**Gypsum products**

**\*gypsum is a product already present in nature as calcium sulfate dihydrate .**

**\*it's important to be dihydrate .**

**\*gypsum product used in dentistry with many modifications .**

**\*we use gypsum in forming calcium sulfate hemi-hydrate (that's why it's important).**

**\*pay attention please that :-**

**#dihydrate  in nature .**

**#hemi-hydrate  when we process it in order to use it in dentistry**

**\*the main uses for gypsum is :-**

**1-cast.**

**2-dies.**

**3-model.**

**4-investment.**

**\*when you take impression" negative view "from patient ,then you pour it ,you will get the casting & this the positive view of patient .**

**Positive view  that represent the patient.**

**Negative view  the impression.**

**\*the primary constituent of gypsum is calcium sulfate hemi-hydrate .**

**\*the process to get this product from nature called calcinations.**

**\*calcinations : heating the product in certain temperature (110-130 C ) to get dental gypsum (calcium sulfate hemi-hydrate).**

**\*application of gypsum product (hemi-hydrate) involve the reverse direction , meaning that we will mix it with water ( because we get it dry as powder) so we will return it to its nature form but with certain properties .**

**\*in nature >>> dihydrate.**

**\*we receive it as >>> hemi-hydrate.**

**\*in use >>> dihydrate**.

**\*reverse rxn involve heat product so its exothermic rxn**

**>>>\*for simplify it imagine the revere rxn like this :**

**Gypsum in nature << gypsum dental product + water**

**.**

**\*we have different calcification of gypsum product , each one of them with different uses , but all of them are chemically identical.**

**\*chemically identical mean all of them is calcium sulfate hemi-hydrate (we talk about it before uses , before mixing with water).**

**\*they differ in physical forms (size of particles , regularity , form of particles ,…. Etc ).**

**\*types of gypsum:**

**>>>chemically identical.**

**>>> differ in physical properties.**

**\*we will start from the least mechanical properties to the highest (from weakest to strongest).**

**\*you should memorize it by heart ☺**

**\*while moving down , improving the properties is obvious.**

**remember we say type 1 rarely use.**

**\*\*we will start with type 2 *(MODEL PLASTER )* :-**

**-**

**-we said that they differ in physical properties so there's thing in the process will make these difference so u have to know how to produce each of this product.**

**-the way of produce it : we heating the powder in open container (heating process exposed to the air ) for elimination of water .**

**-bcuz its in open container exposed to air so its porous , irregular.**

**-we call it (beta-hemi-hydrate) or (type 2 stone).**

**-it’s the weakest & least expensive .**

**-usually white in color (this not rule , it depend on company , per company they are color coded ).**

**-use it when strength is not critical required such as in temporary or transitional use , its less mechanical properties.**

**-example of it the study model (model=cast) the first model you get from patient when he come to you as first time , you don’t begin treatment , you just study it until now.**

**-so here don’t need to use expensive material bcuz its just to keep record for patient , study & do planning for case .**

**Plaster with some modification will give us the plaster impression (type one).**

**\*Dr show slide about close view of particles of plaster model.**

**\*study model : first impression you take from patient to study the case.**

**so..why do we use this?? bcuz high mechanical properities not required.**

***\*\*third category : dental stones :-***

**-it made under steam pressure in closed container .**

**-so we expect fine , regular , uniform ,less porous particle .**

**-also called (alpha-hemi-hydrate ) or (hydrocal).**

**-it has better properties so uses in more critical required such as use it to make cast in parietal & complete denture .**

**-complete denture in edontoluse patient.**

**Pay attention that :-**

**\*primary cast >>> to study case & ,make special try.**

**\*secondary cast >>> to make denture**

* **How we work :-**

**we take primary impression ,put it in plaster (not critical) then make special tray on this cast then take the secondary impression which is the critical one.**

**-dr showed slides about procedure of this :-**

**Impression from patient , then you mix gypsum product , then you pour it in the impression , when it set & separate , it you will have cast from gypsum product.**

