Impression materials

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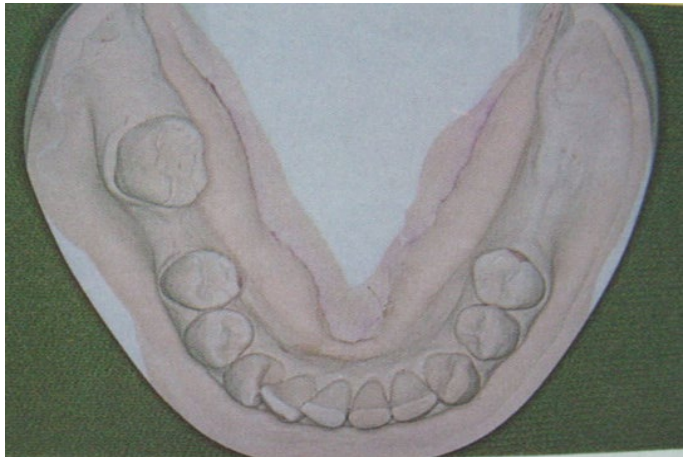
Lect 17 &18

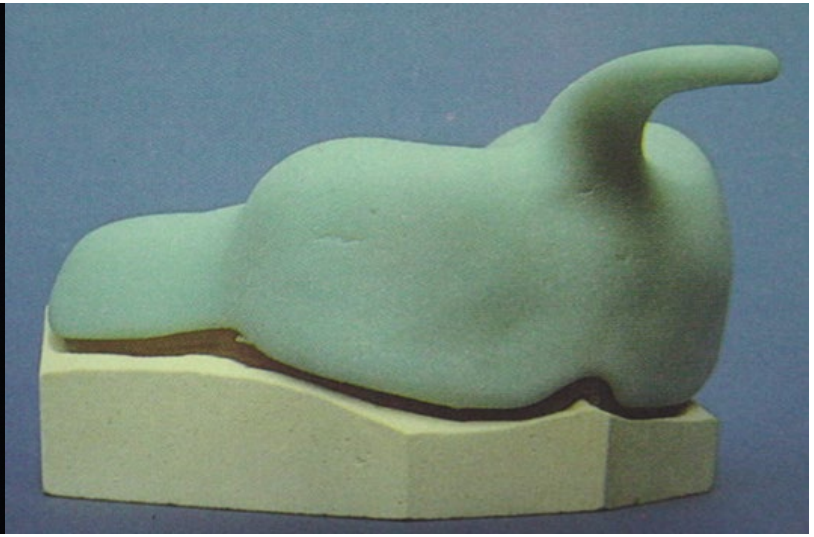
A dental impression is a negative record of the tissues of the mouth .It is used to reproduce the form of the teeth and surrounding tissues .The negative reproduction of the tissues given by the impression material is filled up with dental stone or other model materials to get a positive cast .The positive reproduction of a single tooth is described as a die, and when several teeth or whole arch is reproduced, it is called a cast or model. The impression material is carried to the mouth in a tray which is either stock or special tray.











Advantages of using a cast or model:

1. Models provide a three-dimensional view of the oral structures, thus aiding in diagnosis and treatment planning.
2. Many restorations or appliances are best constructed on a cast.
3. Models can be used to educate the patient.
4. They serve as pre-and post-treatment records.
5. Technical work can be passed on to technicians by using casts.

The desirable properties of impression materials:

1. **An accurate reproduction of surface details.**
2. **Dimensional accuracy and stability.**
3. **A pleasant odor, taste, and acceptable color.**
4. **Not toxic or allergenic to the patient.**
5. **No release of gas or other byproducts during the setting of the impression or cast and die materials.**
6. **Adequate shelf life for requirements of storage & distribution.**
7. **Easy to use (mix and handle) with the minimum of equipment (economic)**
8. **Suitable working and setting a time that meets clinical requirements.**
9. **Adequate strength to avoid breaking or tearing upon removal from the mouth.**
10. **Dimensional stability on setting over temperature and humidity for a period long enough to permit the production of a cast or die.**

Types of impression materials:

Dental impression materials varies depending on the physical properties, setting reaction and the degree of accuracy they are capable of recording. However, the most popular classification, the set impression materials can be either rigid (inelastic) or elastic.

