

# Impression for crown and bridge work

**Definition:** an impression is a negative reproduction or likeness of an object, from which, a positive reproduction (or cast) could be obtained.

## Objective of taking an impression

Because it is neither possible nor desirable to make patterns for fixed prostheses directly in the mouth, an impression or negative likeness of the teeth and surrounding structures is necessary to obtain a cast. This cast is then used to make a restoration in the laboratory. To obtain the cast, an elastic impression material is placed in a tray that is inserted into the patient's mouth. When the material has set, it is removed from the patient's mouth. A suitable dental stone is then poured into the "negative" impression, and a positive likeness or working cast is obtained.

## Requirements of an acceptable impression

1. An acceptable impression must be an exact record of all aspects of the prepared tooth. This means that it must include sufficient unprepared tooth structure immediately adjacent to the margins so that the restoration could be fabricated with proper contour by the laboratory technician.
2. All teeth in the dental arch and the soft tissues immediately surrounding the prepared tooth must be reproduced in the impression. This will allow the cast to be accurately articulated and contribute to proper contouring of the planned restoration.
3. The impression must be free of air bubbles, tears, thin spots, and other imperfections that might induce inaccuracy.

## Requirements of an impression material

1. It should be *elastic* after its placement in the patient's mouth so that it can be removed from the undercut areas that exist on the external tooth surfaces adjacent to the prepared tooth without distortion or fracture.
2. It should have adequate *strength* to resist breakage or tearing on removal from the patient's mouth (*adequate tear strength*).
3. It should have adequate *dimensional stability* over temperature and humidity ranges normally found in clinical or laboratory procedures for a period long enough to permit the production of a cast or die.

4. It should have adequate *accuracy* for the production of the fine details so that it is an exact negative reproduction of the prepared and unprepared teeth.

5. It should be *easy to use with the minimum of equipment*.

6. It should be *free of toxic or irritating components*.

## **Classification of impression materials**

### **1. Non-elastic impression materials:**

- a. Impression compound.
- b. Impression plaster.
- c. Zinc-oxide eugenol paste.

These materials are not used routinely in crown and bridge work because when they set they become rigid, so upon removal from the undercut areas they will fracture.

### **2. Elastic impression materials:**

- a. Hydrocolloids (water-based systems):
  - Reversible hydrocolloids (agar impression material).
  - Irreversible hydrocolloids (alginate impression material).
- b. Elastomers:
  - Polysulfide impression material.
  - Condensation silicone impression material.
  - Polyether impression material.
  - Addition silicone impression material.

## Hydrocolloids

### **-Reversible hydrocolloids (agar impression material)**

Agar hydrocolloid impression material is compounded from reversible agar gel. It is termed *reversible* because as the agar gel is heated, it will liquefy or go into a sol state, and on cooling it will return to the gel state. Because this process can be repeated, a gel of this type is described as *reversible*.

### **Chemical composition of agar impression material**

The main active constituent of reversible hydrocolloid impression product is agar, which is a sulfuric ester of a galactan complex, potassium sulfate, borax, alkyl benzoate, water, coloring agent and flavors. This material forms a colloid with water, which liquefies between 71°C and 100°C and sets again to a gel again between 30°C and 50°C, varying with the concentration of the agar.

The material is supplied as a tray type and a syringe type. The tray type is considerably stiffer at the time of making the impression than the syringe type. The agar content is reduced in the syringe type, so it is much more fluid at the time of injection than is the tray material at the time of insertion.

### **Advantages of agar impression material**

1. If poured immediately, it produces casts of excellent dimensional stability, accuracy, and surface details.
2. A special tray is not required when agar impression material is used. This is because its accuracy is improved if the material has as much bulk as possible. This is in contrast with the elastomeric impression materials (polysulfide and condensation silicone) whose accuracy is improved by minimizing the bulk by using a special tray.

### **Disadvantages of agar impression material**

1. Special equipment and water-cooled impression trays are needed.
2. If the agar impression is not poured immediately, it will undergo dimensional changes. This is due primarily to the ease with which water can be released from or absorbed by the material (syneresis and imbibition). In order to avoid this, the impression should be poured immediately, or if this cannot be done immediately, the impression should be stored in 100% relative humidity.



**The special equipment and the water-cooled impression trays needed for the agar impression material.**

-Irreversible hydrocolloids (alginate impression material)

### **Chemical composition of alginate impression material**

It is supplied as a powder which is composed of sodium or potassium alginate, salts of alginic acid, fillers (diatomaceous earth), calcium sulfate, and modifiers. On mixing the powder with water a sol is formed, a chemical reaction takes place and a gel is formed.



