Impression Materials

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Definitions:

<u>Impression:</u>

- It is a negative reproduction of the teeth and surrounding oral structures.

Definitions:

Impression material:

- It the material that used for making impression. It is inserted into the mouth in a plastic form then set

Definitions:

Cast (Model):

- It is the positive reproduction of the teeth and surrounding oral structure.

Definitions:

Die:

- It is the model of single tooth

Ideal Requirements Impression Material

1. It should be accurate to produce fine details.
2. It should be biocompatible with oral environment. It should be not toxic or irritant to the oral tissues.
3. It should be easily manipulated without complicated equipment.
4. It should have suitable working time.
5. It should have suitable setting time.

Ideal Requirements Impression Material

6. It should have acceptable taste and odor to the patient.
7. It should accept addition and correction.
8. It should be easily disinfected without loss of its accuracy.
9. It should have good shelf life.

Factors Affecting Accuracy of Impression Material

1. <u>Flow:</u>

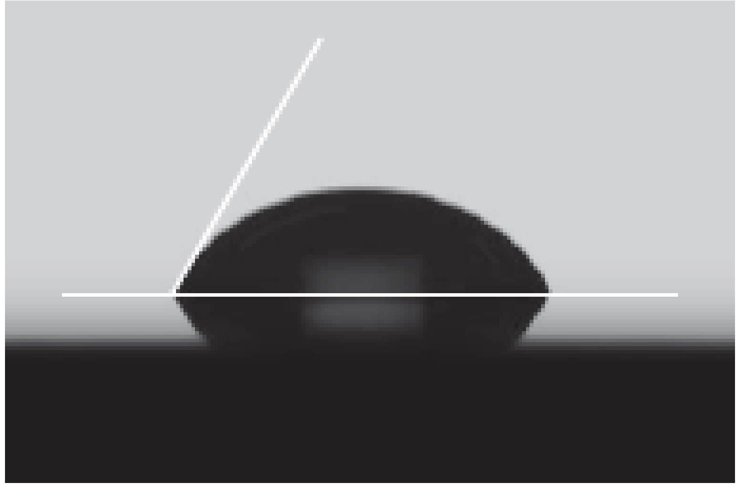
The material should have sufficient flow to record all fine details.

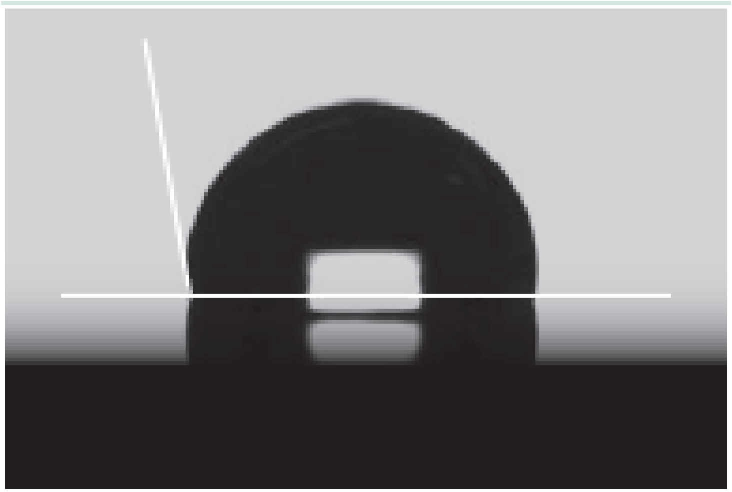
It should have sufficient viscosity to be contained in the tray.

Factors Affecting Accuracy of Impression Material

2. <u>Hydrophilicity:</u>

The material should be hydrophilic to wet the oral tissues easily.





Factors Affecting Accuracy of Impression Material

3. Dimensional accuracy:

The material should not show any dimensional changes during setting (neither expansion nor contraction).

Factors Affecting Accuracy of Impression Material

4. <u>Adhesion to the tray:</u>

The impression material should adhere to the tray during its removal from the patient's mouth.

Factors Affecting Accuracy of Impression Material

5. <u>Elasticity:</u>

The material should be elastic after setting to record the undercuts without distortion or fracture.

Factors Affecting Accuracy of Impression Material

6. <u>Dimensional stability:</u>

The material should not show any dimensional changes during its storage (the time between making the impression until pouring it at the dental laboratory).

Factors Affecting Accuracy of Impression Material

7. <u>Compatibility with model and die materials:</u>

The impression material should not react with the model and die material or affects its setting reaction.

Trays:

Types:

- <u>According to material:</u>
  - Metallic
  - Plastic

Trays:

Types:

- According to perforations:
  - Perforated

    Perforations provide mechanical interlocking with the impression for good adhesion to the tray
  - Non-Perforated:

    The impression sticks to the tray by itself or after adhesive application

Trays:

Types:

- According to perforations:

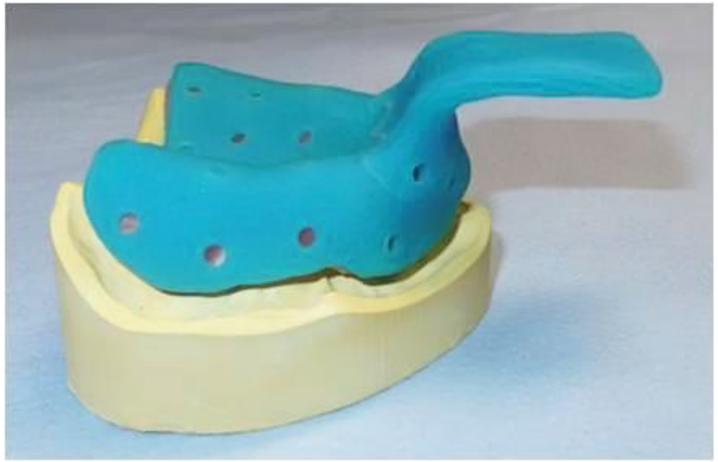
Trays:

Types:

- <u>According to Use:</u>
  - Stock tray

    Used for making primary impression
  - Special tray

    Used of making Secondary impression



Impressions:

	Primary Impression	Secondary Impression
Tray used	Stock tray	Special tray
Impression material accuracy	Low accurate	High accuracy
Cast obtained	Primary cast	Secondary cast

Impressions:

Wash Technique:

- It involves using of two impression materials over each other.
- The first material has high viscosity to fulfill the bulk of the stock tray, while the second one has high flow to record the fine details

Classification of Impression Materials:

1. **<u>According to setting mechanism:</u>**

a) Reversible:

They soften by heat and harden by cooling (physical reaction).

e.g.: impression compound and agar.

Classification of Impression Materials:

1. **According to setting mechanism:**

b) Irreversible:

They set by a chemical reaction.

e.g.: plaster impression material, zinc oxide-eugenol, alginate and elastomers.

Classification of Impression Materials:

2. **<u>According to behavior after setting:</u>**

a) <u>Non elastic (rigid) impression materials:</u>

When removed from undercut they fracture or deform.

They used for completely edentulous patients.

