

Impression materials

2. Impression waxes:

It is described as a rigid, muco-static, Hydrophobic, reversible impression material which set by physical change on applying heat, it softens when heated and on cooling it hardens (thermoplastic material).

These materials consist from a mixture of low melting paraffin and bees waxes in ratio about 3:1. Waxes have high and larger coefficient of thermal expansion. So, it will distort when removed from undercut area. Impression waxes are rarely used to record complete impression.

The impression wax was probably the first impression material used in dentistry. It is cheap, clean, and easy to use. A multitude of waxes are used in dentistry. Some are hard, much like paraffin wax. Others are soft and moldable at room temperature, similar to Play-Doh. It's used in ranging consistencies of soft, medium, hard and extra hard.

Wax used for taking impressions is solid at mouth temperature but is moldable at a temperature that is tolerated by oral tissues. Wax comes in many forms (sticks, strips, tubes, etc.). Wax can be thought of as a low-molecular-weight polymer. It is a thermoplastic material. It is also very weak, and the procedure technique must compensate for wax's poor mechanical properties. Wax is often used to extend tray borders or adapt a stock tray when taking impressions.

Types of impression wax

1. **Corrective Impression Wax:** Corrective impression wax is used as a wax over an original impression to register the detail of soft tissues in a functional state.

2. **Bite-Registration Wax:** Bite-registration wax is used for accurate articulation of certain models of opposing arches. the addition silicone and polyether materials have replaced waxes for bite registration.



3. Impression compound

Impression compound is one of the oldest impression materials. It is classified as inelastic (rigid), hydrophobic, mucocompressive and reversible thermoplastic (it softens when heated and on cooling it hardens) impression material, which sets by physical change. It is mainly used for making impression of edentulous mouth (primary impression).

Alternative Names

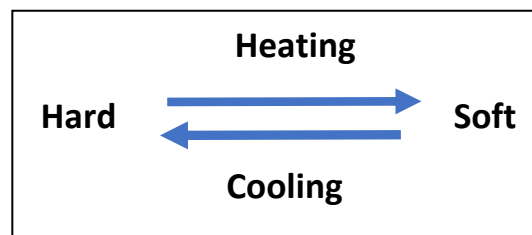
- Dental compound
- Model compound
- Model plastic

Dispensing: present as cakes, sticks and cones.



Setting Reaction

Impression compound is a thermoplastic material, i.e. they soften when heated and harden when cooled, without occurrence of a chemical reaction.



Composition: in general impression compound is a mixture of:

Component	Wt%	Functions
Natural or synthetic resin - Copal resin - rosin	40	<ul style="list-style-type: none"> • Provides thermoplasticity. • Gives the qualities of flow and cohesion.
Waxes (Bee's wax, carnauba wax, paraffin wax)	7	<ul style="list-style-type: none"> • Provides thermoplasticity. • Characterizes the softening temperature and produces smooth surface.
Stearic acid, shellac, and gutta-percha	3	Acts as a plasticizer, which improves plasticity and workability (added to overcome brittleness).
Diatomaceous earth, French chalk, or talc	50	Acts as filler. <ul style="list-style-type: none"> • Increases strength. • Reduces flow at mouth temperature. • Reduces COTE (minimize shrinkage due to thermal contraction) • Overcome tackiness.
Coloring agent	Trace	Gives characteristic color

Types of impression compound: it classified into *two* types:

1. **Type I – Low fusing material, e.g.**

- **Impression compound:** It is supplied in the form of sheets or cakes about 4 – 5 mm thick. It is used to take primary impression for edentulous ridges using stock tray, softened using water bath (55-60) C (found to be ideal for kneaded with fingers in order to obtain plasticity throughout the impression compound). Storage in water should not be so long to prevent leaching of important constituents such as stearic acid over heating make the compound sticky and difficult to handle.
- **Stick compound:** Supplied in stick form and available in different colors such as green, black, gray, brown and white. The composition of stick compound is almost similar to that of impression compound with more plasticizers. Used for border molding of special trays during fitting of the special tray, It is softened by waving over a gas flame and kneaded (dry kneading). The compound should not allow boiling, otherwise the plasticizer is volatilized.

