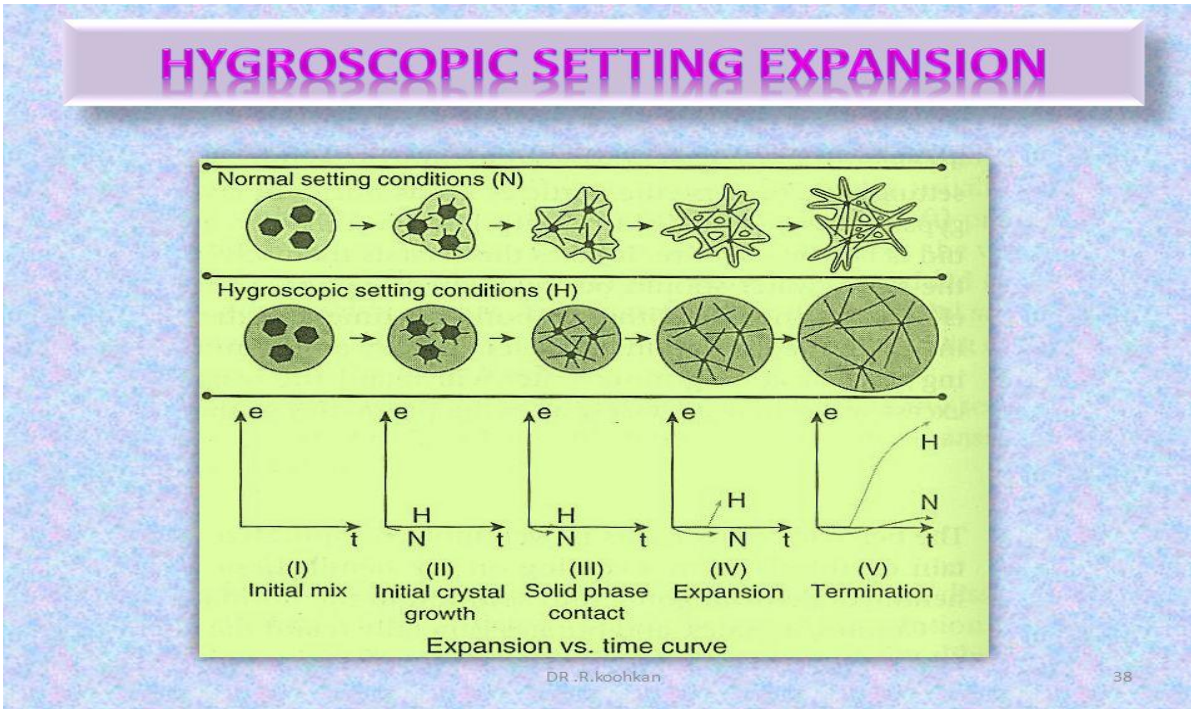
Dimensional changes on setting (setting expansion) Setting expansion is of two types:

1-Normal setting expansion

2-Hygroscopic setting expansion Regardless of the type of gypsum product an expansion of the mass can be detected during the change from the hemihydrate to the dihydrate after mixing with water. This expansion could be explained on the basis of the mechanism of crystallization. It is important in resulting of an accurate cast .

Normal setting expansion There is an outward growth of crystals from nuclei of crystallization, as a result of the growth there is an entanglement and there is interception between the crystals. If one crystal intercepts another crystal there will be stress at the point of interception in the direction of the growth the impinging crystals. If the process is repeated by thousands of the crystals during growth, it is possible that the outward stress or thrust could produce an expansion of the mass. The final structure immediately after setting is composed of interlocking crystals between which are micro pores containing excess water. On drying the excess water is lost and the total empty space is greatly increased



Factors affecting the setting expansion:

1. W/P ratio: the higher the W/P ratio the less the expansion because of fewer nuclei of crystallization per unit volume are present than the thicker mixes and since it can be assumed that the space between the nuclei will be greater in such case, it allows that there will be less growth interaction of the dehydrate crystals with less outward thrust resulting.