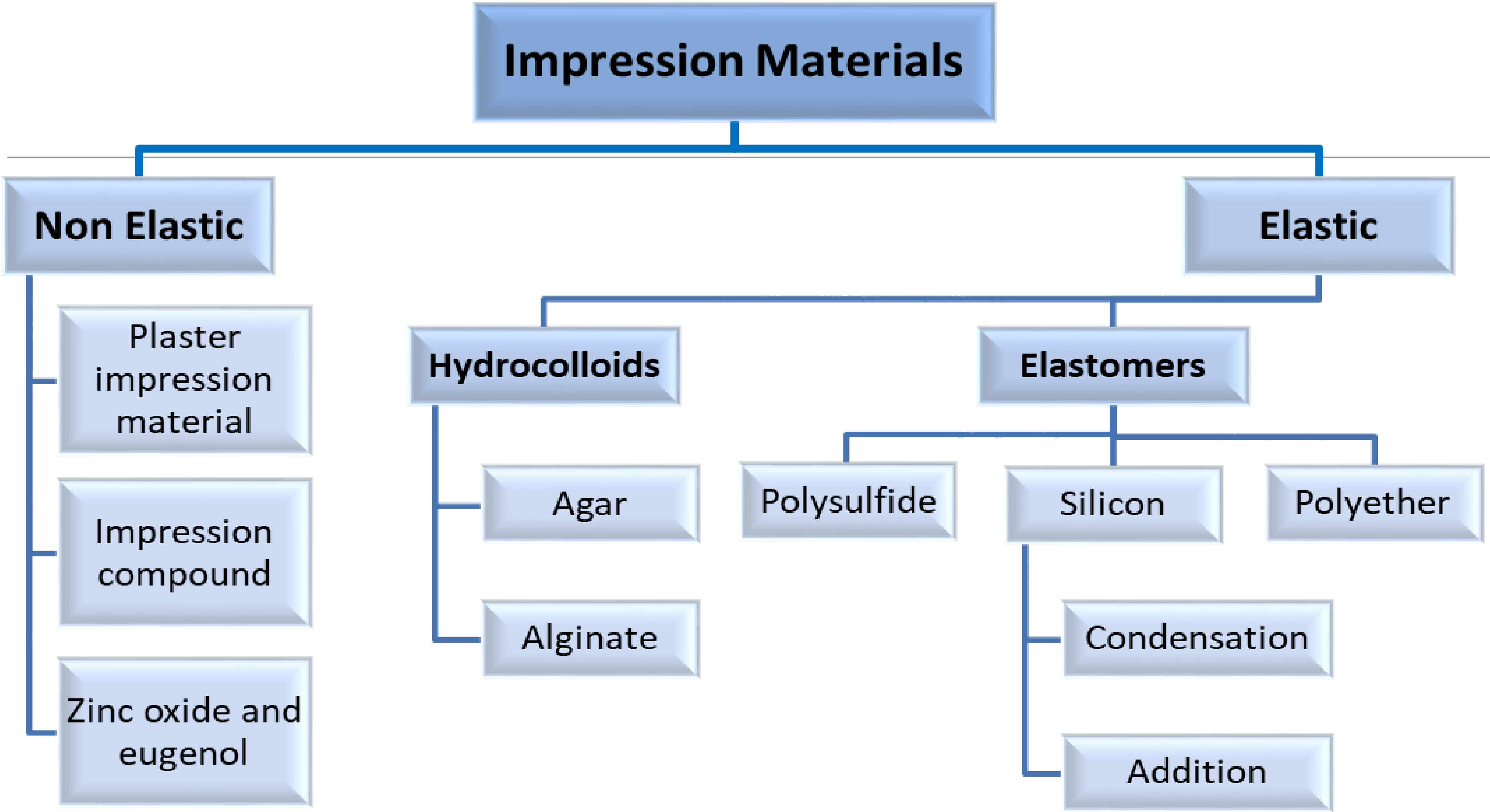
Classification of Impression Materials:

2. **<u>According to behavior after setting:</u>**

b) <u>Elastic impression materials:</u>

They recovered after removal from undercut.

They used for both dentulous and edentulous patients.


Impression Materials
Non Elastic
Plaster impression material
Impression compound
Zinc oxide and eugenol
Elastic
Hydrocolloids
Agar
Alginate
Elastomers
Polysulfide
Silicon
Condensation
Addition
Polyether

Non-elastic Impression Materials

PLASTER IMPRESSION MATERIAL

IMPRESSION COMPOUND

ZINC OXIDE AND EUGENOL

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Mode of supply	Powder + water	✓ Sheets and cakes. ✓ Sticks (green stick compound).	2 pastes of different colors

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Setting reaction	$CaSO_4.\ \frac{1}{2}\ H_2O + 1\frac{1}{2}\ H_2O$ → $CaSO_4.\ 2\ H_2O$ + Heat	Heat Hard ⟷ Soft Cool	▪ $ZnO + H_2O$ → ZnOH ▪ ZnOH + Eugenol → Zn eugenolate + H_2O
	Chemical Reaction	Physical Reaction	Chemical Reaction

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Flow	High flow	Low flow	Good flow

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Dimensional accuracy	Good It has little expansion during setting due to presence of anti-expansion additives.	Bad The material has high coefficient of thermal expansion, so it shows high contraction during cooling from softening temperature to mouth temperature.	Good It has very little shrinkage (0.1%) during setting.

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Elasticity	Rigid. It fractured if removed from undercut.	Rigid. It deformed if removed from undercut	Rigid. It deformed if removed from undercut

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Adhere to tray	Adhere to the tray	Adhere to tray	Adhere to the tray

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Dimensional stability	Good Small degree of contraction occurs due to dryness.	Bad ▪ It shrinks due to cooling from mouth temperature to room temperature. ▪ Distortion occurs due to release of internal stresses (developed due to kneading)	Good It should be stored at low temperature due to presence of thermoplastic resins that may cause distortion at high temperature.

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Compatibility with gypsum product	Not compatible It requires a separating medium which reduces the accuracy of the final cast	Compatible	Compatible After setting of cast, it is placed in a hot water path for easy separation of the impression

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Other properties	▪ It has an unpleasant consistency and taste to the patient. ▪ It may dehydrate the tissues due to heat evolution during setting.		

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Other properties		▪ It accepts addition and correction (If the impression is not satisfactory, it can be re-softened and re-inserted in the patient's mouth). ▪ It can be electroplated with copper	

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Other properties			▪ The eugenol is irritant to some patients (use eugenol-free formula). ▪ It adheres to the patient’s skin and lips (Coat the extra-oral tissues with Vaseline before impression making).

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Tray used	Non-perforated acrylic resin special tray.	Non-perforated stock tray.	Non-perforated acrylic resin special tray.

Non-elastic Impression Materials

	Plaster Impression	Impression Compound	Zinc oxide and Eugenol
Uses	Secondary impression for completely edentulous patients (historically)	<u>Sheets and cakes:</u> ▪ Primary impression of completely edentulous patients. ▪ Tray material for wash technique with zinc oxide-eugenol. <u>Stick:</u> ▪ Border molding (border tracing).	Secondary impression for completely edentulous patients (after border molding with green stick compound)

Non-elastic Impression Materials

- **<u>Manipulation:</u>**

1. Plaster impression:

   Like Gypsum products

Non-elastic Impression Materials

- **Manipulation:**

2. Impression compound:

Sheets and cakes:

- Heated in a water path (55 – 60 °C).
- Due to its lower thermal conductivity it should be immersed for sufficient time and kneaded.
- The material is kneaded outside the water to avoid water incorporation which acts as a plasticizer and increase the flow.

