***sheet no. : 11***

***Refer to slide no. : 5***

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***# obturation materials #***

obturation material consist of :

 **core**: which work as stone , it fill the canal.

**sealer** or **cement** :which give the sealing effect.

there are more than one type of them.

**NOTE : you can study the types from the presentations of your colleagues , but the Dr's presentation is complete , you can study from both references , but you must read the book ☹**

**Ideal properties for root filling materials**

.... Grossman discovered these properties, for core materials and sealers

we have :

1) technical

2) biological

3) handling properties

**" Technical "** as a dentist we most care about is that the filling material has to be inexpensive , easy to handle , accessible, doesn't shrink , does not let moisture in " nothing in and nothing out "

To have a seal we must have adhesion to the dentin wall .

**"biological properties** " are important for the patients

the obturation material must be non irritant to the tissue ,doesn't interfere with the healing , and if it induce healing that would be great . it should be sterile and doesn't cause any allergy.

**" Handling proprieties " :**

easy to handle and work with , easy to put in the canal , and easy to be removed if we did any mistake in the procedure.

1. ***Gutta –percha (GP)***
* the most popular material used for obturation .
* it is the trans isomer of polyisoprene (rubber(
* consist of approximately 20% gutta percha , 65% Zno and other coloring agent
* Gutta percha can't be compressed or made to flow at room temperature
* compaction result in transmission of forces to the canal walls equally and may result in root fracture , we can overcome this problem by heating, or adding solvent as chloroform.

NOTE : when you do an obturation using this flowable gutta percha material and you compact it by lateral compaction using finger spreader which decrease the force transmitted to the dentin , we can't always use heat or warm GP we try not to use solvent because after softening the solvent will shrink.

if you need to use solvent to warm vertical in other world softening and compacting it to decrease the shrinkage.

**# major advantages of GP :**

* it is plastic material
* easy to manipulate
* minimal toxicity
* radiopacity
* easy to be removed with heat or solvents.

**# Disadvantages:**

* its lack of adhesion to dentin .
* when heated , shrinkage will occur after cooling .

**\* GP exist in 2 crystalline form** (( **alpha** and **beta** ((

**alpha phase** : it is the natural phase we take it from markets with the same properties and composition as it's taken from tree .

**Beta phase**: chemically processed phase, you take from the markets

 **alpha** phase is pliable, tacky and can be made to flow when pressure applied , it shrinks on setting but less than beta , so it is better to be used with warm techniques .

-heating **alpha** above 65 , then cooling at room temperature (spontaneously ) it transfer to **beta**.

-heating **alpha** above 65 then very slow cooling (controlled cooling(

it stay **alpha** , it doesn't change .

**chemically** alpha and beta are the same but they differ in their **physical** properties under the effect of processing .

**# beta phase shape :**

1) standardized 2) non standardized

**\* non standardized cones** :nomenclature refer to the dimensions of the tip and the body , it range from extra fine , fine fine , medium fine ,,,,, to extra large .

don't worry about non standardized nomenclature

**\*standardized cone** :designed to match the taper of the used instruments ex : size 40/04 has a tip of .4mm and a taper of .04 mm per 1 mm

Unfortunately uniformity in manufacturing is not present and the actual cone size varies

There is +/- 0.07 error , so some time when you are using a file #35 and you feel that it is not suitable ( you feel it is large ) , you can use another file 35 which might be smaller by chance because of the error.

standardized cones have same color coding of flies.

Extra information ::

 Obturation system matching the system of instrumentation it just has marketing benefits ..

**# sealability of Gutta percha GP**

* GP without sealer will not seal
* sealer fill the spaces between GP cones and canal walls
* but it doesn't fill wall under GP so it is better to add it incrementally.

*use lateral compaction followed by vertical compaction for GP placement.*

 **#GP sterilization**

in fact we can disinfect them not sterilize them by placing them in 5.25%

NaOCl for 1 min , then rinse it using alcohol because NaOCl crystallize on the GP so we remove it by alcohol.

**# Biocompatibility of GP (toxicity(**

GP biocompatible and have minimal toxicity but in one study done on mice , scientist insert GP material subcutaneously , some mice inserted with large pieces and other with powder (small) they found that there is a sever inflammation with the powder, but the large pieces were encapsulated with fibrous tissue in inflammatory Rxn

that mean don't worry of outer extention if happened beacause it will be encapsulated with fibres.

we concern about powder , when we remove it while doing retreatment , postoperative pain will happen if debris get out .

**# how can we remove GP**

 It can be removed Using heat or solvents .

 NOTE ::

Instruments used to put the pellets of GP , **GP extruder** or **elements unit** ( different name for different companies) they heat the GP ( alpha phase ) to use it inside the canals.

**# modification of the standard GP**

by adding disinfectant or by coating,

note : the informations written in the slides about modification is enough.

***2 ) silver point***

* Another core material similar to GP but it is made of silver
* it doesn't adapt the canal wall so there is a spaces in between , so tissue fluids there lead to corrosion , irritation and shrinkage.
* No longer used
* In X ray : they are very well defined , exactly the same radiopacity as amalgam.

***3) Resilon***

* core material resemble the composites, made of similar material , it is a polymer of polyester , it contains bioactive glass , difunctional methacrylate resins , radiopacifier by adding barium sulfate
* they look exactly as GP so clinically it is hard to be recognized
* It has to be used with epiphany sealer
* the problem wirh resilon , that it can be degraded by hydrolytic enzymes.
* usually the most apical part of it , is in touch with apical tissue, the body tissue release hydrolytic enzymes which degrade the resilon so it leave a space ,loss of apical seal .