2. **Type II – High fusing material, e.g.**

- **Tray compound:** They are usually supplied in the shape of tray, which may be black or white in color. it is stiffer and has less flow than regular impression compound and require higher temperature at which they soften (70° C). They are used to prepare custom made preliminary impression (special tray) that

will later hold a second impression material, which will record final impression (secondary impression). Tray compounds lack strength and dimensional stability; hence they have been replaced to a large extent by trays made from self-cure acrylic resins.

The difference in fusing temperature between type I and type II reflects a difference in the % of thermoplastic compound of each (waxes and resins).

Uses:

1. For making a primary impression for edentulous ridges.
2. Border molding of special tray.
3. constructing impression tray.

Manipulation

Softening: Impression compound can be softened by using a *thermostatically controlled water bath or open flame*. The compound is softened by immersing in the water bath at 55°C–60°C. Since the material has low thermal conductivity it must be immersed in the water bath for sufficient time to ensure complete softening.

Kneading: The compound is removed from the water bath and kneaded with the fingers in order to obtain uniform plasticity throughout the mass.

Loading: The compound is kneaded to suitable shape and placed in an impression tray (nonperforated stock tray).

Tempering: The outer surface (tissue side) of the compound can be waved over the flame or spray cold water on metal tray just before it is inserted into the mouth.

Making impression: The compound along with tray is then inserted into the mouth. The impression is retained until it cools to mouth temperature at that might take several minutes due to its lack of conductivity.

Removal: After it has completely hardened the impression is removed from the mouth and washed, dried and trimmed.

Casting: A mix of stone/plaster and water poured into the impression and allow it to set. The safest method for removal of the impression is to immerse it in warm water until the compound softens sufficiently to allow it to be separated easily from the cast.

Properties:

1. It is ***muco-compressive*** and it is the most viscous impression materials used (high viscous), therefore the reproduction of surface details is not very good. However, the reproduction can be improved by reheating the surface of the impression material after tacking the first impression and then resealed it in the patient's mouth even this is not good as the other impression materials.
2. ***Rigid*** once cooled not used to record undercuts (used for primary impression only).
3. ***Poor dimensional stability***, the material has high value of coefficient of thermal expansion (COTE) and undergoes considerable shrinkage on removal from mouth. also, because pressure is applied during formation of an impression (muco-compressive) residual stress exists in cool impression the gradual relief of internal stresses may cause distortion of impression (the impression should be poured as soon as possible within 1 hour).
4. ***Low thermal conductivity*** so it needs thorough heating and a water bath is preferred to soften the impression compound. We should wait for certain time in order that all the material is softened and when we introduce it into the patient mouth, we should wait enough time till the outer and the inner portion of the compound is hard before we can remove it from patient mouth.
5. It is a ***physical reaction*** not chemical reaction so the impression compound can be reused a number of times (for the same patient) in case of error; inaccurate portions can be remade without having to remake the entire impression.

Advantages:

1. Compatible with model material and not need separating medium before pouring the plaster.
2. Can be reused a number of times, added and readopted.
3. Not need special tray.
4. Can be used for compressing soft tissues.
5. Can be used for any technique requiring a close peripheral seal.
6. Can be used in combination with other materials.
7. Relatively cheap.

Disadvantages:

1. Rigid once set and distorts easily so cannot be used in undercut area.
2. muco-compressive material (cause displacement to the soft tissue).
3. Does not reproduce fine surface detail (High viscous, low flow).
4. Can only give an accurate impression with a long and difficult technique. The handling of dental impression material is very technique sensitive. (if it is not prepared properly not softening enough, volatiles can be lost on heating or low molecular weight ingredient can be lost during long immersion in a water bath)
5. High coefficient of thermal expansion leading to dimensional changes.
6. Must be poured within one hour.
7. As it can be resoftened and reused it tends to become unhygienic since it cannot be sterilized without affecting its properties.
8. Its thermal properties are not ideal – large COTE and low thermal conductivity.