***\*type four :die stone :-Dental stone high strength***

**-calcinations in calcium chloride solution or magnesium solution to give very dense powder particle in cuboidal shape with reduced surface area .**

***\*\*Recall :-*smaller particle reduce the surface area.**

**-strongest & most expensive.**

**-referred to modified alpha-hemi-hydrate .**

**-used in more critical cases (when we have very fine details and feature ).**

**Attention :-**

**\*\*type two >>> beta**

**\*\*type three >> alpha**

**\*\*type four >> modified alpha**

***\*\*Type 5 :dental stone gigh strength high expantion:-***

**-the strongest & most expensive .**

**-has the highest compressive strength but with high expansion.**

**-base metal "metal alloys" will shrink upon solidification & this will not fit the cavity in the tooth , so we must pour some material around the crown to allow the expand to compensate for this difference , otherwise the crown will be small.**

 **\* so metal first they are floated surrounded by this material .**

 **\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

***\*\*gypsum –bounded investment :-***

**-there is gold containing alloys >>there melting point less than one thousand , for these gold we can use this category .**

**-investment : the material that surround the crown to save the shape at melting .**

**-crown made by wax ,we take it & put it in flask , so when we take the crown , the investment surround it .**

**-while using investment material >> so when melt the wax , the shape of the crown stay inside it ,so at that we introduce the metal to take shape of crown instead of wax in one side ,then put the metal in other side to achieve the shape.**

**-There is a wide range of investment material according to the metal we use , depending on its melting temperature .**

 **\*eg:there is investment don't tolerate high temperature so it become solubility & deterioration .**

**-if we use gold containing metal , you can use gypsum bounded investment because it can tolerate less than thousand temperature , but in base metal we use different product.**

***\*\*(water : product )ratio***

**-because gypsum types differ in their physical properties so sure differ in this ratio.**

**-alpha hemi hydrate require less water than beta.**

**-more fine particle >>less water require >>all property better.**

**-the more irregularity the particle , the more water they need.**

**-physical property reflect amount of water needed.**

**\*\*there's table you have to memorize it ☺**

**\*\*\*If there's high (w:p) ratio :**

**1-longer setting time.**

**2-weaker product.**

**3-lower hardiness.**

**4-lower setting expansion (high water :lower expansion).**

**-But if there's low w:p so very difficult to pour the mix because it's become rigid so don't give us the details** .

**\*\*there's table with ratio you have to memorize it carefully ☹**

***\*\*factors that affecting the amount of water during mixing:-***

**1-particle size & total surface area.**

**2-particle size distribution.**

**3-adhesion between particles.**

***\*\*physical properties:***

**1-strength & hardness**

**2-dimensional accuracy**

**3-reproduction of details**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

***1-strength & hardness:***

**\*\*The more the water >>the weaker >mechanical properities less>the more the purosity**

**\*\*type one is the most one that need water & as a result its compressive strength the least one.**

**\*\*when you goes up 2 >> 3 >> 4 >> 5 so the compressive strength rise & the water ratio decrease .**

 ***2-dimensional accuracy:***

**\*\*it decrease from 2 to 3 to 4 to become more accurate & increase in 5 for certain use.**

**\*\*accuracy reflected by expansion .**

**\*expansion not good thing.**

**\*setting time must be very low to allow the material to fix when we work with it.**

***Control the expansion :-***

***a-water:***

***\*if we increase the amount of water >>the center of growth drift apart & expansion will be less.***

***\*more water will inhibit the growth of nuclei so less expansion.***

***b-longer mixing time:***

***\*if we take more time while you are mixing >>,the center of crystallization form because all powder dissolve in liquid.***

