TATYASAHEB KORE DENTAL COLLEGE AND RESEARCH CENTRE
NEW PARGAON – 416 113

Tal.: Hatkanangale Dist.:Kolhapur (Maharashtra State)

National Dental Commission

INFORMATION REGARDING INSTITUTIONAL COMPLIANCE

4. Clinical Compliance

4.2 Student clinical work registers are updated regularly.

Mahatma Gandhi Charitable Medical Trust, Warananagar.

TATYASAHEB KORE DENTAL COLLEGE & RESEARCH CENTRE, NEW PARGAON

SERVICE IS RELIGION

WARANA
HEALTH MOVEMENT
Est : 1992

DENTAL MATERIALS RECORD BOOK

Photograph

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Permanent Registration No. :

Roll No. / Exam Seat No. :

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Mahatma Gandhi Charitable Medical Trust, Warananagar.

TATYASAHEB KORE DENTAL COLLEGE & RESEARCH CENTRE, NEW PARGAON

CERTIFICATE

This is to certify that Shri / Kum Patil Nakshatra Jaywant ______________________ has satisfactorily carried out the practical work in Dental Materials as prescribed by

MAHARASHTRA UNIVERSITY OF HEALTH SCIENCES NASHIK

For the year 20 - 20

Staff Incharge	**Staff Incharge**
H.O.D.	**H.O.D.**
Professor & Head of Department	**Professor & Head of Department**
Department of Prosthodontics	Department of Conservative Dentistry
Signature of Internal Examiner	**Signature of External Examiner**
1)	1)
2)	2)

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INSTRUCTION FOR THE STUDENTS

1. Students must attend the classes with neat, clean dress and apron.
2. Minimum of 75 % attendance both in theory and practical classes is required.
3. Students must purchase all the instruments listed in the next page.
4. Loaning or borrowing of instruments in not allowed.
5. Students must have enough knowledge about the equipments and machines before handling them.
6. No work should be done without taking guidance from staff members.
7. Maintain Cleanliness.
8. This record book should be kept up to date, and be maintained till the end of the B.D.S. Course.

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1 st YEAR BDS STUDENTS INSTRUMENTS KIT

Sr. No.	Items	Qty.	Sr. No.	Items	Qty.
1	Dental Flask (Upper)	1	33	Dappen Dish	2
2	Dental Flask (Lower)	1	34	Glass Slab	1
3	3 Pin Articulator	2	35	Plain Glass	1
4	Hinge Articulator	1	36	Porcelain tile	1
5	Steel Tray	1	37	Scissors	1
6	Enamel Bowl	1	38	Mouth mirror with handle	1
7	Kidney Tray	1	39	Dental tweezer	1
8	Impression Tray	12	40	B.P. Handle No.3	1
9	PVC Bowl Medium	1	41	B.P. Handle No.4	1
10	PVC Bowl Large	1	42	B.P. Handle No.10	1
11	Wax Knife	1	43	B.P. Handle No.15	1
12	Plaster Knife	1	44	Dental File	1
13	Plaster Spatula St	1	45	Acrylic Mixing jar	1
14	Plaster Spatula cd	1	46	Acrylic Trimmer	1
15	Wax Spatula	1	47	Metallic Trimmer	1
16	Amalgam Carrier	1	48	Mortar & Pestle	1
17	Amalgam Condenser	1	49	Cotton Holder	1
18	Burnisher	1	50	Waste Cotton Receiver	1
19	Excavator	1	51	Copying Pencil	1
20	Cement Spatula	1	52	Glass Marking Pencil	1
21	Dental Probes	2	53	Napkin	1
22	Willam's Probe	1	54	6" Steel Scale	1
23	G.M.T.	2	55	Tooth Forceps	1
24	Hollen Back Carver	1	56	Plain forceps	1
25	Wartz Carver	1	57	Magnifying Glass	1
26	Parallelogram Condenser	1	58	Spirit lamp	1
27	Diamond Shaped Carver	1	59	Blow torch	1
28	Enamel Hatchet	1	60	Universal Plier	1
29	Plastic filling instrument	1	61	Sand Paper Mandrel	1
30	Lacron's Carver	1	62	Mandrel	1
31	Agate Spatula	1	63	Mc Intosh Sheet	1
32	Chop Syringe	1	64	Clamps	2

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Exercise No. 1

Name of Exercise Gypsum product

Sr. No.	Date	Work Done	Grade	Staff Sign.
1.	24/11/25	Dental plaster cube (2.5×2.5×2.5)	A	Desai
2.	24/11/25	Dental plaster cube (2.5×2.5×2.5)	A+	
3.		Dental plaster cube (2.5×2.5×2.5)	A+	Desai
		Dental stone cube (2.5×2.5×2.5)	A	Desai
		Dental stone cube (2.5×2.5×2.5)	A+	
		Dental stone cube (2.5×2.5×2.5)	A+	

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Gypsum Products

Q.1. What is Gypsum and write application of gypsum products

Gypsum is naturally occuring mineral with chemical composition $CaSO_4 . 2H_2O$. It is also an industrial by product.

