesive or sealer that binds to gutta percha and the sealer bind to dentine then these elements will function as one unite so this will reinforce the root, but it still as a theory.

**Glass ionomer based sealer:**

Have been introduced as endodontic-sealer that binds to dentine. This material have a mildly antibacterial activity and adheres to dentine, but it is difficult to be removed and you will face a difficulty in retreating a tooth or when you want to use a post.

Some extra points from the slides:

1. Slightly soluble
2. Unset GIC is cytotoxic but when set this reduces with time

**Examples**:

1. Ketac-Endo sealer
2. ActiV GP sealer

**Silicone based sealers:**

We use this material to prevent micro leakage, it expands upon setting so it will reduce the micro leakage.

One of Silicone based sealers is the Roekoseal sealer which comes on capsules, so we use something like amalgamator for a half minute then we put the capsule in a gun that inject the sealer inside the canal. This material will expand by 0.2 % but it will not adhere to root canal, so you can remove it easily.
25; 01 did not show any superiority!!!

Some extra notes from slides:

We use an addition type silicone

GuttaFlow is Roekoseal sealer with added gutta percha particles.

**New root canal filling materials:**

As the resin based sealer does not bind to gutta percha, some companies develop resin-based root canal filling material in an attempt to create an adhesive bond between the solid-core material and the any type of resin based sealer.

1-Resilon is an example of these materials, it can be supplied in the same sizes and shapes of cones as gutta-percha, but it is pink in color not orange.

Resilon has been introduced in 2004 to provide a mono-block phenomenon, but unfortunately this material fail to provide better prevention of micro leakage and does not reinforce the root canal.

26; 25 to 26; 30

2-EndoRez sealer (provided by Ultra Dent Company): A gutta percha cone coated with resin, so the core of the cone is gutta percha and the outer layer is a resin. Again, it is manufactured in order to bind to resin based sealers.

3-ActiV GP: glass ionomer coated gutta percha which can be used with glass ionomer based sealers.

Until now we don’t have any material which is adhesive in nature that could prevent micro leakage by binding and strengthen the canal. So we still use gutta percha as we can’t find a better material.

\*\* If we have polymerization shrinkage in resin material, does that necessarily lead to re-infection of the tooth? No, because unless the bacteria exist in the root canal, then we won’t have an infection and this is depending on two factors: excellent coronal restoration and successful cleaning & shaping procedure will prevent this. So you may see a root canal which is obturated since 18 years in a wrong way but you can’t find a lesion in PA area, this is due to a very good coronal restoration which prevents any bacterial leakage to the canal.

**Retrograde root filling materials:**

If the patient came to you complaining of pain in the upper central and it is indicated for RCT then you did an excellent RCT and it was good on the x-ray and the taper the obturation and everything was fine and after two weeks the patient came with a sinus and pus, so we repeated the obturation removed the gutta percha and cleaned the canals again then, and the sinus for example is good now, then also after weeks the pt. came with swelling , so we can’t do the RCT anymore, because the tooth will become more weak.

\*\*So we have a surgical procedure in endodontics called Apicectomy.

**Apicectomy**:

It is a surgical procedure in which we make a flap then we go directly to the apex of the inflamed tooth -usually the infected area is the area around the root- then cut about 3mm of the apex and removes all the affected tissue. Then enter and prepare another 3mm of the canal by an arthosonic tips. After preparing, use retrograde root filling material >> put a filing material and close the flap, bonding and healing then occur and all the symptoms now disappears.

***Why we remove 3mm of the apex first?***

Because 75% of accessory canal go to the 3mm apically so to prevent infection by bacteria that come from accessory canal not the main canal.

They use many materials, such as: Amalgam: use it since we need material its seal is perfect but the problem with it that there is leakage, IRM, EBA, composite & glass ionomer.