Rigid (inelastic impression material):

These materials exhibit minimum elastic deformation when it is flexed and it breaks down when the stress exceeds its ability without plastic deformation.

Types of rigid impression materials

1. Plaster of Paris.
2. Impression compound.
3. Zinc-oxide eugenol (ZOE).

Impression Plaster

- **Presentation: present as powder mixed with water (w/p=0.6).**
- **This material very accurate with minimum setting expansion, less than 0.06%.**

- **Composition:**

1. **Calcium sulphate β- hemihydrates ($[CaSO_4]^1/_2\ H_2O$).**
2. **Potassium sulphate (K2SO4): to reduce expansion and to accelerate the setting reaction.**
3. **Borax: to reduce the rate of setting (counter act potassium sulphate).**
4. **Starch: is added for easier separation of impression plaster from the cast (to help disintegration of impression on separation from the plaster/stone model).**

After cast hardens, the impression and the cast are placed in hot water, the starch swells and the impression disintegrates, making it easy to separate the cast from the impression.

- **USES:**

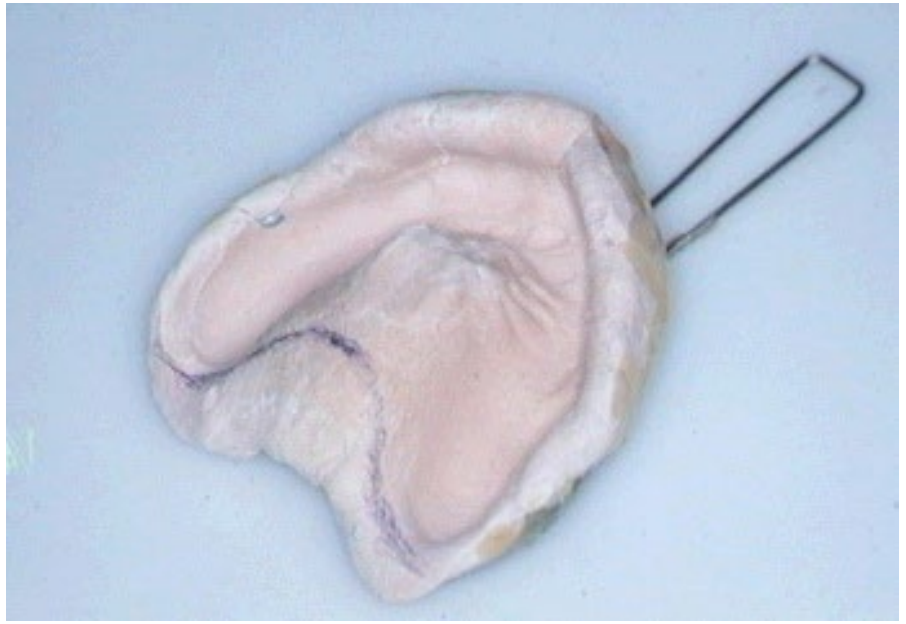
1. Making final impression in constructing complete dentures.

2. occlusal bite registration material.

3. Maxillofacial prosthesis.







Impression compound

- **Types of impression compound**

1. Type I impression compound (lower fusing): supplied in sheets, sticks form or cones.

a. Sheet form material used to take primary impression for edentulous ridges using stock tray, softened using water bath (55-60) C .

b. Stick form material used for border molding of an acrylic special tray during fitting of the special tray, it's softened over flame.

2. Type II tray compound (higher fusing): it is stiffer and has less flow than regular impression compound. Used to make a special tray (now largely replaced by acrylic tray) into which another impression material is placed in complete edentulous arches.


Impression Compound
KERR
Type I
Net Wt. 1/4 lb. (113 g)
KERR MANUFACTURING CO.
Does Not Require MSDS
Made in U.S.A.
GREEN
Working
Temp. 123


PREVEST DENPRO LIMITED
HIFLEX
Contents : 5 Cakes
Net Wt. : 200g


KERR
KERR
KERR

Zinc-oxide eugenol

Zinc oxide eugenol impression material:

It's described as a rigid, mucostatic impression material, irreversible impression material which set by chemical reaction. The combination of zinc oxide and eugenol is widely used in dentistry.