- Applications

1) Impression plaster :- Used extensively in the past for impression of mouth and face.
2) Various plasters are used to make moulds, casts & dies over which dental prosthesis & restoration are made.
3) To attach casts on articulator
4) for bite registration.
5) Dental investments :- Plasters mixed silica is known as dental investment. They are used to form refractory moulds into which molten is cast.

Q.2. classify Gypsum products

- classification

Type 1 :- Dental plaster for impression.

Type 2 :- Dental plaster • class 1 - for mounting
• class 2 - for models.

Type 3 :- Dental stone for model

Type 4 :- Dental stone [High strength, low expansion] for dies.

Type 5 :- Dental stone [High strength, high expansion] for dies

Q.3. Describe in detail about manufacturing of gypsum products.

The process of heating gypsum for the manufacturer of plaster is known as calcination. mixed gypsum is ground & heated. When heated gypsum [calcium sulphate dihydrate] loses part of its water of crystallization & changes to calcium sulphate hemihydrate on fucther heating, the remaining water of crystallization is lost first. hexagonal anhydrite [soluble is formed. Later orthorhombic anhydrite [insoluble] is formed.

Depending on method of calcination, forms of hemihydrates.

1) Beta Hemihydrate (Plaster) 2) Alpha Hemihydrate (stone) 3) Alpha modified hemihydrate (die stone)

- Manufacture of Dental Plaster :-
- Gypsum is ground and heated in an open kettle or kiln at a temperature of 110 to 130°C. The process is called dry calcination β-type of crystals are formed.

Microscopically - fibrous aggregated of the fine crystals with capillary pores. They are then ground to break up the needle like crystals.

- Manufacture of Dental stone :-
- Gypsum is calcined under steam pressure in an autoclave at 120 to 130°C at 17 lbs/sq.inch for 5 to 7 hours. Thus, the product obtained is much stronger & harder than β hemihydrate. microscopically, clevage fragments & crystals in the form of rods & prisms.

9.

* Dental Plaster.

$$CaSO_4 \cdot 2H_2O \xrightarrow[110-130°C]{Heat} CaSO_4 \cdot \tfrac{1}{2} H_2O$$

β-hemihydrate

* Dental stone

$$CaSO_4 \cdot 2H_2O \xrightarrow[17\ lbs/sq.inch\ pressure]{120-130°C} CaSO_4 \cdot \tfrac{1}{2} H_2O$$

α-hemihydrate

* Gypsum Products

$$\underset{\text{calcium sulphate dihydrate}}{CaSO_4 \cdot 2H_2O} \xrightarrow{110-130°C} \underset{\text{calcium sulphate hemihydrate}}{CaSO_4 \cdot \tfrac{1}{2} H_2O} \xrightarrow{130-200°C} \underset{\text{Hexagonal anhydrate}}{CaSO_4} \xrightarrow{200-1000°C} \underset{\text{(orthorhombic anhydrite)}}{CaSO_4}$$

9.4. Write about setting reaction of gypsum products & methods

When plaster is mixed with water it takes up one & half molecules of water, i.e. it regains its water of crystallization and becomes calcium sulphate dihydrate.

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$(CaSO_4)_2 . H_2O + 3H_2O \longrightarrow 2\,CaSO_4 \cdot 2H_2O +$ Unreacted $(CaSO_4)_2 \cdot \frac{1}{2}H_2O$ + Heat

Hemihydrate water Dihydrate unreacted hemihydrate

The reaction is exothermic and is same for all gypsum products. The amount of water required to produce workable mix varies between the products.

- Measurements of setting time.

1) Loss of glass method :- As reaction proceeds glass disappears from surface of plaster mix.

2) Exothermic reaction - The temperature rise of mass can be also used as reaction is exothermic.

3) Penetration tests :- By using penetrameters

Types of penetrometers
↓ ↓
Vicat needle Gillmore needles.

9.5. Write in detail about theories of setting of gypsum & factors affecting setting time.

A) Colloidal theory :- The theory proposes that when mixed with water, plaster enters into a colloidal state through sol-gel mechanisum. In a sol state, hemihydrate combines with water to form dihydrate. As water is consumed, the mass turns to a solid.

B) Hydration theory :- It suggests that rehydrates plaster particles join together through hydrogen bonding to sulfate group to form set material.

