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Dental Materials

IMPRESSION MATERIALS

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Impression materials are used to register the form and relationship of teeth and surrounding tissues. An understanding of each material's physical characteristics and limitations is crucial for the proper use in clinical dentistry.

Usually, an impression material is placed into an impression tray and inserted against the tissue of the patient's mouth, it is allowed to harden or set by keeping it inside patient's mouth, and then it is removed from there. The positive reproduction of a single tooth is described as die, and when several teeth or a whole arch is reproduced, it is called cast or model.

Requirement of impression materials:

1. Pleasant odor, taste and acceptable color.
2. Absence of toxic or irritant materials.
3. Adequate shelf life for requirements of storage and distribution.
4. Reasonable pricing.
5. Easy to use with minimum equipment.
6. Sufficiently fluid to adapt to the oral tissues, viscous enough to be contained in a tray.
7. Should not dissolve in saliva and oral fluids or be harmful in any way to the tissues it is applied on.
8. Transform (set) into the required rigid or elastic properties that allows safe removal from the area of application without trauma to the tissue or distortion of the tray. The setting process should complete in a reasonable time (less than 7 min.).
9. Dimensional stability over temperature and humidity ranges normally found in clinical and laboratory procedures for a period long enough to permit the production of a cast or die.
10. Accuracy in clinical use.
11. Readily disinfected without loss of accuracy.
12. Compatibility with cast and die materials and with no gas release during setting of the impression or cast or die materials.

Classification of impression materials

A. According to elasticity (properties of the set material):

1. Rigid materials: They cannot engage undercuts, so their use is restricted to edentulous arches without undercut.

a- Impression plaster.
b- Impression compound.
c- Zinc oxide eugenol.
d- Impression wax.

2. Elastic materials:

Setting to an elastic body, they can engage undercuts, and they may be used in edentulous, partially dentate, and fully dentate patients.

• Hydrocolloid:
a- Reversible hydrocolloid (agar-agar).
b- Irreversible hydrocolloid (alginate).

• Elastomers
a- Polysulfide.
b- Condensation polymerizing silicone.
c- Addition polymerizing silicone.
d- Polyether.

B. According to setting reaction :

1- SET BY CHEMICAL REACTION (IRREVERSIBLE) * Impression plaster. * Zinc oxide eugenol. * Alginate. * Polysulfide. * Polyether. * Silicones.

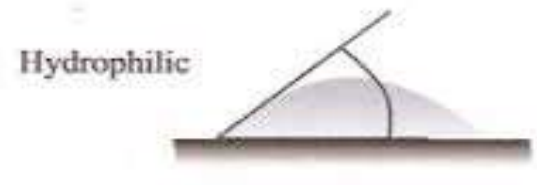
2- SET BY TEMPERATURE CHANGE (REVERSIBLE) (THERMOPLASTIC) * Impression compound. * Impression wax. * Agar-agar.

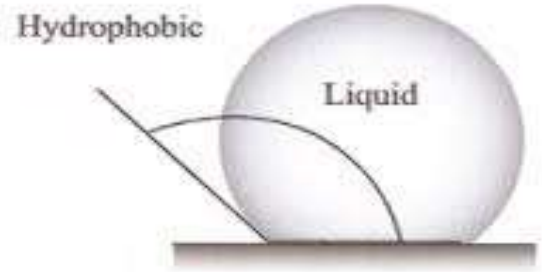
C. According to affinity to water:

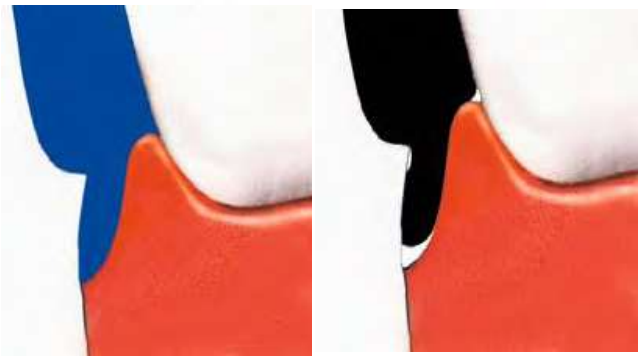
A- Hydrophilic:- The impression will absorb the saliva from the patient's mouth which means that the material is compatible with moisture & saliva like alginate.

B- Hydrophobic:- Means the impression will not absorb saliva and repel it; so the

patient's mouth must be completely dried before making an impression.







4- According to viscosity before setting:

a- Mucostatic: doesn't compress tissue during seating of the impression in patient's mouth. Like impression plaster.

b- Muco-compressive: compresses tissue during seating of the impression in patient's mouth because the material is more viscous. Like impression compound.

c- Psudoplastic: Material fairly viscous whilst under low stress conditions may become fluid during recording of impression.
* Polysulfide.

Non-Elastic impression materials

1. Impression compound:

Non-elastic, thermoplastic, hydrophobic, mucocompressive impression material. Used mainly for complete denture (primary impression) and other uses depending on its type.

Types and uses:

1.Type I Impression compound (lower fusing) :

Supplied in sheet or stick forms.