Non-elastic Impression Materials

- **Manipulation:**

2. Impression compound:

Sheets and cakes:

Non-elastic Impression Materials

- **<u>Manipulation:</u>**

2. Impression compound:

<u>The sticks:</u>

- They heated over a direct flame.
- Avoid overheating as it will cause volatilization of some ingredients which will affect its properties.

Non-elastic Impression Materials

- **<u>Manipulation:</u>**

3. Zinc oxide and eugenol:
   - Dispense equal lengths form both tubes on a glass slab or oil resistance pad.
   - Mix using stainless steel spatula until homogenous color is obtained.

Non-elastic Impression Materials

- **Manipulation:**

3. Zinc oxide and eugenol:

Non-elastic Impression Materials

- **<u>Manipulation:</u>**

3. Zinc oxide and eugenol:
   - Reaction is accelerated by:
     1. Heat
     2. Humidity.
     3. Primary alcohols as Ethyl alcohol.

Elastic Impression Materials

HYDROCOLLOIDS

ELASTOMERS

Mixtures

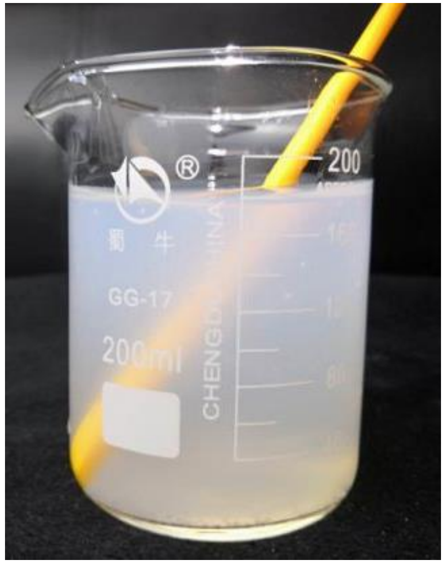
Mixtures

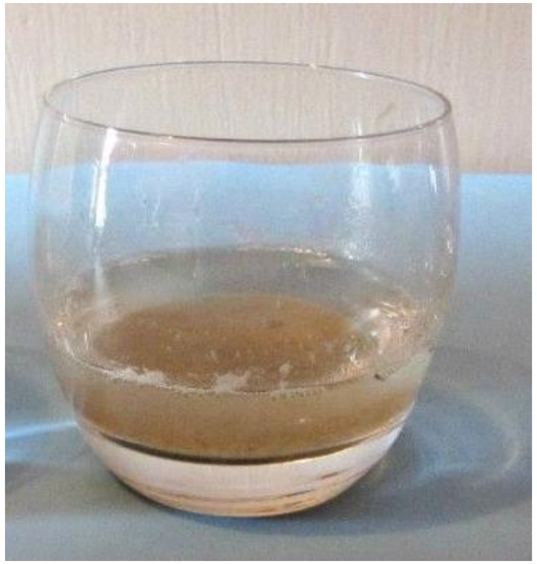
- True Solutions
- Colloids
- suspensions

Mixtures

True solutions	Colloids	Suspensions
Homogeneous mixture.	Heterogeneous solution	Heterogeneous mixture.
Dispersed phase particle size less than 10^{-7} cm.	Dispersed phase particle size from 10^{-7} to 10^{-5} cm.	Dispersed phase particle size more than 10^{-5} cm.
Solute particles cannot be seen by naked eye.		Solute particles can be seen by naked eye.
Solute particles cannot be filtered.		Solute particles can be filtered.
e.g.: Sugar in water		e.g.: Sand in water

Mixtures





Mixtures

Colloids

- Dispersed phase particles are held together by primary or secondary bonds.
- If the dispersion medium is water, it is called hydrocolloids.
- They are either sol or gel

Mixtures

Colloids

Colloids

Sol

It is a viscous liquid state.

The dispersed phase is soluble in the dispersion medium.

The impression material is inserted into patient’s mouth in this state.

By agglomeration of the dispersed phase

Either by **physical** or **chemical** reaction

Gel

It is a semi-solid state.

The dispersed phase form fibrils or chains in a network structure (brush heap structure).

The impression is removed from the patient’s mouth after reaching this state.

General properties of hydrocolloids

1. **<u>Gel strength:</u>**
   - It depends on:
     1. Concentration of the fibrils: ↑ fibrils → ↑ gel strength.
     2. Concentration of fillers. ↑ fillers → ↑ gel strength.
     3. Temperature (in revisable hydrocolloids): ↓ temperature → ↑ gel strength

General properties of hydrocolloids

2. **Tear strength:**
   - Hydrocolloids tear strength is relatively lower than elastomers.
   - To increase tear strength of hydrocolloids:
     1. Its thickness should not be less than 4 mm (4-6mm).
     2. After setting, the impression should be removed rapidly with sharp snap movement.

General properties of hydrocolloids

3. **<u>Elastic recovery:</u>**

   - Hydrocolloids are viscoelastic material (strain-rate sensitive).
   - To decrease the permanent deformation results from impression removing from the undercuts, the impression should be removed rapidly with sharp snap movement in direction parallel to long axis of the teeth.

- Elastic impression materials are removed from patient's mouth with sharp snap movement to:

1. Increase tear strength.
2. Decrease permanent deformation.

General properties of hydrocolloids

4. **Dimension stability:**
   - Hydrocolloids are dimensionally unstable due to:
     a) Synersis and imbibition.
     b) Thermal changes.

General properties of hydrocolloids

4. **<u>Dimension stability:</u>**
   a) Synersis and imbibition:
      - In the gel state of hydrocolloids, the fibrils entangle to form a network and the water is entrapped within this network.
      - The gel state can lose or uptake water.

General properties of hydrocolloids

4. **Dimension stability:**
    a) Synersis and imbibition:

General properties of hydrocolloids

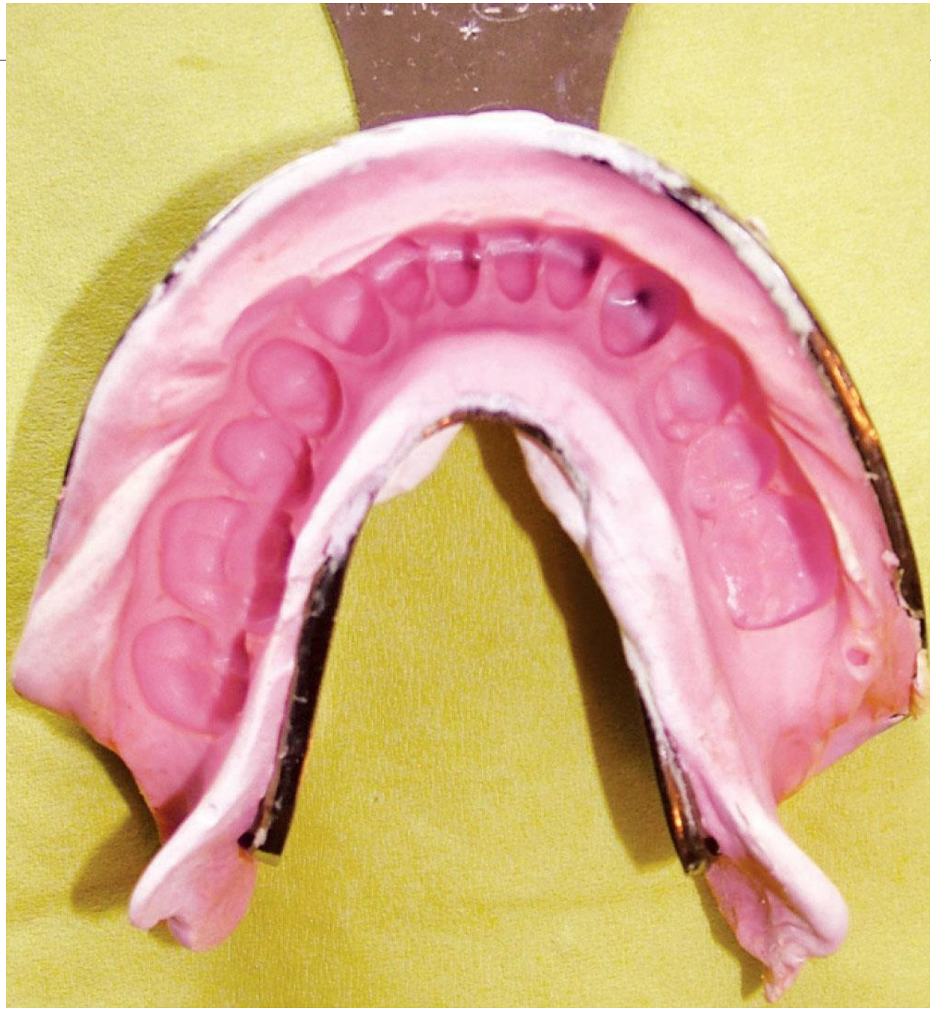
4. **Dimension stability:**

   a) Synersis and imbibition:

      - Synersis:

        It is the loss of the water. This occurs if the impression is left in the air. This results in shrinkage of the impression.

General properties of hydrocolloids



General properties of hydrocolloids

4. **Dimension stability:**
    a) Synersis and imbibition:
        - Imbibition:

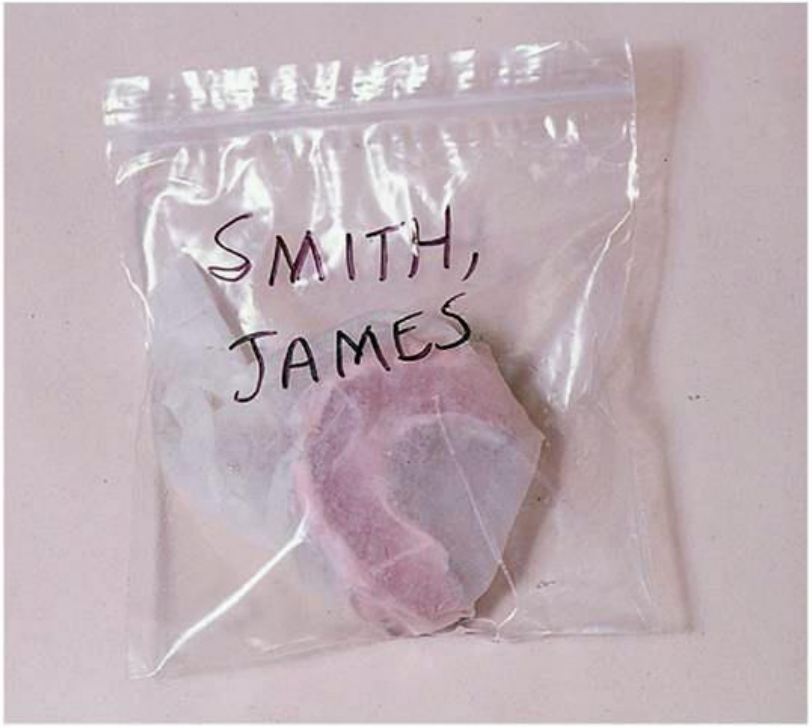
          It is the uptake of the water. This occurs if the impression is immersed in water. This results in expansion of the impression.

General properties of hydrocolloids

4. **Dimension stability:**
   a) Synersis and imbibition:
      - Imbibition:

General properties of hydrocolloids

4. **Dimension stability:**
   a) Synersis and imbibition:
      - To avoid synersis and imbibition, the hydrocolloids impression should be stored in 100% relative humidity or stored in 2% potassium sulfate solution.



General properties of hydrocolloids

4. **<u>Dimension stability:</u>**

   b) Thermal changes:

   - In alginate impression, slight contraction occurs due to transfer of the impression from the mouth (37 °C) to room temperature (23 °C).
   - In agar impression, slight expansion occurs due to the difference in temperature of the water cooled tray (15 °C) to room temperature (23 °C).

General properties of hydrocolloids

4. **<u>Dimension stability:</u>**
   - Hydrocolloids should be poured within short time.

General properties of hydrocolloids

5. **Disinfection:**
   - The disinfection process should be rapid (due to poor dimensional stability)
   - The disinfectant should be sprayed (to avoid imbibition if the impression is immersed into disinfection solution).
   - The most commonly used disinfectants are iodophor, 2% glutaraldehyde and 1% sodium hypochlorite.

General properties of hydrocolloids

6. **<u>Compatibility with gypsum:</u>**

   - Hydrocolloids are not compatible with gypsum. The surface of the cast may be soft due to:

     a) Presence of water at the surface of hydrocolloid impression which may affect the setting of gypsum.

     b) Constituents of the hydrocolloids (as borax) may retard the setting reaction of the gypsum.

General properties of hydrocolloids

6. **<u>Compatibility with gypsum:</u>**
   - This limitation can be counteracted by:
     a) Immersion of the impression into gypsum accelerator (2% potassium sulfate).
     b) Addition of gypsum accelerator to the hydrocolloid material during manufacturing.

General properties of hydrocolloids

7. **<u>Electroplating:</u>**

   - They cannot be electroplated due to their tendency for imbibition

General properties of hydrocolloids

8. **Hydrocolloids are non-toxic and non-irritant**

Hydrocolloids

	Reversible hydrocolloid Agar impression material	Irreversible hydrocolloid Alginate impression material
	It is the first elastic impression material introduced in dentistry.	It was developed as a substitute for agar during World War II as agar supply decreased during the war.
Nature	It is a polysaccharides extracted from seaweeds	It is a natural material extracted from a marine plant.

Hydrocolloids

	Reversible hydrocolloid Agar impression material	Irreversible hydrocolloid Alginate impression material
Mode of supply	Gel suppled in tubes and syringes.	Powder + Water

Hydrocolloids

	Agar impression material	Alginate impression material
Composition	▪ **Agar:** 12.5%: as dispersed phase. ▪ **Borax:** strengthening agent and increase viscosity. It retards setting reaction of gypsum. ▪ **Potassium sulfate:** accelerate gypsum setting (counteract the inhibitory effect of agar and borax). ▪ **Water**: 85% as dispersion medium. ▪ **Fillers**: control strength and viscosity.	