C) Dissolution - precipitation theory :- According to this, the plaster dissolves and reacts to form gypsum crystals which interlock to form set solid. The setting reaction is explained on the basis of difference in solubility of hemihydrate and - dihydrate. Hemihydrate is 4 times more soluble than dihydrates.

- Factors affecting setting time

1) manufacturing process :- If calcination is incomplete and excess gypsum (dihydrate) is left in final product, plaster will set faster.

Excess soluble anhydrite :- plaster will set fast.

Excess natural anhydrite :- plaster will set slow.

fineness - finer the hemihydrate particle, size the
2) mixing & spotulation :- within the limits, longer & fast the plastec is mixed, the fastec it will set.
3) watec/powdec ratio :- more the watec used for mixing more the setting time will be prolonged.
4) Temperature :- on increasing from a room tempecatuce of 20°C to the body temperatuce of 37°C, the rate of reaction increase slightly and the setting time is shortened.
5) modifies :- Acclerators - decreases setting time
Retarders - increases setting time.

Q.6. What is recommended W/P ratio of gypsum products & factors affecting W/P ration of gypsum.

Impression plastec :- 0.50 to 0.75
Dental stone :- 0.28 to 0.30
Dental plastec :- 0.45 to 0.50
Die stone, Type 4 :- 0.22 to 0.24
Die stone, Type 5 :- 0.18 to 0.22.

- Factors affecting W/P ratio

1) shape & compactness of crystals :- Irregulac, spongy plastec particles need more watec than dental stone
2) small amount of surface active material like gum arabic plus lime markedly reduce watec requirement of all gypsum products.
3) Particle size distribution - Grinding of the powdec breaks up needle like crystals & reduce the watec needed.

Q.7. Explain manipulation of gypsum

- Proportioning :- To secure maximum strength a low watec powdec ratio should be used. The watec should be measured & powdec should be weighed.
- Instruments :- Fexible rubbec/plastic bowl, stiff bladded spatula.
- Hand mixing.

- watec is taken first to prevent adhecance of dry powdec to the sides of bowl. watec and powdec

are dispensed accordingly to recommended w/p ratio.
- It is allowed to settle for 30 sec. to minimise air transpment.
- The mix is stirred vigrously. Periodically wipe the inside of bowl with a spatula to ensure wetting of powder & breaking up of lumps. continue till a smooth creamy mix is obtained spatulation should be completed in 40-60 sec.
- Vibrates the mix & pour it into impression, taking care not to entrap air.

• Mechanical mixing :- mechanical mixing under a vaccum gives stronger and denser casts. However, the equipment is expansive.

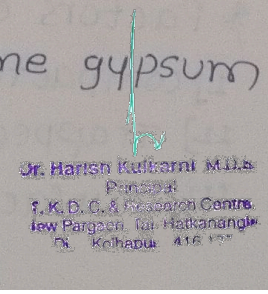
Q.8. Describe the normal setting expansion & hygroscopic expansion in detail.

A] Normal setting Expansion :- All gypsum products show a linear expansion during setting, due to outward thrust of the growing crystals during setting. Crystals growing from the nuclei not only intermesh but also intercept each other during growth.

* Importance :- In dentistry, it can be both desirable & undesirable depending on use. It is undesirable in impressible plaster, dental plaster & stone as it will result in an inaccurable cast or change in occlusal relation if used for mounting.

B] Hygroscopic Expansion :- When a gypsum product is placed under water before the initial stage, a greater expansion is seen due to hygroscopic expansion. When the expansion begins, externally available water is drawn into pores forming in the setting mass & this maintain & continuous aqeous phase in which crystal growth takes place freely.

* Importance :- Used to expand some gypsum bounded investments.



9g Explain properties of gypsum products

1] Strength - It increases rapidly as the material hardens after initial setting.

- Wet strength :- It is the strength when excess free water is present in the gypsum.

material	wet strength (MPa)
1> model plaster	12.5
2> Dental stone	31
3> Die stone	45

- Dry strength :- It is the strength of gypsum when the excess free water is lost by evaporation. It is two or more times greater than wet strength.
- W/P Ratio - more the water, greater the porosity & less the strength.
- Spatulation :- within limits strength increases with increased spatulation.
- Addition of accelerators & retarders lower strength

2] Hardness and abrasion resistance - Dies and casts often used to construct restoration & prosthesis. A good surface hardness & abrasion resistance is therefore essential.

3] Flow :- The flow of freshly mixed gypsum depends on amount of water used. A correctly proportioned mix has sufficient flow.

4] Reproduction of detail

Gypsum products reproduce details accurately.

* Significance

a> Impression plaster has to accurately record oral tissue.

b> Cast material has to duplicate all the details recorded by impression.

* Factors affecting -

I] Compactibility with impression material.