2. Addition of chemicals (accelerators and retarders): both will reduce the setting expansion. The reduction of the expansion is due to that the initial rate of crystallization is so rapid that subsequent growth is resisted with the accelerators. For the retarders the crystalline form may be changed and the crystals may become thick and short so the thrusting between the crystals is reduced so the expansion is reduced.

Hygroscopic expansion: If the setting process is allowed to occur under water the setting expansion may be more than double in magnitude this is called hygroscopic expansion. This increased expansion is due to the additional growth of the crystals permitted and not to any difference in the chemical reaction. Strength: The strength of gypsum products is generally expressed in term of compressive strength although tensile strength is also considered.

Factors effecting the Strength:

1. W/P ratio 2. Mixing 3. Drying 4. Chemicals 5. Porosity

The strength of the gypsum increases rapidly as the material hardens after the initial setting time. The excess water presents in the set mass affect the strength. Therefore, there is wet strength and dry strength. The wet strength is when there is excess left in the mass. The dry strength is that when the excess water has been dried in air or in oven in warm temperature. The dry strength may be two times greater than the wet strength.

The effect of drying is to remove the excess water between the crystals. The excess water reduce the cohesion between the crystals themselves 40% of the strength is due to the cohesive forces between the crystals in addition to the strength which

can be attributed to the interlocking of the crystals during growth. The set plaster or stone is porous. The greater w/p ratio the greater the porosity and the fewer the crystals. Mixing time also effect the strength. Increase mixing increase the strength but over mixing will reduce strength because it will break up the crystals which are formed and will result in less crystal interlocking. The addition of accelerators and retarders lowers both the wet and dry strength. This is due to the reduction in the inter crystalline cohesion

Tensile strength Gypsum is a brittle material ,thus weaker in tension than in compression .The one hour tensile strength of model plaster is approximately 2.3 MPs. When dry ,the tensile strength of dental stone is twice than that of plaster. It is significant in fracture of teeth in the cast while separating from the impression ,tensile strength is a better guide to fracture resistance. Hardness and abrasion resistance This is related to the compressive strength. The higher the compressive strength of the hardening mass, the higher the surface hardness .After the final setting occurs, the surface hardness remains constant until most of the excess water is dried, after which it increases.

Storage Plaster and stone absorbs moisture which causes gradual deterioration. Hydration begins on the surface of the hemihydrates particles forming fine coat of gypsum and this will act as effective nuclei for crystallization and this shortens the setting time, to avoid deterioration plaster and stone powders should be stored in airtight waterproof containers in a dry region of the laboratory.

Care of the cast If the gypsum cast soaked in water it must be placed in a water bath in which plaster debris remains constantly on the bottom of the container to provide a saturated solution of calcium sulfate at all times. This is known as "slurry water ".If the cast is washed in ordinary water, surface layer may dissolve ,so the slurry water is used to preserve surface details .All gypsum casts must be handled carefully, as any departure from the expected accuracy may result in a poorly fitting appliance

Infection control

If the impression is not disinfected it is wise to disinfect the stone cast. 1- Immersion cast in a disinfection solution. 2-Addition of disinfectant into the stone.

TESTS FOR SETTING TIME: Vicat test Needle with a weighted plunger rod is supported and held just in contact with the mix. soon after gloss is lost the plunger is released. The time elapsed until the needle no longer penetrates to the bottom of the mix is known as the setting time. Gillmore test Measured by using the heavier Gillmore needle. The elapsed time at with this needle leaves a barely perceptible mark on the surface is called the final setting time .

Differences between dental plaster and dental stone:

Types of properties	Dental plaster	Dental stone
Manufacture	Dry calcination	Wet calcination
Particle size and shape	Larger, irregular, and porous	Smaller, regular and dense
W/P ratio	0.5	0.3
Mechanical properties	Less strength and hardness	More strength and hardness
Application	Diagnostic casts	Master cast
porosity	More porous	Less porous