Hydrocolloids

	Agar impression material	Alginate impression material
Composition		• **Soluble salt of alginic acid**: (sodium or potassium alginate) 12%. • **Calcium sulfate**: 12% • **Tri-sodium phosphate** retarder. • **Fillers**: 70%. • **Fluoride:** to improve surface hardness of gypsum cast. • **Flavoring agent:** to give good taste to the patient. • **Chemical indicators:** to indicate working and setting time.

Hydrocolloids

	Agar impression material	Alginate impression material
Setting reaction	Physical reaction (reversible reaction) Cooling 43°C Sol ⟷ Gel Heating 100°C The great difference between liquefaction and gelation temperature is called **hysteresis**.	

Hydrocolloids

	Agar impression material	Alginate impression material
Setting reaction		• Chemical **reaction (irreversible reaction)** • **The alginate** is set by formation of the insoluble salts alginic acid (calcium alginate).

Hydrocolloids

	Agar impression material	Alginate impression material
Setting reaction		**Setting reaction:** Potassium alginate + calcium sulfate → calcium alginate + potassium sulfate. ▪ Because of the setting reaction is too fast; retarder (tri-sodium phosphate) is added to increase working time.

Hydrocolloids

	Agar impression material	Alginate impression material
Setting reaction		▪ Calcium sulfate prefers reacting with tri-sodium phosphate more than potassium alginate. ▪ So, formation of insoluble salts (setting reaction) will not start until finishing all tri-sodium phosphate molecules. **Retardation reaction:** Tri-sodium phosphate + calcium sulfate $\longrightarrow$ Sodium sulfate + calcium phosphate

Hydrocolloids

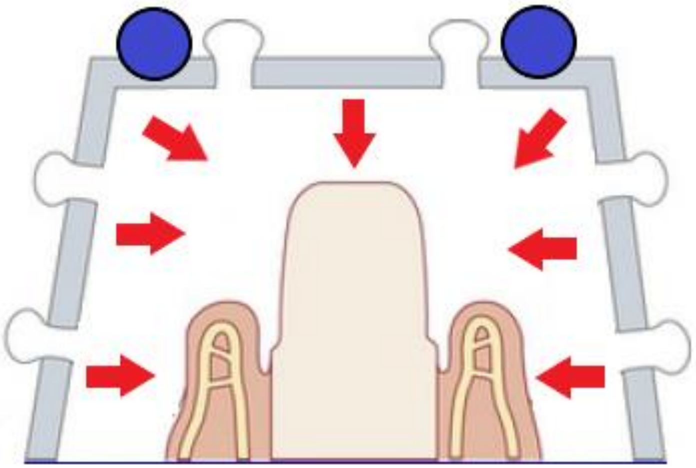
	Agar impression material	Alginate impression material
Flow	Good flow	Good flow but less than agar.

Hydrocolloids

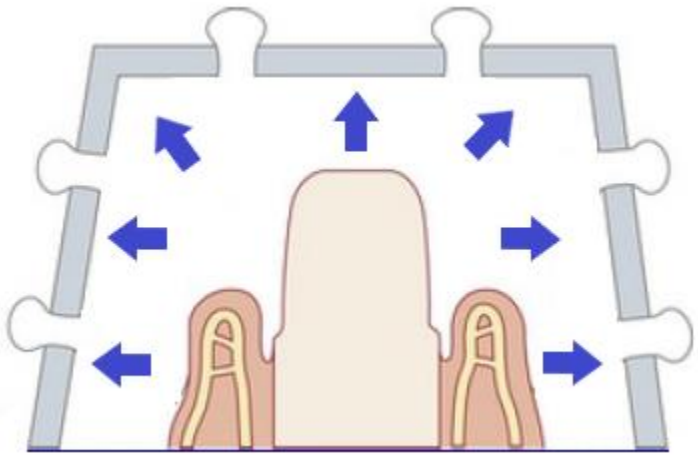
	Agar impression material	Alginate impression material
Dimensional accuracy	Good dimensional accuracy. ▪ The setting starts from tray to tissues (as the tray is cooler). ▪ So, the impression contacting the tissue stays liquid for longest time and can flow to compensate any changes occurs during setting.	Bad dimensional accuracy. ▪ The setting starts from tissue to tray (as the tissues is hotter than tray and setting reaction is chemical reaction accelerated by heat). ▪ So, any changes occur during setting will affect the accuracy of the impression. ▪ The tray should not move during setting to minimize distortion.

Hydrocolloids

Agar



Alginate



Hydrocolloids

	Agar impression material	Alginate impression material
elasticity	Viscoelastic material. (discussed before)	
	Elastic recovery 98.8%	Elastic recovery 97.3%

Hydrocolloids

	Agar impression material	Alginate impression material
Flexibility	High flexibility	The **most flexible** impression material

Hydrocolloids

	Agar impression material	Alginate impression material
Adhere to the tray	Do not adhere to the tray. They require perforated trays for mechanical interlocking. Some manufacture provides adhesives.	

Hydrocolloids

	Agar impression material	Alginate impression material
Dimensional stability	Bad dimensional stability (discussed before)	

Hydrocolloids

	Agar impression material	Alginate impression material
Compatibility with gypsum products	Not compatible but this problem can be solved (discussed before).	

Hydrocolloids

	Agar impression material	Alginate impression material
Tray required	Specially designed water cooled perforated tray	Perforated stock tray

Hydrocolloids

	Agar impression material	Alginate impression material
Cost	Requires expensive equipment	Cheap

Hydrocolloids

	Agar impression material	Alginate impression material
Uses	1. Duplicating material (for duplicating the casts at the laboratory) 2. Making secondary impressions. (This use became very limited after introduction of elastomeric impression materials).	1. Making primary impressions for dentulous and edentulous patients. 2. Making impressions for orthodontic appliances. 3. Making impressions for dental appliances such as mouth guard, occlusal splints, …. 4. Making impressions for opposing casts in indirect restorations.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation	**It requires:** 1. Hydrocolloid conditioner. 2. Water-cooled tray. 3. Running water supply.	

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation	1. <u>Hydrocolloid conditioner.</u> It has three compartments: a) **Liquefaction:** at 100°C. The tubes and syringes are heated for 10 minutes (gel → sol). b) **Storage**: the sol agar can be stored for several hours at 65°C. c) **Tempering**: The sol agar is loaded at the tray and tempered at 46 °C for 2 minutes just before inserting into patient's mouth.	

Hydrocolloids

Hydrocolloids

	Agar impression material
Manipulation	2. <u>Water-cooled tray.</u> It is a specially designed tray. It has channels for circulation of cold water (sol → gel).

Hydrocolloids

	Agar impression material
Manipulation	3. <u>Running water supply.</u> It supplies the tray with cold water (20°C). The water temperature should not be less than 13 °C to avoid developing of thermal stresses.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The tray should provide 4mm thickness for alginate. ➢ Shake the alginate powder container before use to provide an even distribution of the constituents. ➢ Water-powder ratio (W/P) adjuster as manufacturer instructions. Manufacturer usually provides a measuring tools.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ Use rubber bowl and wide rigid spatula. ➢ The water is added in the bowl then the powder. ➢ Mixing starts with a stirring mixing to wet the powder followed by a rapid and vigorous mixing with squeezing the mix against the sides of the bowl until a creamy mix is obtained.