- **General uses of zinc oxid –eugenol**



1. **Final impression for edentulous arches.**
2. **Occlusal bite registration.**
3. **Temporary relining material for dentures.**

- **<u>Types of Zinc oxide eugenol impression material</u>**

1. **Type I hard.**
2. **Type II soft, which sets slower than type 1.**

- **<u>Presentation:</u>**

The impression material is in the form of two pastes (2 tubes):

- **Base paste (white color).**
- **Reactor or accelerator or catalyst paste (red in color).**





Chemical reaction

$$\text{Zinc oxide + eugenol} \xrightarrow{H_2O} \text{zinc eugenolate + zinc oxide (unreacted)}$$

The set material consists of a mixture of amorphous zinc eugenolate matrix which holds unreacted zinc oxide particles together. This impression material has an excellent dimensional stability and a setting shrinkage of less than 0.1%



Elastic impression materials

Elastic impression material

It is the ideal impression materials for reproduction of tooth form and relationship, which can be with-drawn from the undercut area & return to its original form without distortion.

Types of Elastic impression material

1. Hydrocolloids Impression Materials.
2. Elastomeric Impression Materials.

Hydrocolloids are classified into two types based on mode of gelation:

1. **Reversible: called reversible because their physical state can be reversed; this make them reusable (by lowering the temperature). e.g. Agar impression material.**

2. **Irreversible: once these set is usually permanents, so known as irreversible. set by chemical reaction e.g. alginate impression material.**

- **Reversible hydrocolloids …..agar**

Gel → Sol → Gel

heating *cooling*

Physical reaction

Irreversible hydrocolloids…..alginate

Sol → Gel

Chemical reaction

Agar syringe and tray material

- **Syringes: low viscosity – high flow.**
- **Tubes: high viscosity – heavy body: low flow.**



- **Uses:**

1. **Widely used at present time for cast duplication (during fabrication of cast removable partial denture).**
2. **Full mouth impression without deep undercut.(less use nowadays).**

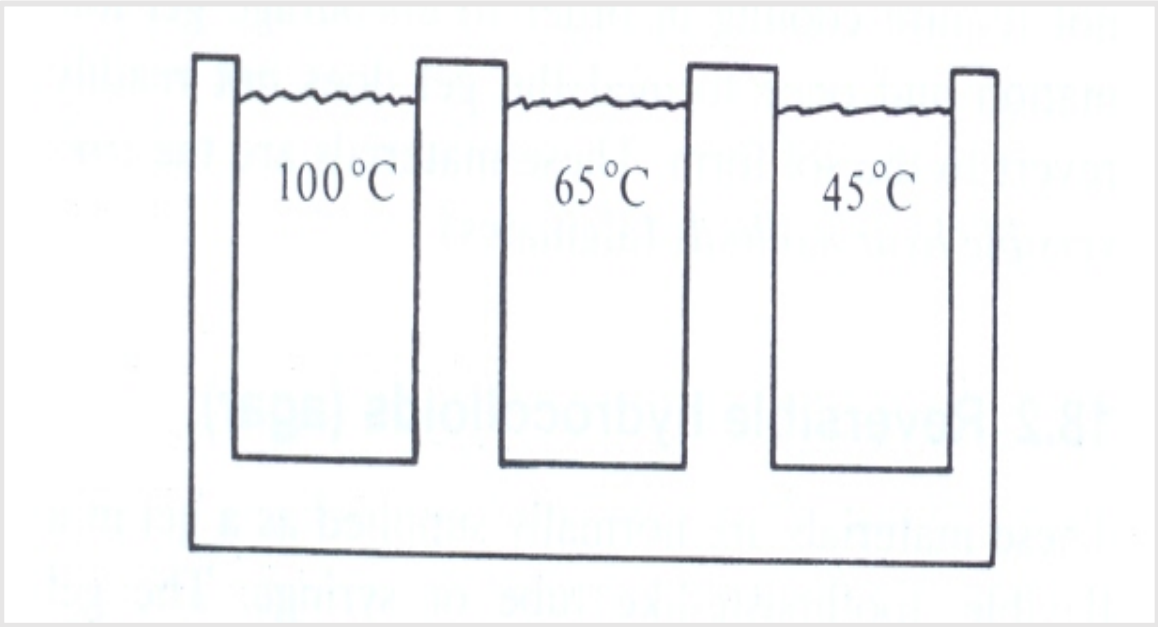
- **Manipulation**

Agar hydrocolloid requires special equipment:

A. Hydrocolloid conditioner.

B. Water cooled rim lock tray.

AGAR-AGAR CONDITIONER





Water bath used for conditioned agar imp material

Water cooling system tray for agar impression



Alginate impression material (irreversible hydrocolloid)

One of the most widely used dental impression material. It is more popular than agar for dental impression because it is simpler to use. It changes from sol to gel by chemical reaction.