- Sheet form material: used to make primary impression for edentulous patient, softened using **water bath** (55-60) ºC. Putting it in hot water should not be so long to prevent leaching of important constituents. Over heating make the compound sticky and difficult to handle.

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- Stick form (tracing), used for border molding of special tray. Softened by using heat of flame & the tracing sticks should not be allowed to boil by direct contact with the flame (plasticizers will volatilized).

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2. Type II Impression compound (higher fusing) tray compound:

- Supplied in sheet form, it is stiffer and less flowable. Used to make a tray into which another impression material is placed. This is done for complete dentures of edentulous arches.

Properties:

1. **Thermoplastic property**: Impression compound is softened when it is heated to 45 ºC and becomes hard when it's cooled to 37ºC.
2. There is no chemical reaction but only a physical reaction, so the material is reversible and can be reused many times (for the same patient only).
3. **Not used to record undercut because it is rigid once it is cooled**. It's used as primary impression for complete denture. It will not record the undercut areas. It flows up to (85%) at 45ºC, and less at 37ºC about (6%).Therefore the reproduction of surface detail is not very good.
4. **Poor Dimensional stability:** Material has high value of coefficient of thermal expansion & undergoes considerable shrinkage on removal from the mouth. Also it has Relaxation because stresses are introduced into the material during making the impression or during removal of the impression (muco-compressive). Then residual stress exists whene cooling the impression. The gradual relief of internal stresses may cause distortion of impression so the impression should be chilled immediately in cold water to reduce the stress relaxation.
5. **Thermal conductivity:** Impression compound is poor thermal conductors, so it needs thorough heating, and a water bath is preferred to soften the impression compound. We should wait for certain time so that all the material is softened. When we introduce it into the patient's mouth we should wait enough time till the outer and the inner portion of the impression compound is hard before we can remove it from the patient's mouth.

Disadvantages

- ✓ The handling of dental impression compound is very technique sensitive. If it is not prepared properly, plasticizer can be lost during immersion in a water bath.
- ✓ Due to a high coefficient of thermal expansion, the dimensions of the impression are not likely to be the same as the dimensions in the mouth (dimensionally unstable).
- ✓ These materials are non-elastic and may distort on removal from the mouth (undercut).

Disinfection

Dental impression compound can be disinfected by immersion in sodium hypochlorite. The manufacturer's recommendations for proper disinfection should be followed.

2- Zinc oxide-eugenol impression material:

Zinc oxide-eugenol impression material is Non-elastic, Chemical setting, hydrophilic, mucostatic impression material. It comes in two tubes; one is base & the other is catalyst.

Composition:

Base paste: Mostly (Zinc oxide) as a ***reactive component***

Accelerator paste: the most important ingredient (reactive component) is Eugenol (oil of cloves قرنفل).

Chemical reaction:

Zinc oxide + Eugeno $\xrightarrow{water}$ Zinc eugenolate

As we see, the set material consists of a mixture of zinc eugenolate matrix.

Manipulation: two strips of equal length are squeezed from each tube on paper pad or glass slab, mixed by a spatula till the tow colors blend together. Mixing is for about (60 sec) & then the mixture is filled into the special tray.

Initial setting time (I.S.T) is the time for mixing the tow pastes, filling the tray with the patients and seating the imp. Material in to patient's mouth . (I.S.T= WORKING TIME)

Final setting time (F.S.T) is the time when the imp material is hard enough to resist penetration by certain load.

Factors affecting the S.T:

- Factors controlled by manufacture.
- Factors controlled by the dentist: those are :

i. Few drops of H2O to the eugenol paste shorten the S.T
ii. Cooling the spatula and glass slab prolongs S.T, and humidity shortens setting time.
iii. Change the ratio between the two pastes, this results in either increase or decrease of S.T depending on which paste contains the accelerator but this is not recommended .
iv. Longer mixing time (within limit) will shorten the S.T.

Properties:

1. Non-elastic and should not be used for partially edentulous arches, it fractures when removed from undercut area.
2. Accurate registration for surface details (Mucostatic)
3. It sticks to dry surfaces very well; this is why we should put petroleum jelly like Vaseline to patient's lips and cheek to make cleaning them easy. Also no need for adhesive or perforated tray because it sticks very hard to any surface.
4. Dimensional stability: it is adequate but it has (0.1%) shrinkage; so the impression could be left for period of time before the pouring of the impression.

Advantages

The material is stable after setting, has good surface detail reproduction, and is inexpensive.

Disadvantages

Eugenol is irritating to soft tissues burning sensation. Also this material is non- elastic and may fracture if undercuts are present.

3- Impression plaster:

One of four types of gypsum products, calcium sulfate hemihydrates CSH ($CaSO_4$) $\frac{1}{2}H_2O$. It is supplied as pink powder, mixed with water at 0.6 ml / gm ratio.