II] Trapped air bubbles in mix.

III] Surface contaminats like saliva.

Q.10 Describe various specialised gypsum products.

A] Dental casting investment :- Adding refractory material like silica or quartz or cristobalite to dental plaster or stone permits it to withstand high temperature.
- used to prepare refractory mold to casting dental alloys.

B] Divestment - It is combination of die stone & gypsum bounded investment mixed with colloidal silica.
- used to make refractory dies.

C] Synthetic Gypsum :- It is possible to make α & β hemihydrates from the by product during manufacture of phosphoric acid.

D] Orthodontic stone :- for orthodontic study models most orthodontists prefer to use white stone or plaster.

E] Resin modified stone :- It is a blend of synthetic resin & α gypsum.

F] Mounting plaster :- Plaster used for attaching the cast to the articulator is known as mounting plaster.

G] Fast setting stone :- Fast setting stone with an each high compressive strength allowing separation of the cast from the impression in 5 min.

Q.11 Write about disinfection and core of cast.

- Gypsum products can be disinfected by
1) immersing cast in disinfection solution.
2) Addition of disinfectiant to stone.
3) Overnight gas sterillisation.

- Core of cast :-
- If the gypsum cast has to be soaked in water it must be placed in water both in which plaster debris is allowed to remain constantly on the bottom of container to provide a saturated solution of calcium sulfate at all times.

This is known as 'slurry water'.

Good 5/11/26

Exercise No. 2

Name of Exercise

Sr. No.	Date	Work Done	Grade	Staff Sign.
1)	22/12/25	manipulation of impression compound & making thumb impression.	A+	Desai
2)	05/01/26	manipulation of impression compound making primary impression of maxilla using impression tray.	A+	Desai 5/1/26.
3)		manipulation of impression compound making primary impression of mandible using impression compound.	A+	DC 12/3/26.

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Impression material

Q.1) Define Impression. Write advantages of using a cast

→ A dental impression is a negative record of the tissues of the mouth. It is used to reproduce the form of the teeth & surrounding tissue.

- Advantages of using a cast

1) Models provide a 3 dimensional view of the oral structure thus aiding in diagnosis & treatment planning.
2) Many restorations or appliances are best constructed on casts. It may be inconvient to both dentist & patient if these have to be made directly in the patient's mouth.
3) Models can be used to educate the patient.
4) They serves as treatment record.
5) By using casts, technical work can be passed on to technician saving valuable clinical time.

Q.2) State the desirable (ideal) properties of an impression material

→ 1) Should be nontoxic & non-irritant to dentist & patient.
2) Acceptance to patient.
   a] Have a pleasant taste, odor, consistancy & colour.
   b] Should set quickly once place in the mouth.
3) Should be accurate.
   a] Accurate surface detail.
   b] Elastic properties with freedom from permanent deformation after strain.
   c] Dimentionally stable.
4) Have adequate shelf life for storage & distribution.
5) Be economical
6) Handling properties
   a] Sufficient working time
   b] set quickly in mouth (saves chairside time).
   c] Be easy to use with the minimum equipment
   d] Satisfactory consistancy & texture
7) Have adequate strength so that it will not break or tear while removing from the mouth.
8) Should be compatible with the die & cast materials.
9) Should be able to be electroplated.

Q.3 Classify Impression materials

→ There are several way of classifying impression material

① According to made of setting & elasticity

- Impression material
  - Rigid
    - Thermoset (Irreversible) set by chemical reaction eg - Impression plastec zoe
    - Thermoplastic (Reversible) set by temp. change eg - compound waxes.
  - Elastic
    - Hydrocolloids
      - Agar Agar (Reversible)
      - Alginate (Irreversible)
    - Elastomeric
      - Polysulfide
      - polyether
      - silicons.

② According to tissue displacement

- Impression material
  - mucostatic
    - produce minimal tissue displacement during impression making
    - eg - Plastec
    - zinc oxide eugenol
    - low viscosity alginate
    - low viscosity elastomeric material.
  - mucocompressive
    - more viscous & displace tissue while recording the
    - eg. - Impression compound
    - High viscosity alginated
    - High viscosity elastomeric.

③ According to use in dentistry

- Impression Material
  - For edentulous mouth
    - for complete denture prosthesis
    - Hard to be removed from undercuts thus suitable for edentulus mouth.
    - eg. Impression plastec compound ZOE plaste.
  - for dentulous mouth
    - for removable partial dentuce prosthesis
    - Elastic enough to remove from undercut thus suitable for dentulous mouth
    - eg - alginate rubber base material.

• Impression compound •

1) What is impression compound ? How is it classified ?