The main problem when we close the flap bleeding (fluid) occurs >> so if the material we used sensitive to moisture or fluid, it will not set probably >> not sealed probably >> re-infection and complication occur (for example: composite)

🖐🕭-The most important material used is MTA (mineral trioxide aggregate)

*The main problem is the presence of bleeding or fluid* so in 1998, Dr.Ibrahim Torabinjad start thinking about material that not affected by moisture or even can set in moisture and he introduced the MTA. MTA is basically made of Portland cement (cement that used in building). So what he did, he brought 22 types of Portland cement and examined them, eventually he found out just 2 types that can be used for humans. Then he modified them by removing the toxic material from it & changing them to radiopaque & very compatible >> finally he came out with MTA.

🖐MTA is the most expensive material but the perfect one because it needs moisture to set, can reach zero micro-leakage & it’s cemento-genesis material, it stimulate the growth of cementum -when you removed the root, you removed dentino-cementum at the cut area. So by putting MTA inside the canal, it will enhance the growth of cementum- .

At the beginning, they use it in the **surgical procedure**. Now, they moved on using it in other cases such as **pulp capping** and it has superior properties than calcium hydroxide -Calcium hydroxide can be used for small pin-point pulp exposure, more than pin-point the MTA is the best-

If children came to the clinic with pain (has symptoms of irreversible pulpitis) so the *pulp vital* but inflamed >> what we do is (**MTA pulpotomy**), HOW?

By removing all pulp tissue in the pulp chamber & *the pulp tissue in the canal remain (radicular pulp*) >> then put cotton with hypochlorite inside the pulp chamber & wait for 5 min >> after that if there’s no bleeding mix MTA and closed the pulp chamber by it. So what I’m doing here:

1-removing the inflamed pulp tissue which I supposed is the coronal pulp (since the bleeding stop >> so supposed is not inflamed anymore)

2-filling the whole chamber with MTA to keep the remaining pulp tissue inside vital that has the potential for healing and repair

-Partial pulpotomy: not removing the whole tissue in the pulp chamber just remove 2mm and then put MTA as in children with fracture crown & the pulp exposed.

*\*\*Note: Vital pulpotomy removes tissue from inside the crown (above the gum line). Root canal treatment removes all of the nerve tissue, including the part in the roots of the tooth, below the gum line*

-**Perforation**: the best material is the MTA, sometimes glass ionomer when the perforation is supra-bony (not infra-bony)

-**Resorption in the root**

-**Non-surgical apical closure**:

Used when *the pulp is necrotic* -patient with trauma and open apex- (can’t use pulpotomy if the pulp not vital), so what supposed to do?

In the past, they irrigated & sterilized the canal very well then fill it by non-setting calcium hydroxide (liquid) in the canal and every 3 months in 2 years change it. Non-setting calcium hydroxide made calcium barrier (Calcium Bridge) over the apical root-end. After closure the apex by Calcium Bridge, you can do root canal treatment but you have to be very cautious not to break this bridge. Nowadays, they start using the MTA to close the apex. In the first visit after 1 months check if the canal clean & not infected >> in the second visit if everything okay put MTA ---------(47:15) at the apical part of the root & wait for the next visit >> in the next visit ensure if the MTA is completely set then filling the canal with gutta percha.

*MTA is the perfect material but has 2 main problems:*

1. Very difficult to handle it & needs experience
2. Long setting time (4 hours) so you can't continue the whole procedure in the same day >> we put MTA & a wet cotton on it because it needs water to set, and dismiss the patient for another appointment to continue.

**Pulp Regeneration**

For example if we have central incisor with necrotic pulp, what to do to regenerate the pulp?

Do good cleaning & irrigation to the canal >> remove the infection >> go inside the canal with file causing bleeding in the whole canal >> after the canal is full with blood put the MTA coronally not apically. So the blood inside the canal change & the cells differentiate into odontoblasts forming new pulp & dentine.

🕭this sheet is written with a help from last year ones

Back to slide#5 for extra information

if you have any question please don t hesitate to ask 🖂

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GOOD LUCK ☺