Hydrocolloids

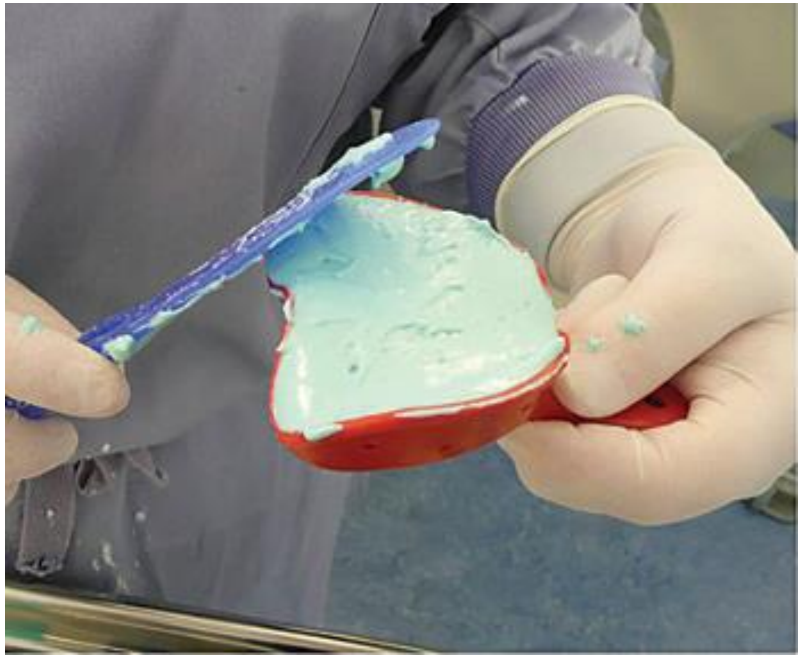
Hydrocolloids

Hydrocolloids

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The tray is loaded with alginate mix using the tip of the spatula. The mix should be pressed against the tray to release any trapped air.

Hydrocolloids



Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The alginate surface should be smoothed with moistened fingertip to prevent formation of air bubbles.

Hydrocolloids

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The tray is inserted into patient's mouth. During gelation, it should not be moved or subjected to excessive pressure to avoid development of stresses that will released after removal of the tray and cause distortion.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The impression is removed from the patient’s mouth 2-3 minutes after loss of tackiness to insure that the material reached sufficient strength.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The impression should be removed by sharp snap motion in direction parallel to long axis of the teeth. ➢ The impression is rinsed and disinfected.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The impression should be poured with gypsum as soon as possible but if not, it should be stored in 100% relative humidity (wrapped with a moist towel and placed inside a sealed plastic bag.

Hydrocolloids

	Agar impression material	Alginate impression material
Manipulation		➢ The impression should be removed from the cast after 30-60 minutes from pouring as the gypsum may absorb water from the impression leading to a chalky surface.

Hydrocolloids

	Agar impression material	Alginate impression material
Notes		**<u>The setting time of alginate can be managed by:</u>** 1. Water temperature (18 - 24°C). 2. Water/powder ratio 3. Concentration of tri-sodium phosphate (retarder)

Hydrocolloids

	Agar impression material	Alginate impression material
Notes		**<u>The setting time of alginate can be managed by:</u>** 1. Water temperature (18 - 24°C). ▪ Increase water temperature will accelerate the reaction. ▪ This can be recommended way

Hydrocolloids

	Agar impression material	Alginate impression material
Notes		**<u>The setting time of alginate can be managed by:</u>** 2. Water/powder ratio: ▪ Increase water will retard the setting reaction. ▪ This is **not recommended** as it will adversely affect the properties of the material.

Hydrocolloids

	Agar impression material	Alginate impression material
Notes		**<u>The setting time of alginate can be managed by:</u>** 3. Concentration of tri-sodium phosphate (retarder): ▪ Manufactures can control the setting time by controlling the percentage of tri-sodium phosphate. ▪ They supply alginate in the form of regular set and fast set. ▪ It is the **best way** to control setting time.

Hydrocolloids

	Agar impression material	Alginate impression material
Notes		Alginate powder should be stored under cool and dry conditions

Elastic Impression Materials

~~HYDROCOLLOIDS~~

ELASTOMERS

Elastomeric impression materials

- They are a variety of rubber-like impression materials that have several names as:
  - ✓ Non-aqueous elastomeric impression materials.
  - ✓ Rubber base materials.
  - ✓ Elastomers.

Elastomeric impression materials

- They set by a polymerization reaction.
- They are formed of long, highly coiled chains that can be highly stretched to produce wide range of elastic deformation (elastomers).

Elastomeric impression materials

- They supplied in different consistencies; light, medium, heavy and putty consistencies.
- The consistencies differ in fillers amount and molecular weight of the polymer.

Elastomeric impression materials

- They supplied in two containers; base and catalyst with two different colors.
- They have higher dimensional accuracy and stability than hydrocolloids.
- Elastomers are more expensive than alginate.

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Consistencies	Light, medium and heavy	Light, medium, heavy and putty		Light, medium and heavy

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Composition (Base)	• Low molecular weight polysulfide polymer with reactive mercaptan (SH) group. • Fillers. • Plasticizers. • Sulfur (accelerator).	• Low molecular weight polydimethyl silozane polymer with terminal (OH) group. • Fillers.	• Low molecular weight polysiloxane polymers. • Fillers.	• Low molecular weight polyether polymer with ethylene-imine group ($-N-(CH_2)_2$) • Fillers.

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Composition (Catalyst)	• Lead dioxide (to start reaction) • Fillers. • Plasticizers. • Stearic acid (retarder)	• Tetra-ethyl orthosilicate (for cross linking). • Tin octoate (catalyst). • Diluent.	• Low molecular weight divinylpolysiloxane with vinyl terminal group ($-CH=CH_2$). • Chloroplatinic acid (catalyst). • Fillers.	• Aromatic sulfonic acid ester. • Fillers.

Elastomeric impression materials

Reactor is a more accurate term than catalyst.

