Impression materials
Definition

- **Dental Impression** is the negative replica of hard and soft tissues of the mouth.
- Made with a material which relatively sets while still in contacts with the tooth and tissues.
Cast (model): positive replica of the oral hard or soft structures.
Purpose of taking impression

1. To study alignment of teeth
2. Construction of special (custom) tray
3. Treatment planning
4. Fabrication of indirect restorations
Types of trays

1. Stock trays

2. Special trays

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The desirable properties of an impression

- 1. A pleasant odor, taste, and acceptable color
- 2. Absence of toxic or irritant constituents
- 3. Adequate shelf life for requirements of storage and distribution
- 4. Not expensive
- 5. Easy to use with the minimum of equipment
6. Setting characteristics that meet clinical requirements
7. Readily wets oral tissues
8. Elastic properties that allow easy removal of the set material from the mouth and good elastic recovery
9. Adequate strength to avoid breaking or tearing upon removal from the mouth
10. Dimensional stability over temperature and humidity ranges normally found in clinical and laboratory procedures for a period long enough

11. Compatibility with cast and die materials

12. Readily disinfected without loss of accuracy
Classification of impression materials

I. According to withdrawal against undercuts or elasticity after setting

- Plaster
  - Impression compound
  - Zinc oxide–eugenol

- Nonelastic
  - Impression compound
  - Zinc oxide–eugenol

- Elastic
  - Hydrocolloids
    - Agar
    - Alginate
  - Polysulfides
    - Lead dioxide catalyst
    - Clean catalysts
  - Nonaqueous elastomers
  - Silicones
    - Condensation
    - Addition (vinyl)
  - Polyethers
II. Based on setting reaction of the material

I. Chemical reaction (irreversible)
- Plaster of paris
- Zinc oxide eugenol

II. Physical change of state (reversible)
- Agar agar
- Impression compound
A. Rigid (non elastic) impression materials

1. Impression compound

- **Thermoplastic** imp. mat. that is softened by heating & hardened by cooling.
- **Forms**: sheets & sticks of different colors
Types and uses

Type I: “Lower fusing compound” (<70°C)

a. **Sheet** form for recording **primary** imp. of edentulous pts. **without** undercut.

b. **Stick** form for **border tracing** of special tray.

c. **Stick** or **small cones** form for copper band impression.

Type II: “Higher fusing compound” (>70°C)

Used as tray material for wash impression technic
Composition

1. Thermoplastic materials
   To give thermo plasticity, flow and cohesion.
   e.g. natural resins & waxes

2. Fillers
   To give body and suitable working consistency.

3. Plasticizers
   To act as lubricants & control consistency (with fillers).

4. Coloring agents
   to give characteristic color.
Setting reaction

Thermoplastic physical reversible reaction.

Manipulation (for 1ry imp)

As the material has low thermal conductivity, it must be immersed & kneaded under water for sufficient time, but not too long, to ensure complete softening but without leaching out of its ingredients.
Properties

1. **Accuracy**
   Compound is *not sufficiently fluid* to record fine details.

2. **Dimensional stability**
   It has high coefficient of thermal expansion and contraction, so it shows considerable amount of *shrinkage* on cooling (during hardening & cooling to room temp.).

3. **Elasticity**
   the material is *non-elastic*, so cannot be used in undercut areas.
4. **Compatible** does not need separating medium. To separate cast from the impression, use warm water.

5. As the material is reversible, it can be re-used, but after sterilization.

6. Compound impression can be added or corrected.

7. Other properties:
   * Non-toxic or irritant
   * Suitable setting time
   * Long shelf life
   * Can be copper plated
Zinc oxide-eugenol pastes
It is rigid or inelastic impression material that harden by chemical reaction, used for recording secondary or corrective wash impressions of edentulous arches in the preparation of complete dentures.
Composition

- **Tube 1 (Base)**
  - Zinc oxide 80%
  - Inert oil 15%

- **Tube 2 (Accelerator)**
  - Oil of cloves or eugenol 15%
  - Gum rosin and oils 65%
  - Filler (talc or kaolin) 16%
  - Accelerator (MgCl₂ or CaCl₂) and water 4%
- **Inert oils** act as plasticizer and decrease the irritating action of eugenol.
- **Oil of cloves** which contain 70% to 85% eugenol is used in preference to eugenol because it produces less burning sensation.
- **Rosin** produces smoother coherence mix and imparts thermoplastic properties to the set imp.
- **Filler** to give paste of several consistency.
- **Accelerator** hastens the setting reaction and can be incorporated in either one or two pastes.
Setting reaction

- Is known as *Chelation*.
- $\text{ZnO} + \text{HOH} \rightarrow \text{Zn(OH)}_2$
- $\text{Zn(OH)}_2 + 2\text{HE} \rightarrow \text{ZnE}_2 + 2\text{HOH}$
  
  Acid    Salt
  
  (Eugenol) (Zinc eugenolate)

- Water is needed to initiate the reaction and it is also a by product of the reaction. This reaction is often called *autocatalytic* reaction.
Manipulation

- Usually an equal length of each paste is dispensed on the mixing pad or the glass slap. A stiff stainless steel spatula is used for mixing. Mixing time is approximately 1 min. until a uniform color is achieved.
Factors affecting setting time

- **Temp.:**
  - $\uparrow$ temp. $\rightarrow$ $\downarrow$ setting time.
  - $\downarrow$ temp. (the temp. is not lower than the dew point) $\rightarrow$ $\uparrow$ setting time.

- A drop of water or alcohol or accelerator $\rightarrow$ $\downarrow$ setting time.

- **Inert oils** $\rightarrow$ $\uparrow$ setting time.

- **Ratio** of the two pastes $\rightarrow$ $\uparrow$ or $\downarrow$ setting time depending on particular product.

- **Mixing time:** $\uparrow$ the mixing time within limits $\rightarrow$ $\downarrow$ setting time.
Characteristic properties

- **Biological properties**
  Non toxic, but those containing eugenol can be irritant to the patients so use eugenol free zinc oxide impression material.

- **Dimensional changes**
  A negligible shrinkage (less than 0.1%) may occur during hardening.

- **Flow**
  There is a correlation between flow and setting time.
Elasticity

It is inelastic imp. material and cannot be used for recording undercuts.

Disinfection

The imp. Should be immersed in 2% alkaline glutaraldehyde for recommended time, rinsed, and poured.

Pouring and separating the cast

No separating media is needed. Gypsum product can be used.
Advantages

- Adhere well to dried surfaces of compound, resin, and shellac bases.

- Sufficient resistance so that borders can be built up if the tray is slightly deficient in any area.

- Hard when set, and the resulting imp. can be taken in and out of the mouth repeatedly.

- Adequate working time for border molding in the mouth.

- Adequate fine details and dimensionally stable.

- Can be repaired.

- No separating media before the cast is poured.
Disadvantages

1. Burning sensation caused by eugenol when it contact soft tissue.
2. Cannot be used when undercut exists as it is nonelastic.
3. Requires special trays.
4. Instruments are difficult to clean.
Non eugenol paste

Because of the previous disadvantages of eugenol, development of eugenol free impression occurred.

It is formed by a saponification reaction to produce an insoluble soap if zinc oxide reacted with a carboxylic acid as ortho ethoxybenzoic acid (EBA).

\[ \text{ZnO} + 2\text{RCOOH} \rightarrow (\text{RCOO})_2\text{Zn} + \text{H}_2\text{O} \]