→ It can be described as rigid, reversible impression material which set by physical change on applying heat it softens & cooling it hardens classification :-

Type I :- Impression compound - fusion temp. above 45°

Type II :- Tray compound - fusion temp. above 75°

tray compound is used to prepare a tray for making an impression.

2) What is made of supply of impression compound & its application in dentistry

→ supplied as - sheet, stick, cake, cone in variety of colour.

Application - 1) for making preliminary impression in an edentulous mouth.

2) For impression of full crown preparation where gingival tissue must be displaced.

3) peripheral tracing or border molding

4) To check undercut in inlay preparation

5) To make special tray.

3) What is the requirement of impression compound.

→ 1) Harden at or little above mouth temperature.

2) Be plastic at a temperature not injurious or harmful to oral tissue.

3) Not contain irritating or toxic ingredients.

4) Harden uniformly when cooled without distortion.

5) Have a consistancy when softened which will allow it to reproduce fine details.

6) Be cohesive but not adhesive.

7) Not undergo permanent deformation or fracture while withdrawing the impression from the mouth.

8) Be dimensionally stable after removal from the mouth & during storage.

9) exhibit a smooth glossy surface after flaming.

10) Withstanding trimming with sharp knife without flaking or chipping after hardening

Q.4 Write composition of impression compound & state function of each ingredient.

Ingredient	Parts	functions
Rosin	30	Impart high flow & low strength
copal Resin	30	plasticity
carnouba wax	10	Impact high flow & low strength
stearic acid	5	plasticizer
Talc	25	Filler
colouring agent	–	provide colour to compound.

Q.5 Describe in detail properties of impression compound.

→

- Fusion temperature –
  - Temperature at which the material completely looses its hardness or brittleness on heating & again from a rigid make on cooling for impression compound fusion temperature is 43-50°C.
- Thermal conductivity –
  - Impression compound has low thermal conductivity ie. poor conductor of heat.
- coefficient of thermal expansion –
  - comparitively high dere to resin & waxes, lineat contraction is 0.8% from mouth temperature to room temp.
- Dimensional stability:
  - Poor dimensional stability so poor the cast immediately within 1 hour beat it properly before removal.
- surface detail reproduction :–
  - comparitively less because of high viscosity & less flow

Q.6. Write about manipulation of impression compound.

→ stick :- small amount of compound can be softened over a flame.

cakes -

- Large amount of compound are softened in warm water in thermostatically controlled water bath usually in range of 65-75°C.
- After the compound is removed from water bath, it is usually kneaded with finger in order to obtain uniform plasticity throughout the mass.

Loading the trays :-

1) slightly oversized tray is selected.
2) softened material is looped onto the tray & quickly seated onto the tissue to be recorded.
3) If the compound is too hot it may be tempered by impressing in slightly cooler water the lips are manipulated to mold the border of impression while it is still soft.

Q.7. Write advantages & disadvantages of impression compound.

→ Advantages :-

1) The material can be reused number of times.
2) Inaccurate portions can be remade without having to remake the entire impression.
3) Accuracy can be improved by flaming the surface.
4) The material has its own body to support itself especially in peripheral portion & thus prevent collapse if not supported by

Disadvantages :-

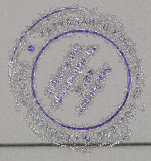
1) Records less detail because of its high viscosity
2) Compresses soft tissues during impression
3) Distortion due to its poor dimensional stability.
4) Difficult to remove if there are serve undercuts.
5) There is always the possibility of over extension especially in the peripheries.

Good 15/11/26

Exercise No. 3

Name of Exercise

Sr. No.	Date	Work Done	Grade	Staff Sign.
1.		manipulation of zinc oxide eugenol paste and making thumb impression.		



•ZINC OXIDE EUGENOL•

Q.1 Write uses of zinc oxide eugenol in dentistry. zinc oxide & eugenol based products are widely used in dentistry.

→ 1) cementing and insulating medium.
2) Temporary filling material.
3) Root canal filling material
4) Surgical pack in periodontal surgical procedure.
5) Bite Registration paste.
6) Temporary relining material for dentures.
7) Impressions for edentulous patients.

Q.2 Write about classification of zinc oxide eugenol paste and how it is supplied.

→ • Classification of ZOE paste.
According to ADA specification NO. 16
1) Type I or Hard
2) Type II or soft
• Supplied as
In paste form in two tubes
1) Base paste (white in colour)
2) Accelerator or catalyst or reactor paste (Red in colour)

Q.3 Write composition of zinc oxide eugenol impression paste & describe function of each ingredient.

→ • composition of base paste.

Component	Percentage	function
1) zinc oxide	87 %	• Reactive ingredient
2) vegetable or mineral oil	13 %	• Act as plasticizer • Aids in masking the action of eugenol as an irritant.