- **Uses:**

1. **An elastic impression material for partial & complete dental prosthesis.**
2. **To prepare study cast, not recommended for making impression of cavity preparation or crown and bridge (It doesn't give a high degree of accuracy).**
3. **For surgical splint.**
4. **For duplicating models.**

- **Presentation:**

It's supplied as power mixed with water, A powder is packed in:

1. Bulk containers.

2. Preweighed packets for single impression.

A plastic scoop is supplied for dispensing the bulk powder & plastic cylinder for measuring the water.







- **Types:**

Depending on the setting alginate can be classified into:
***Regular set.**
***Fast set.**

- **Composition:**

1. **Potassium alginate (hydrogel former, dissolve in water & react with calcium ions.)**
2. **Calcium sulphate dihydrate (provide calcium ions to react with potassium alginate to form an insoluble gel.)**
3. **Fillers (to control the consistency of the mixed alginate)**
4. **Potassium sulphate, (counteract the inhibiting effect of the alginate on the setting gypsum, giving high quality surface of the die.)**
5. **Sodium sulphate (control working time, serve as retarder react with calcium sulphate)**

- **Advantages:**

1. **It is easy to mixed and manipulation with minimal requirement of equipment.**
2. **It has suitable setting time.**
3. **Flexibility of the set impression.**

- **Disadvantages:**

1. **It can't be corrected.**
2. **Poor dimensional stability and poor tear strength.**
3. **Lower detail reproduction.**

Elastomeric impression material

They are soft and rubber like and are known as elastomers or non aqueous impression material.

Types of elastomers (According to the chemistry):

1. **Polysulphide.**
2. **Condensation polymerizing silicones.**
3. **Addition polymerizing silicones.**
4. **Polyether.**

- **Presentation:**

Regardless of type all elastomeric impression materials are supplied as two paste systems (base and catalyst) in tubes. While the Putty consistency is supply in jars.



- **Uses: generally used in all cases**

1. **Crown and bridge impressions.**
2. **Partial and complete denture impressions.**
3. **Implant.**

Polysulphide impression material:

It has a Polysulphide polymer base that reacts with sulfur with the help of a catalyst. This impression material has good elastic property and excellent tear strength. However, this impression has unpleasant smell. It is available in different consistencies.





Silicone impression materials

Two types of silicon impression materials based on the type of polymerization reaction occurring during its setting.

1. Condensation silicon impression materials.

2. Addition silicone impression materials.

Condensation silicon impression materials

They consist of a base material and a catalyst. The base material is a dimethyl siloxane with 35-70% silica filler. With the help of alkyl silicate catalyst the polymerization is carried out by liberation of alcohol. The material has rapid setting reaction but high setting shrinkage.







heavy body **light body**

Addition silicone impression materials.

They have better properties than condensation silicone and the polysulphide. This material is often called a polyvinyl siloxane (PVS) or vinyl polysiloxane (VPS) impression material. Addition silicone is available in extra low, low, medium, heavy, and very heavy (putty) consistencies. This material is also provided as a base and catalyst tubes with no byproduct resulted upon reaction.

- **Properties of addition silicones**

1. **Pleasant odor and color, avoid skin contact to prevent allergic reaction.**
2. **Excellent reproduction of surface details, Setting time is (5-9) min.**
3. **It has the best dimensional stability among the elastomers even after 1 week (dimensional stability), It has good tear strength, hydrophobic.**







Polyether impression material

It has good mechanical properties and dimensional stability. Its disadvantages were that the working time is short and the material is very stiff. It is also expensive and bitter in taste. Polyether remain popular among a large number of clinicians mainly because of their hydrophilic nature.