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Setting reaction	Condensation polymerization reaction	Condensation polymerization reaction	Addition polymerization reaction	Addition polymerization reaction

Elastomeric impression materials

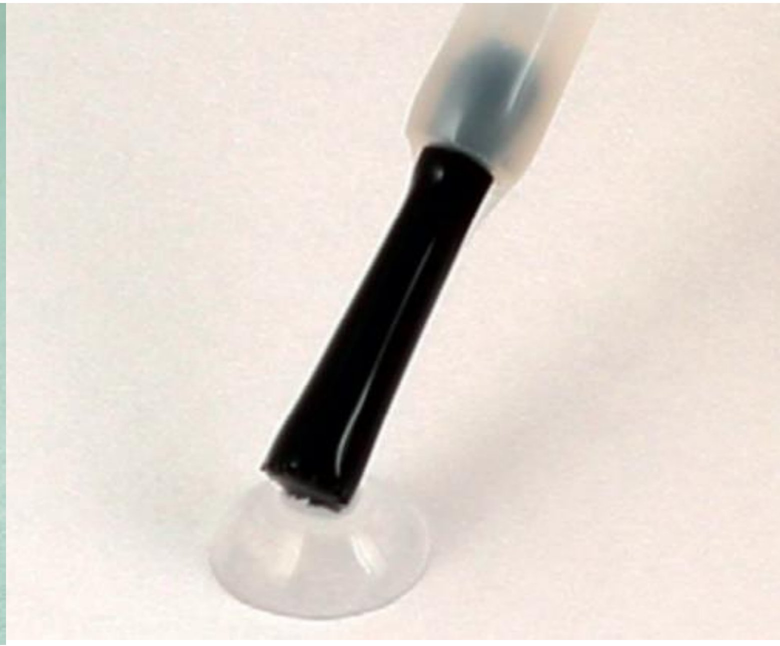
	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Byproducts	Water	Ethyl alcohol	--	--

Manipulation

- A special acrylic tray is constructed to allow a thickness of 2-3 mm for the impression material
- Increasing thickness of impression material leads to more polymerization shrinkage and less dimensional accuracy.

Manipulation

- The tray is painted with adhesive as the impression material doesn't adhere to the tray.



Manipulation

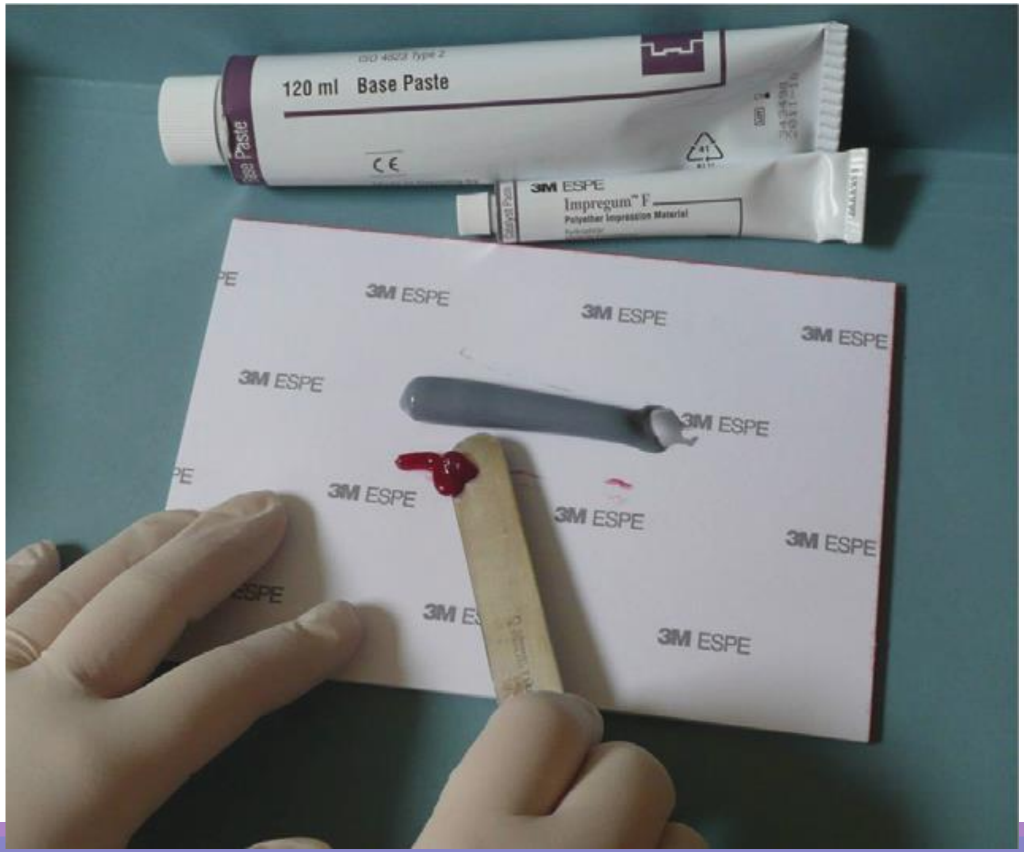
Mixing techniques:

1. Hand mixing for pastes:

- Use tapered stiff spatula over a disposable oil-resistant paper.
- Equal lengths of the paste & catalyst are extruded over the mixing pad.
- Spread the material in a thin layer to release trapped air.
- Mix until obtain homogenous color.

Manipulation

Mixing techniques:



Manipulation

Mixing techniques:

Manipulation

Mixing techniques:

2. Hand mixing for putty consistencies (kneading):
   - Wear over-gloves in case of addition silicon.
   - The condensation silicon is supplied as a putty base and catalyst paste.
   - The addition silicon is supplied as two putties.

Manipulation

Mixing techniques:

2. Hand mixing for putty consistencies (kneading):
    - Recommended ratio for condensation type or equal scopes for addition type are dispensed and kneaded by using fingertips until homogenous mixing is achieved.

Manipulation

Mixing techniques:

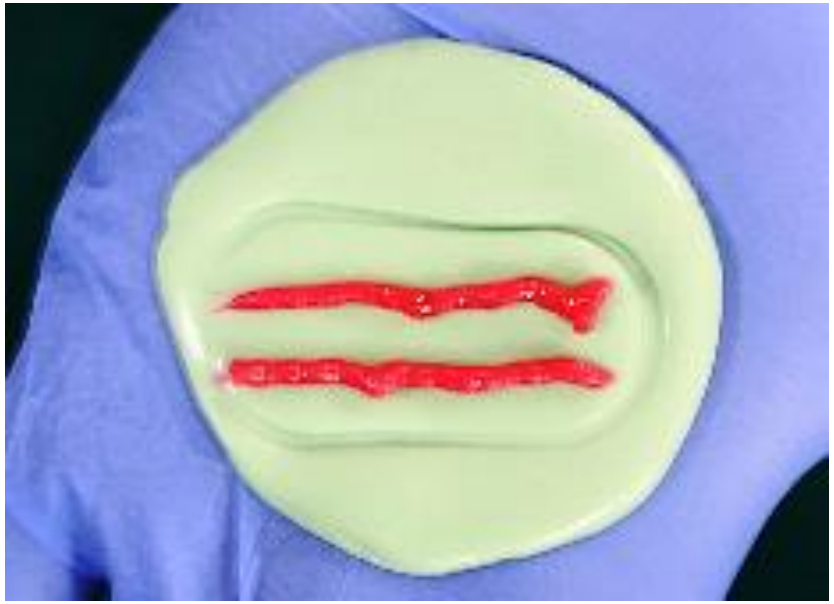
2. Hand mixing for putty consistencies (kneading):