• composition of accelerator paste

Component	wt %	function
1) Oil of cloves or eugenol	12 %	- Reduce burning sensation - oil of cloves.
2) Gum or polymerised resin	50 %	- speeds the reaction - Improves Homogeneity.
3) Filler (silica type)	20 %	- Improve strength,
4) Canada & pecu balsam	3 %	- improve flow and mixing properties.
5) Calcium chloride & colour	5 %	- Act as an accelator or setting reaction.

Q.4. Describe the setting reaction & microstructure of ZOE paste.

→ • Setting Reaction

- It is typical acid-base reaction to form chelate

1) $ZnO + H_2O \rightarrow Zn(OH)_2$

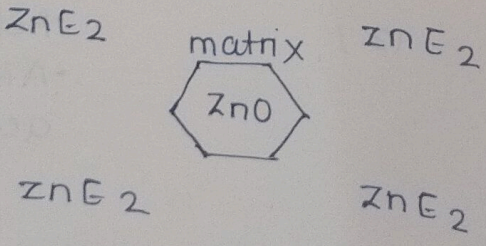
2) $Zn(OH)_2 + 2HE \longrightarrow ZnE_2 + 2H_2O$

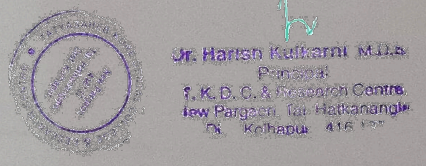
(Base) (Acid) (salt) (water)

(eugenol) (zinc eugenolate)

• Microstructure

- The chelate (zinc eugenolate) forms a matrix surrounding a core of zinc oxide particle.
- The chelate is thought to form amorphous gel that tends to crystallize giving strength to set mass.





5) Define 1) working time 2) setting time
write about setting time of ZnO_2 eugenol impression paste & factors affecting setting time.

→ 1] working time :- time for mixing, loading onto the tray & seating time impression into mouth.

2] setting time :- time required for material to set in the mouth.

	Initial setting time	final setting time
Type I	3-6 mins	10 mins
Type II	3-6 mins	15 mins.

• Factors affecting setting time

1) If the particle size of zinc oxide powder is small & if it is acid coated, the setting time is lesse.

2) setting time can be decreased by adding zinc acetate or drop of water or acetic acid.

3) Longer the mixing time, shorter is the setting time.

4) High atmospheric temperature and humidity accelarate setting.

5) setting can be delayed by cooling the mixing slab, spatula or adding small amount of retarder or oil or waxes.

6. Describe various properties of ZOE impression paste

→ 1] consistency & flow

A paste of thick consistency can compress the tissue
A thin free flowing material copies the tissue without distorting them.

2] Detail reproduction

It registers surface details quite accurately due to good flow.

3] Rigid and strength

The impression should resist distortion & fracture when removed from mouth after setting.

4] Dimensional stability.

It is quite satisfactory. Negligible shrinkage occurs.

Q.7 Describe manipulation of ZOE impression paste.

→ 1) The mixing is done on an oil - impervious paper or glass slab.

2) Two ropes of paste of same length & width, one from each tube are squeezed onto the mixing slab.

3) A flexible stainless steel spatula is used.

4) The two ropes are collected with spatula & mixed until a uniform colour is observed.

5) Mixing time = 1 min.

Q.8 State advantages & disadvantages of ZOE paste.

→ • Advantages

1) Enough working time to complete border molding.

2) Can be checked in mouth repeatedly without deforming.

3) Registeres accurate surface details.

4) Dimensionally stable.

5) Does not require separating media since it does not stick to cast material.

6) Minor defects can be corrected locally without discarding a good impression.

• Disadvantages

1) Requires special tray for impression making.

2) Sticky in nature & adhers to tissue.

3) Eugenol can cause burning sensation & tissue irritation.

4) Cannot be used for making impression of teeth & undercut areas as it is inelastic in nature.

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Q. 9. Describe various other zinc oxide paste.

→ 1) Surgical pastes (periodontal packs)

After certain periodontal surgeries where sutures cannot be placed, a zinc oxide-based surgical paste may be placed, over the wound to aid in the retention of the medicament, to protect the wound & to promote healing.

2) No eugenol impression (surgical paste)

The chief disadvantage of zinc oxide eugenol paste is the burning sensation. Some patient find the taste of eugenol disagreeable & in cases where surgical pack is worn for several weeks chronic gastric distrubance may result. Hence non-eugenol pastes were developed.

3) Bite Registration pastes.

These materials are used for recording the occlusal relationship between two occluding surface, eg-teeth occlusal rims, etc.

eg- ZOE paste, wax, silicons.