Manipulation:

Water is placed in to the rubber bowl and the powder is added, mix with spatula till the creamy mixture is formed the tray is filled and seated into the patients mouth where it is allowed to set, setting time (3-5) minutes. Increasing the water ratio prolong the S.T

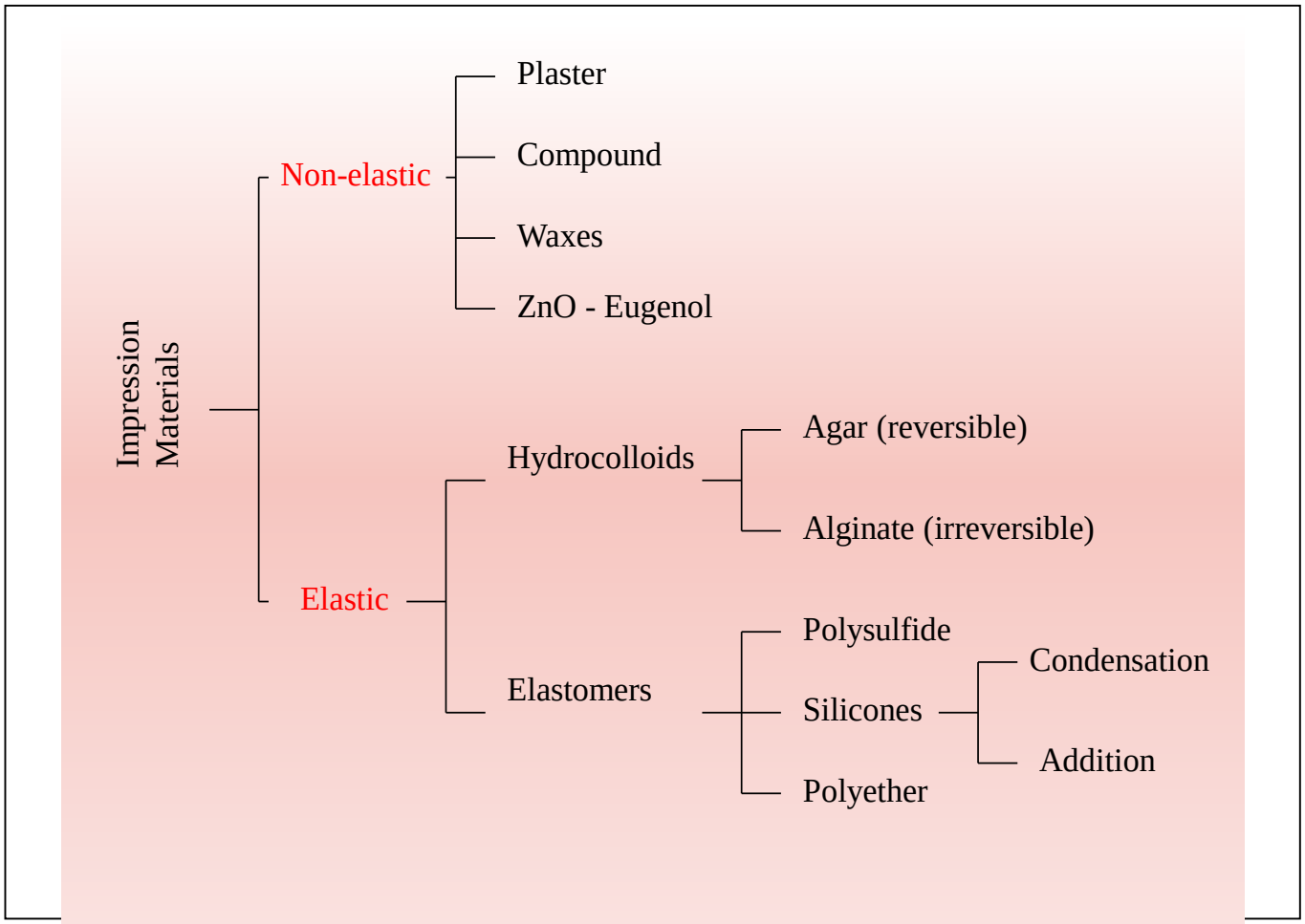
Usage: Used in making final impression for edentulous arches

Properties:

1. It is mucostatic because the mixed material has very low viscosity.
2. It is hydrophilic so it causes dryness of patient's mouth & patient complains from very dry sensation after impression making. Also because it is hydrophilic, it adapts very well to the soft tissue recording their surface details with great accuracy.
3. Separating medium is needed before pouring the cast (e.g. soap and water solution)
4. Construction of cast should be within (1 hr) because of an uneven dryness of the cast.
5. Non- elastic & rigid; if it is removed from the undercut area, it will fracture.
6. Setting time 3-5 minutes.
7. Dimensional stability is very good.

4- Wax as an impression material:

It is not widely used because of its high coefficient of thermal expansion & contraction. Some kinds of waxes have been used to make impressions. Usually these materials are mixture of paraffin wax and bees wax (3:1).


Impression Materials
Non-elastic
Plaster
Compound
Waxes
ZnO - Eugenol
Elastic
Hydrocolloids
Agar (reversible)
Alginate (irreversible)
Elastomers
Polysulfide
Silicones
Condensation
Addition
Polyether