**4. Zinc oxide eugenol (ZOE) impression paste:**

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 oxide –eugenol

1. Final impression for edentulous arches.
2. Occlusal bite registration.
3. Temporary filling.
4. Surgical pack in periodontal surgical procedure.
5. Root canal filling.
6. Cementation and insulating medium.
7. Temporary relining material for dentures.

Types of Zinc oxide eugenol impression material

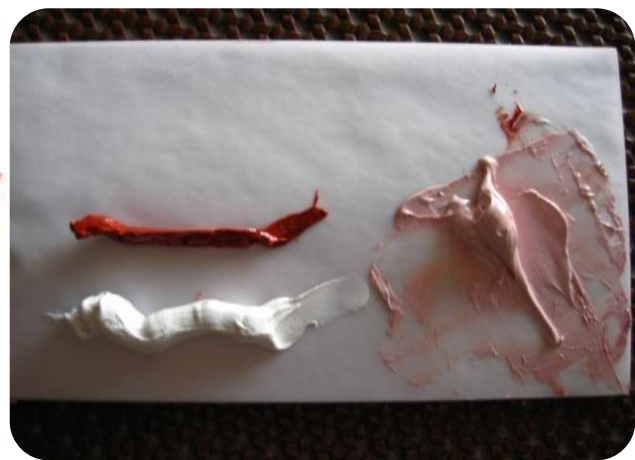
1. Type I hard.
2. Type II soft.

The difference between two types related to their hardness after setting.

Dispensing

Usually supplied as two pastes in collapsible metal tubes.

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

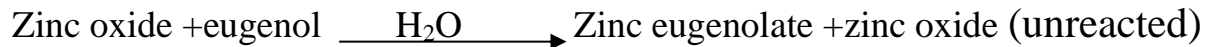


Composition

Base paste		
Component	Wt%	Functions
Zinc oxide	87	<ul style="list-style-type: none"> • Reactive ingredient, which takes part in setting reaction.
Fixed vegetable oil or mineral oil	13	<ul style="list-style-type: none"> • Paste former. • Plasticizer – provides smoother and more fluid mix. • Retarder—retards the rate of reaction and increases the setting time. • Aids in masking the action of eugenol as an irritant
Water	Trace	<ul style="list-style-type: none"> • (Initiator)

Reactor paste		
Component	Wt%	Functions
Oil of cloves or eugenol	12	<ul style="list-style-type: none"> • Reactive ingredient, which takes part in setting reaction. • Oil of cloves contain 70–80% of eugenol it reduces the burning sensation in the soft tissues of the mouth when the mixed paste is first placed in contact with them
Gum or polymerized rosin	50	<ul style="list-style-type: none"> • Facilitates the speed of reaction and produces a smoother homogeneous mix. • Gives body and coherence to the mixed material.
Filler (silica type)	20	<ul style="list-style-type: none"> • Used to form a paste with eugenol. • Increases strength of the mixed paste.
Lanolin	3	<ul style="list-style-type: none"> • Plasticizer
Resinous balsam (Canada balsam)	10	<ul style="list-style-type: none"> • To increase flow and improve mixing qualities.
Accelerator solution (CaCl₂)	5	<ul style="list-style-type: none"> • Accelerates the setting reaction.
Color pigments	Trace	<ul style="list-style-type: none"> • To distinguish from other paste. • Enables thorough mixing to be achieved as indicated by a homogeneous color, free of streaks in the mixed material.

Chemical reaction



The set material consists of a mixture of amorphous zinc eugenolate matrix which holds unreacted zinc oxide particles together.