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Exercise No. 04

Name of Exercise

Sr. No.	Date	Work Done	Grade	Staff Sign.
1]		manipulation of thumb impression		
2]		manipulation of alginate - maxillary Impression.		
3]		manipulation of alginate - mandibular impression		

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Reversible Hydrocolloid - Agar

Q.1 Describe solution and suspension

A] Solution :- In this one substance, usually a solid is dispersed in another, usually a liquid & the 2 phases are microscopically indistinguishable. Thus a solution exists as a single phase because there is no separation between the solute & solvent.

B] Suspension :- It ~~contains~~ consist of a large particles that can be seen under a microscope or even by the naked eye, dispersed in a medium.

Q.2 Write in detail about the colloids.

Colloids :- They are often classified as the fourth state of matter known as colloidal state. It is a two-phase state system.

The two phases are.

① Dispersed phase or dispersed particle (the suspended particle)

② Dispersed phase or medium (the substance in which it is suspended.)

* Types of colloids

A] Liquid or solid in air (Aerosol)

B] Gas, liquid or solid in air (lyosol)

C] Gas, liquid or solid in solid.

• Hydrocolloids :- They consists of gelatin particles suspended in water (lyosol) since water is dispersion medium it is known as hydrocolloid.

• Colloids with a liquid as the dispersion medium can exist in two different forms.

Sol	Gel
- It has the appearance & ~~may~~ many characteristics of viscous liquid.	- It is a jelly like elastic material & produced from sol by a process called gelation.

Q.3- Introduce Reversible Hydrocolloid & enumerate its uses.

- Reversible Hydrocolloids - They are reversible because the physical state can be reversed & this makes them reusable.
- Agar is the ex. of reversible hydrocolloid & it is first succesfull elastic impression material to be used in dentistry.
- It is an organic hydrophilic colloid extracted from seaweed (Gelidium, Gracilaria).
- It is a sulfuric ester of liner polymer of galactose

* classification based on viscosity *

- Type I - Heavy bodies as tray material
- Type II - medium bodied - as tray / syringe material
- Type III - Light bodied for syringe use only.
- Type IV - Light bodies - for agar-alginate combn technique

* uses

1) For cast duplication
2) For full mouth impression without deep undercuts
3) For FPD impression prior to elastomers.
4) As a tissue conditioner.

State composition of Agar & function of each ingredient.

Ingredient	% wt	function
Agar	13 - 17 %.	Basic constituent
Borates	0.2 - 0.5 %.	Improves gel strength & retarder.
Potassium sulphate	1 - 2 %.	counteracts retarding effects of borates
wax, Hard	0.5	filler
Thixotropic material	0.3 - 0.5 %.	plasticizer
Alkylbenzoates	0.1 %.	Preservative
colouring & flavouring agent	Traces	for patient comfort & acceptance
water	Balance (Around 84 %.)	Dispersion medium

Describe the setting of Agar

Agar - sol $\rightleftharpoons$ gel
(Physical process)

- As Agar sol cools, the dispersed phase groups to form fiber called micelles.
- The fibrils branch & intermesh together to form brush heap structure.
- These fibrils forms weak covalent bonds with each other which breaks easily at higher temperature resulting in gel turning to sol & the process is known as liquefaction which occurs at a temperature between 70°C & 100°C.
- On cooling agar reverse to the gel state & the process is called as gelation which occurs at or near mouth temperature which is necessary to avoid injury to oral tissues.

Explain in detail manipulation of Agar

A] Hydrocolloid conditioner

- Boiling or liquefaction section - 10 mins in boiling water (100°C). The sol should be homogeneous & free of lumps.
- storage section - 65 - 68°C temp. is ideal. It can be stored in sol condition.
- Tempering section - 46°C for about 2 min with material loaded in tray. This reduces the temperature so that it is tolerated by sensitive oral tissue. It also makes the material viscous.

B] Impression Trays :- Rim lock trays with water circulating devices are used.

C] Making the Impression - The tray containing tempered material is removed from the bath. The outer surface of agar sol is scraped off, then the water based are connected & the tray is positioned in mouth. Water is circulated at 18 - 21°C through the tray until gelation occurs.

D] Working time - 7 min - 15 min

setting time - 5 min

E] Removal of impression :- When agar has gelled peripheral seal is broken & impression is remove from the mouth rapidly.

- Storage is to be avoided at all casts & cast should be poured immediately.

Q.7. Write properties of agar

1] Gelation, Liquefaction & Hysteresis -

- Gelation occurs at 37°C approx. & liquefaction occurs at 50-70°C higher temperature than gelation temp. This temperature lag between gelation & liquefaction is known as hysteresis.

2] Syneresis and imbibition -

- Excluding of fluid from gel is known as syneresis And if it is immersed in water, it absorbs water by a process known as imbibition.
- Both can result in Dimensional changes and therefor inaccurate casts.