### **Properties**

- Good surface detail.
- Reaction is faster at higher temperatures.
- Elastic enough to be drawn over the undercuts, but tears over the deep undercuts.
- Not dimensionally stable on storing due to evaporation.
- Non toxic and non irritant.
- Setting time can depend on technique.
- Alginate powder is unstable on storage in presence of moisture or in warm temperatures.

### **Advantages**

1. Non-toxic and non-irritant.
2. Good surface details.
3. Easy to use and handle.
4. Cheap and has good shelf-life.
5. Its setting time can be controlled by controlling the temperature of water used.

### **Disadvantages**

1. Poor dimensional stability (syneresis and imbibition); therefore, an alginate impression should be cast within 15 minutes.
2. It does not adhere to the impression tray.
3. Setting time very dependent on operator handling.

### **Polysulfide impression material**

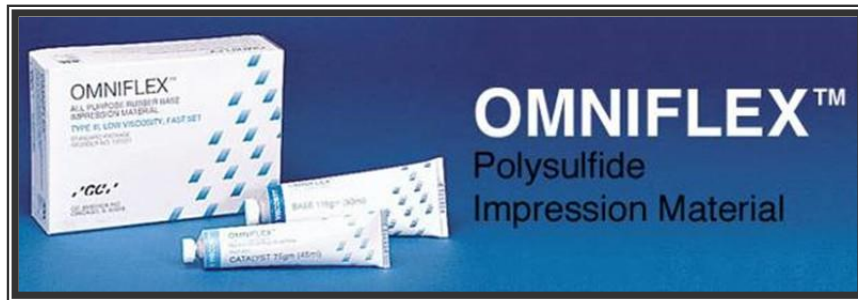
The polysulfides, commonly known as "rubber bases", were introduced in the early to middle 1950s and used widely by dentists because of their better dimensional stability and tear strength than hydrocolloids. Nevertheless, it was important that the polysulfide impression be poured as soon as possible after impression taking since delay of over an hour resulted in clinically significant dimensional change.

### **Chemical composition of polysulfide impression material**

The material is supplied as a two-paste system (*base* and *accelerator* or *catalyst*) in three consistencies (heavy, medium, and light bodies)

which differ only in the amount of filler loading. The base is composed of polysulfide polymer, titanium dioxide, zinc sulfate, copper carbonate, or silica. The accelerator or catalyst is composed of lead dioxide, dibutyl or dioctyl phthalate, sulfur, and other ingredients as magnesium stearate and deodorants.

Water is a by-product of polysulfide polymerization. Its evaporation results in a slight contraction of the polymerized material, which can be minimized through the use of a special tray as this reduces the material's thickness.



### **Advantages of polysulfide impression material**

1. It has high tear resistance and high elastic properties which facilitate impression making in sulcular areas and pinholes.
2. It has improved dimensional stability over hydrocolloids but inferior to polyether and addition silicone.
3. It is the least expensive of elastomers.

### **Disadvantages of polysulfide impression material**

1. It has dimensional instability which is due to the mode of polymerization of polysulfide which is of condensation type which gives off water as a by-product, whose evaporation from the set material causes dimensional contraction.
2. It has a long setting time in the mouth (typically 10 minutes) which induces poor patient's acceptance (especially in view of its unpleasant sulfide odor).
3. Humidity and temperature dramatically reduce its working time which may be so short that polymerization begins prior to insertion in the mouth with resultant severe distortion.
4. Most polysulfide materials are polymerized with the aid of lead peroxide (catalyst) which gives the material its typical brown color and the polymerized material is so sticky and should be handled carefully since it could stain the clothes permanently.

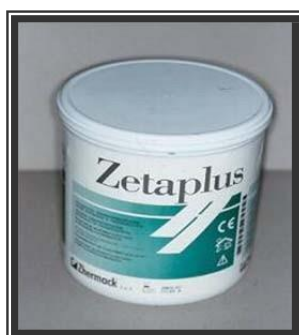
### **Condensation silicone impression material**

Condensation silicone has been developed to overcome some of the disadvantages of polysulfide. It is odorless and can be pigmented to virtually any shade. An additional advantage of condensation silicone

over polysulfide is its relatively short setting time in the mouth (typically 6-8 minutes). As a result patient acceptance is better than polysulfide. It is also less affected by high operatory temperatures and humidity. Unfortunately, its dimensional stability is less than that of polysulfide although greater than that of reversible hydrocolloid.