Manipulation

The proper proportion of two pastes is generally obtained by squeezing two ropes of pastes of the same length onto the mixing slab (glass slab or oil impervious paper pad mixed). A flexible stainless steel spatula is used for mixing. The reactor paste is first collected and applied over the base paste. It is now mixed with broad strokes in a sweeping motion until a uniform homogeneous color mix is obtained. Mixing time is approximately 1 minute.

the mix is collected and spread over the special tray and is placed in the mouth. The surface of the special tray should be dry since the material will not adhere to wet surfaces. The mix will stick to the dried skin and instruments. So it is advisable to coat the patient's lips with petroleum jelly. This enables excess impression paste to be wiped away.

It is held firmly in position (in the patient mouth) until the material has uniformly hardened. Once the material has set, the impression is removed from the mouth. If the impression is not properly recorded another increment of a fresh mix can be placed over that and better impression can be obtained.

The impression is well-rinsed under running tap water for removal of any saliva or debris; disinfected and dried.

Cast is made by pouring a mix of dental stone and water into the impression and allowing it to harden. No separating medium is required when making the cast.

The impression can be separated from the cast by immersing in hot water at 60°C for 5–6 min.

Properties

1. These materials are nontoxic but those containing eugenol can be irritant giving stinging or burning sensation to the patient and leaving a persistent taste, which some patients may regard as unpleasant. So non eugenol paste was developed where the zinc oxide is reacted with a carboxylic acid.
2. Relatively low viscosity (mucostatic) allows all the finer details to be recorded in the impression.
3. Rigid inelastic once set and should not be used for partially edentulous arches, or undercut areas it's fractured when removed from undercut area.
4. It requires a fit special tray (without space) for impression making.
5. It has adequate adhesion to acrylic tray (no need adhesive material).
6. It has advantages of being dimensionally stable, a negligible shrinkage (less than 0.1%) may occur during hardening.
7. It does not stick to the cast material (No separating medium is needed before the stone model is poured).
8. The paste tends to adhere to skin, so the skin around the lips and the cheek should be protected with petroleum jelly (Vaseline) to make the cleaning process much easier.
9. It can be checked in mouth repeatedly without deformation.
10. Setting time should not be too long as it causes inconvenience to the patient and should not be too short so that the material cannot be manipulated.
 - Type I: Initial setting time = (3-6) Min., final setting time = 10 Min.
 - Type II: Initial setting time = (3-6) Min., final setting time = 15 Min.

Factors affecting setting time		
Factors	To decrease setting time	To increase setting time
Temperature	Increase (Glass slab and spatula can be heated)	Decrease (Glass slab and spatula can be cooled)
Humidity	Increase	Decrease
Altering the ZnO paste to eugenol (not recommended)	More eugenol paste (reactor)	More ZnO paste (Base)
Mixing time (within limits)	Faster and longer	Slower and shorter
Chemical Modifiers	Add accelerators (CaCl ₂ , MgCl ₂ , and water)	Add retarders (inert oils and waxes)

Advantage

1. Good adapted to the soft tissues without causing displacement of the soft tissue (mucostatic), so it has good reproduction of surface detail.
2. Good dimensional stability.
3. Well Adhere to the dried surfaces of special tray (no need for adhesive).
4. Inexpensive.
5. Not need separating medium before the stone model is poured.
6. It can be checked in the mouth repeatedly without deformation.
7. Minor defects can be corrected locally.
8. It has enough working time to complete border molding.
9. Easy to manipulate.

Disadvantage

1. Messiness
2. Inelastic and may fracture if undercuts present (It cannot be used when undercut exists).
3. Variable setting time due to temperature and humidity.
4. Some patients find the eugenol content unpleasant (may cause burning sensation or irritation to the oral tissues).
5. Requires special tray for making impression.
6. The skin around the lips and the cheek should be protected with petroleum jelly (Vaseline).
7. Instruments are difficult to clean