***\*longer & quick spatulation time>>more expansion cuz more chance for growth of nuclei.***

***c-chemicals:***

***\*some of them by their nature reduce the expansion such as sodium chloride , potassium sulfate or borax.***

***\*once you put these chemicals in the rxn they will reduce the center if growth so reduce the expansion***

***3-reproduction of details:***

***\*if the mix is fine the detail is better so the best choice is at the end of the list.***

***\*finer particle >> smoother mix >> more details***

***\*we use die stone in fine cases.***

***\*SOLUBILITY :-***

**\*gypsum product not soluble to limit but if you put it in certain environment it will be soluble .**

***HYGROSCOPIC SETTING EXPANSION :-***

**\*if you put the mix under water after initial setting time >>expansion increase thus this expansion called hygroscopic setting expansion.**

**\*\*we have two expansion :**

**1-setting expansion : water reduce it (the water in w:p ratio ).**

**2-hygroscopic expansion : after initial setting under water, its physical properties , water increase it .**

***\*\*SETTING TIME :***

**\*start mixing time one min.**

**\*initial setting 8-16 min.**

**\*final setting takes 30-45 min , here become very rigid you can separate cast from impression ,here the rxn complete.**

**\*you can check the rigidity by knife .**

**\*you have to use standard tool to check rigidity .refer to the resercher.**

 **\*\*e.g. we use small or large Gilmore needle to test it , if the needle penetrates so the final setting doesn't occur yet .**

***CONTROL OF SETTING TIME :***

**1-IMPURITY :**

**\*If you mix in pole that already has impurity >>then some centre are formed already from the previous mix >>the shorter setting time**

**\*particles will get something to bind & continue making center .**

**2-FINENESS:**

**\*there's growth around centers when we have fine particles .**

**\*finer particle need less water so shorter setting time .**

**\*water will delay the setting time.**

**\*thinner mix need longer time to mix comparing to thick.**

***3-(WATER:POWDER) RATIO :***

**\*the more water >> the more setting time .**

**\*water drift apart particle leads to slowing down the growth. therefore , takes more time to set.**

***4-MIXING :***

**\*longer & more rapidly spatulation will enhance the growth >>increase expansion so less setting time .**

***5-TEMPERATURE:***

**\*(25-37) C will accelerate the setting time .**

**\*very high temperature will make retardation." inhibit the setting time"**

**RETARDATION & ACCELERATER :**

**\*certain chemical increase the rxn or slow it down or retard it.**

**\*these chemical are already mix with the product.**

**\*\*Accelerator >> increase potential for crystallization material.**

**\*\*retarder >> inhibit it , e.g. : glu,heavy & viscous material , gum , gelatin.**

***MANIPULATION :***

**\*powder & liquid should be in specific ratio.**

**\*you put water first then powder then start spatulation until you have homogenous mix (recall working time one min ).**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

***\*\*SPECIAL PRODUCT :***

**\*mounting stone & modified stone or plaster used to fix the cast on the articulation .**

**\*we can replace it by type two.**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

***\*DISINFECTION :***

**\*you have to disinfect cast but we prefer to disinfect the impression .**

**\*there's some modification use , so we don't have to clean cast because we already disinfect impression , otherwise , you have to disinfect cast.**

**\*advantage of gypsum product :**

**1-inexpensive .**

**2-good accuracy & dimensionally stable.**

**3-reproduction of fine details.**

**\*\*disadvantages:**

**1-mechanical property generally not ideal. Even we use them in almost all cases.**

**2-compatible .**

**\*\*when we use material , it must be compatible .**

**\*compatible : matching , so when pour impression it will give nice details eg:alginate.**

**\*sometimes we have difficulty with alginate , may make retardation because it has inside (borax)**

**(( ) which is one of the retarder.**

**\*so sometimes after pour alginate impression & separate it , it will be little bit soft , so we put surfactant on impression before pouring , so this reduce compatibility.**

**\*gypsum product combatable with all imprision matrials**

**Special THX 4** : Ghayda' Al-Gallab

Masterwork sheet ☺

**\*Notes ☺**

**-I don't have the slides so I try to write everything ,, so you can studythe sheet only cuz it contain every word the dr said in lecture .**

**-special thanks to Samar Jaiosy for sending my sheets always :P**

**-if you have any Q please don't hesitate to contact me** .