3] flexibility -

- It ranges from 4% to 15%. when a stress of 12.2N is applied.

4] Elasticity and elastic recovery

- They are highly elastic and elastic recovery occurs to extent of 98.8%.

5] Gel strength -

- Tear strength - 0.8 - 0.9 kN/m.
- Compressive strength - 0.5 - 0.9 g/cm².

Q.8 - Explain Laminate technique.

- After injecting the syringe agar on the area to be recorded on impression tray containing a mix of chilled alginate that will bond with the agar is positioned over it.
- The algenate gels by chemical reaction, whereas agar gels through contact with the cool alginate, rather than the water circulating through the tray.

• Advantages

1) The syringes agar gives better details than alginate.
2) Less air bubbles.
3) Water cooled trays are not required.

Q.9. Write advantages and disadvantages of agar.

• Advantages -

1) Accurate dies can be prepared, if material is handled properly.
2) Good elastic properties, help reproduce mast undercut areas.
3) Good recovery from distortion.
4) Hydrophilic moist mouth not a problem.
5) palatable and well tolerated by patient.

• Disadvantages

1) Does not flow well
2) cannot be electroplated
3) During insertion or gelation the patient may experienced thermal discomfort.
4) only one model can be poured.
5) Requires special and expensive equipments.

Irreversible Hydrocolloid - Alginate

Q.1. Introductione irreversible Hydrocolloid.

Irreversible Hydrocolloid - once these set, it is usually permanent so known as irreversible.

- Alginate is an example of irreversible hydrocolloid.
- The word alginate means from 'algic acid' (anhydro-β-d-mannuronic acid) which is a mucous extract yeilded by species of brown seaweed (phaeophyceae)
- Alginic acid is a naturally occuring hydrophilic colloidal polysaccharide.
- Types - Type I - fast setting
  Type II - Normal setting.

Q.2. Write uses of alginate

1) It is used for impression making
   - when there are undercuts
   - In mouths with excessive flow of saliva.
   - for partial dentures with claps.
2) for making preliminary impression for complete denture.
3) for impression to make study models & working casts.
4) For duplicating models.

Q.3. Write composition of alginate & role of each ingredient

Ingredient	%. wt	function
Sodium or potassium alginate	15 %.	Dissolves in water & reacts with calcium ions.
calcium sulfate	16 %.	Reactor
zinc oxide	4 %.	filler
Potassium titanium fluoride	3 %.	Gypsum Hardener
Diatomaceous earth	60 %.	filler
Sodium phosphate	2 %.	Retarder
colouring & flavouring agents.	Traces.	Pa[illegible]nts C[illegible]

Q.4. Describe setting reaction of alginate.

Reaction 1 :- $2Na_3PO_4 + 3CaSO_4 \longrightarrow Ca_3(PO_4)_2 + 3Na_2SO_4$

Reaction 2 - sodium alginate $+ CaSO_4 + H_2O \rightarrow$ Ca alginate (gel) $+ Na_2SO_4$.

- Calcium sulfate prefers to react with the retarder first only after the supply of the retarder is over then calcium sulfate reacts with sodium alginate which gives insoluble calcium alginate which forms a gel with water.
- Reaction with sodium phosphate ensure adequate working time.
- Gel structure - Brush heap of calcium alginate fibril network enclosing unreacted sodium alginate sol, excess water, filler particles & reaction by products.

Q.5. Write properties of alginate.

1) Taste and odour - It has pleasant taste & smell.
2) flexibility - It is about 14% at a stress of 12.2 N.
3) Elasticity & elastic recovery - It is highly elastic but less when compared to agar and about 98.2% elastic recovery occurs.
4) Reproduction of tissue details :- It is lower when compared to agar hydrocolloid.
5) strength - compressive strength - 0.5 to 0.9 MPa.
   Tear strength = 0.4 to 0.7 KN/m.

Q.6. Write modification of alginate

1) In the form of sol, containing the water. A reactor of plaster of paris is supplied separately.
2) As a two paste system - one contains the alginate sol, while second contain calcium reactor.
3) one product is supplied in low density for use while syringe.
4) Dust free alginate.
5) chromatic alginate.

Q.7. State working time & setting time of alginate

	working time	Setting time
Type I	1 1/4 min	1.5 - 2 min
Type II	2 min	3 - 4.5 min.

Q.8. Write advantages & disadvanges of alginate.

- ADVANTAGES

1) Easy to mix & manipulate
2) Minimum requirement of equipment
3) flexibility of the set impression.
4) Accuracy if properly handled

- DISADVANTAGES -

1) Cannot be electroplated
2) Cannot be corrected
3) Poor dimensional stability
4) Distortion may occur.

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