### **Chemical composition of condensation silicone impression material**

The material is supplied as a *base* and an *accelerator* in a low consistency and putty-like consistency. The base is composed of a linear silicone called *polydimethylsiloxane* and fillers (either calcium carbonate or silica). The accelerator may be a liquid that consists of stannous octoate suspension and alkyl silicate, or it may be supplied as a paste by adding a thickening agent.



(A)



(B)

**The condensation silicone impression material: The putty-like (A), and the low consistency (B).**

### **Disadvantages of condensation silicone impression material**

1. The main disadvantage of condensation silicone is its poor wetting characteristics because it is extremely hydrophobic; therefore, the prepared teeth and gingival sulci must be completely free of moisture for a defect-free impression.
2. It has dimensional instability which is due to the mode of polymerization which is of condensation type which gives off ethyl alcohol as a by-product, whose evaporation from the set material causes dimensional contraction.
3. Pouring the impression made of condensation silicone without trapping air bubbles is more difficult than with other impression materials.

### **Polyether impression material**

Polyether impression material has a polymerization mechanism unlike those of the other elastomers. No volatile by-product is formed, and thus it has excellent dimensional stability.

### **Chemical composition of polyether impression material**

The material is also supplied as a two-paste system (*base* and *accelerator* or *catalyst*) in three consistencies (low, medium, and heavy bodies). The base paste consists of a long-chain polyether copolymer, silica fillers, compatible plasticizers of a non-phthalate type, and triglycerides. The catalyst paste consists of an aliphatic cationic initiator (as a cross-linking agent), silica fillers, and plasticizers. Coloring agents are added to the base and catalyst to aid in the recognition of different materials types.

### **Advantages of polyether impression material**

1. It has high dimensional stability since no volatile by-product is formed and its polymerization shrinkage is unusually low compared with most room temperature-cured polymer systems. Therefore, an impression made of polyether can be poured more than a day after the impression has been made and still having accurate casts. This is especially useful when it may be impossible or inconvenient to pour the impression immediately. The new polyether materials can be poured up to fourteen days after impression taking.
2. It has short setting time in the mouth (typically 5 minutes, or less than half the time required for polysulfide).

### **Disadvantages of polyether impression material**

1. The set material is stiff. This causes problems when separating a stone cast from the impression, especially in thin and single teeth as in the mandibular incisors. However, this problem has been recently solved with the introduction of soft polyether materials such as Impregum Penta Soft.
2. The polyether is stable only if stored dry since it will absorb moisture (imbibition) and significantly change dimensionally.
3. There are reported cases of allergic hypersensitivity to polyether, manifested as a sudden onset of burning, itching, and general oral discomfort.

### **Addition silicone impression material (polyvinylsiloxane)**

The main difference between the addition silicone and the condensation silicone is that it has much greater dimensional stability than the condensation type as its polymerization reaction does not give off any by-product.

### **Chemical composition of addition silicone impression material**

The material is also supplied as a two-paste system (*base* and *accelerator* or *catalyst*) in extra low, low, medium, heavy, and very heavy (putty) consistencies. The base paste consists of dimethylsiloxane with vinyl terminal groups, plus fillers. The accelerator (catalyst) also

contains dimethylsiloxane with vinyl terminal groups, fillers, and platinum catalyst.

#### **Advantages of addition silicone impression material**

1. It has high dimensional stability which is equivalent to polyether.
2. The set material is less rigid than polyether.

#### **Disadvantages of addition silicone impression material**

1. Like other materials, adverse tissue responses have been reported.
2. Setting inhibition by some brands of latex gloves.

### **Digital impression**

Digital impression represents the most recent development in Dentistry. The basics of digital impression start with capturing an image of the prepared teeth. This system uses an intra-oral camera (scanner) to capture the desired image (optical impression). This image is then electronically transferred to a manufacturing facility which fabricates a working, articulated model. On this model, a multitude of different restorations can be designed (crowns, bridges, inlays/onlays, and veneers) with a special computer software, which is connected with a milling machine. This procedure is termed CAD-CAM (Computer Aided Designing - Computer Aided Manufacturing).

#### **Advantages of digital impression**

1. Digital impressions eliminate the uncomfortable experience of making a physical impression.
2. The image on the monitor shows you if you have captured all the needed details before sending it to the lab.
3. The accuracy of the mounting, bite registration, and stability of the dies create a model that allows the laboratory technician to fabricate a final restoration that has excellent marginal fit and incredibly accurate occlusion.
4. The ability to see if proper occlusal reduction has been achieved.



**Chairside CAD-CAM unit.**



**Laboratory CAD-CAM unit.**