**monoblock**::

 tryin to make the obturation and the dentin as one block so it become stronger.

earlier studies says that it is good and it strengthen the root ,late studies deny this.

usually here we have dentin then sealer then resilon

dentin then sealer --🡪 this is the first interference

sealer then roslin ---🡪 this is the second interference

usually the failure happens at the interference between the sealer and dentin , sometimes in odd cases we can find that there is failure between resilon and sealer ; because it is technique sensitive , the canal must be dry and clean in order not to affect the bond strength

because of that monoblock is not popular

also we do bonding all around 360 degree, **(( c- factor ))**which is the polymerization shrinkage so when there is 360 degree of bonding, stress increase on dentine with shrinkage ( read about C fiber from the book )

***# sealers #***

 as we said that we put them between the The gutta percha cones and the dentin .

The function of sealer is to make bond between the cones and the dentin , also fill the gap between the cones themselves , and fill the voids and irregularities that present in the accessory and lateral canals , because w3 don't fill them with cones

Also we use them as lubricant for the core material

All sealer are toxic before setting , but after setting the toxicity will decrease alot

* Ideal sealer characteristics( we don't have an ideal one)
* Tissue tolerance (no tissue destruction nor cell death)
* No shrinkage with setting, cause if it shrink this will lead to voids
* Slow setting time (adequate working time for obturation)
* Good adhesive (between core material and dentin)
* Radiopaque
* Doesn't stain
* Bacteriostatic effect (bactericidal might be toxic to tissues), although there is some bacterioradical but not toxic
* Insoluble in tissue fluids( to prevent dissolving )
* And of course, creates a seal

***Zinc Oxide Eugenol***

Zinc Oxide is one of the most used, and longest tested of all root canal sealers

On balance it is the best, easiest, least toxic and most reliable of all sealing materials.

To make it adhere pretty well requires small particle sizes and thinner mixes.

Early formulas used to use silver for radiopacity, Modified formulas replaced silver and introduced a non-staining formula( they replace the silver with barium sulfate or bismuth oxide)

Powder/Liquid

**Powder:-**zinc oxide (42%) -staybelite resin (27%) -bismuth subcarbonate (15%) -barium sulfate (15%) -sodium borate (1%)

**Liquid:** - Eugenol

when we mix the ZNO with the eugenol , there will be ZNO eugenol and still some free eugenol that doesnt react ( this is toxic)

\* the more unreacted eugenol , the more the toxicity

\*also the increase release of eugenol will lead to decrease in the volume of the sealer , so shrinkage will occur

***advantages:***

* Long history of successful usage
* Anti-microbial activity
* Not expensive

**Disadvanates :**

* Stains if not removed properly
* Very slow setting time (about 2 months)
* poor adhesive
* Shrinkage on setting
* soluble

**Calcium hydroxide (Ca(OH)2)**

we use it to weep the canal ( remove exudate , pus , blood )

and as intracanal medicament ( bacteriostatic and bactericidal(

it is alkaline and it's ph = 11 , so this is good because most of the bacteria need acidic environment to live

it is inexpensive and very easy to use, but unfortunately it make acid itching

Ca(OH)2 , can be used in pulp capping( in the setting form )

or in root canal medicament ( in the non setting form)

when we put it inside the biological tissue it make calcification , either in dentin or cement or bone ( it induce calcified tissue formation)

so they though if we use it , a biological effect will occur on the root tip (cementum formation ) but this is not the case , because in order to work like this , the hydroxy ion should be released (free) , if it was not setting ( free Ca, and oh ) so the affect will be more

but in sealer , setting will occur so the biological effect won't happen.

Note : study ca(oh)2 from the doctor slides .

**Resin sealer**

it has long history of use , modification occur on them each period of time

they don't contain eugenol ( advantage , not toxic)

it is plastic material , easy to deal with

it has 2 types : 1) epoxy resin 2) methacrylate

epoxy resin : when polymerization occur , the ring will open and the rxn will occur by the oxygen ion

we have 2 types if epoxy resin 1) AH26 2) AH26 +

**AH26 :** it was found that it release formaldehyde (toxic) when it set

it is powder liquid

**advantages:**

* Not sensitive to moisture( if microleakage occur it won't dissolve)
* high radiopacity
* less shrinkage

**disadvantages :**

* toxic due to formaldehyde
* stain ( cause it may contain sliver)

how ever this Dr. said that this is the old formula of AH26 , but the new formula it has no silver , and the release of formaldehyde is significantly reduced (not zero but , too small).

**AH26 +** , modified formula of , AH26

the physical properties are the same as AH26

but the biocompatibility is better ( no silver , and reduced release of formaldehyde)

the nomenclature of it (AH26) : **AH** refer to the materials it contain (A-aethioxyline resin , H-hexamethylene tetramine)

and **26** : refere to the number of trail when they discover it.

**Diaket**

polyvinyl resin , first resin to be used

Powder : ZO and bismuth-P , & Liquid :Diketone

NOT used so much nowadays.

**methacrylate based resin**

it is similar to the resin that we use in composite .

**Other Resin sealers**

New resin sealers have been introduced for use with resilon

these sealers bond to canal wall and the core material to create a “monoblock

1)Epiphany : dual-curing , it has chemical curing from it self , also we should cure it by light

it has 2 base in the same syringe (automixing) , more easy and accurate mixing.

2)Realseal