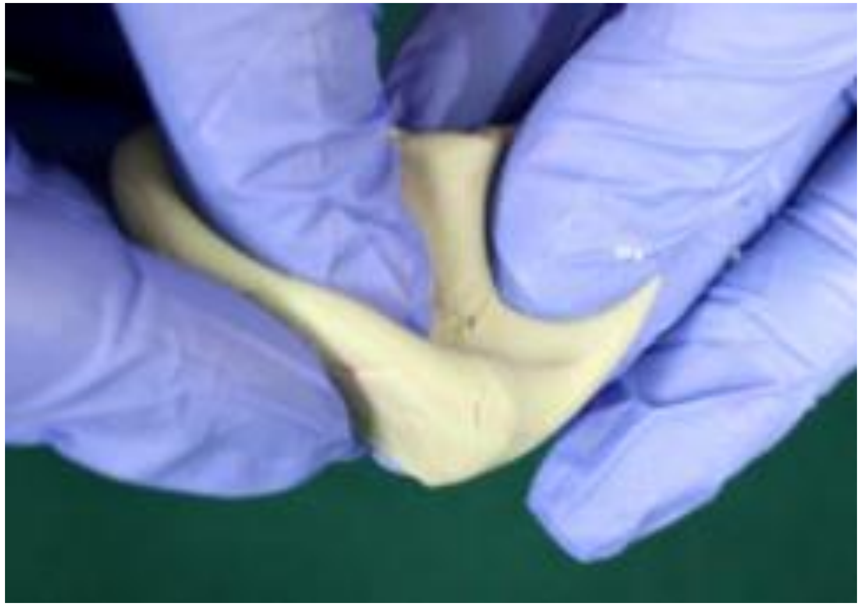
   - Kneading is done using fingertips rather than the palm of the hand because the hand temperature may accelerate the setting reaction.

Manipulation

Mixing techniques:

2. Hand mixing for putty consistencies (kneading):





Manipulation

<u>Mixing techniques:</u>

2. <u>Hand mixing for putty consistencies (kneading):</u>

Manipulation

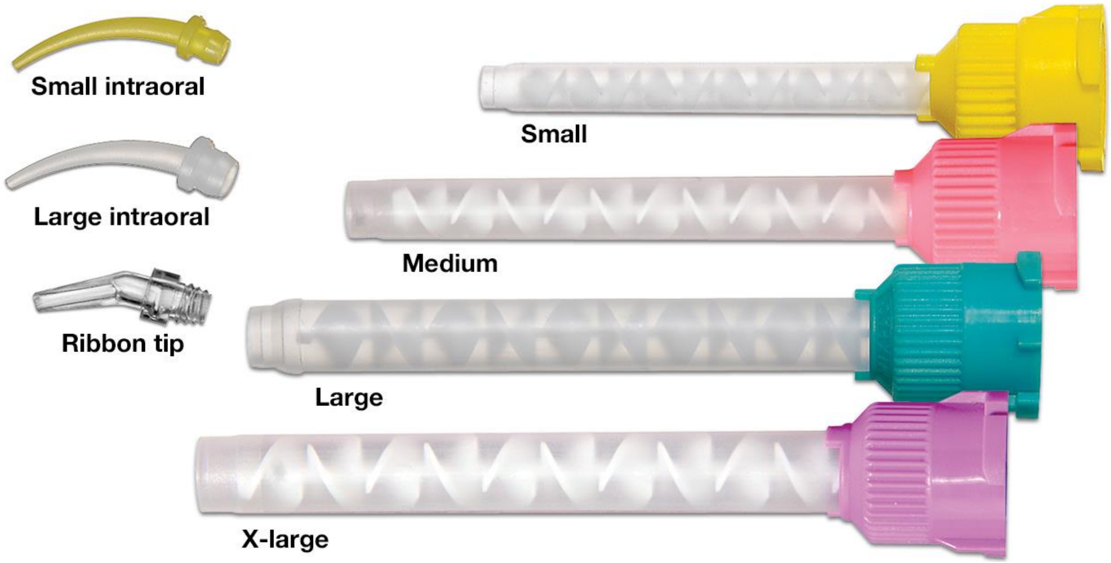
Mixing techniques:

3. Static Mixing:
   - This system consists of mixing gun, impression cartridge and mixing tip.
   - The cartridge composed of two cylinders containing base and catalyst separately.

Manipulation

Mixing techniques:

3. Static Mixing:



Manipulation

Mixing techniques:

3. Static Mixing:

Manipulation

<u>Mixing techniques:</u>

3. <u>Static Mixing:</u>

   - ➢ The cartridge is loaded in mixing gun. Then the mixing tip is attached to the cartridge.
   - ➢ The mixing gun compress the impression material from the cartridge into the mixing tip to be mixed before its extrusion.

Manipulation

Mixing techniques:

4. Dynamic Mixing:

   - The impression material is supplied in a cartridge.
   - The cartridge is loaded inside a motor driven mechanical mixing machine and a mixing tip is placed on the front of the machine.

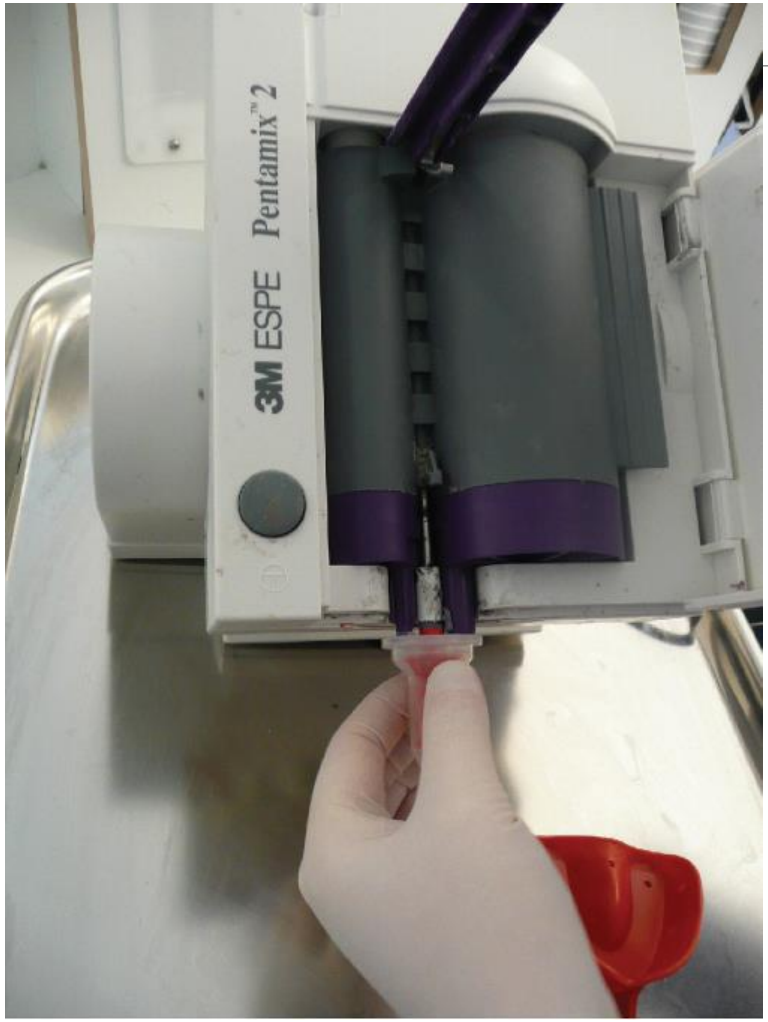
Manipulation

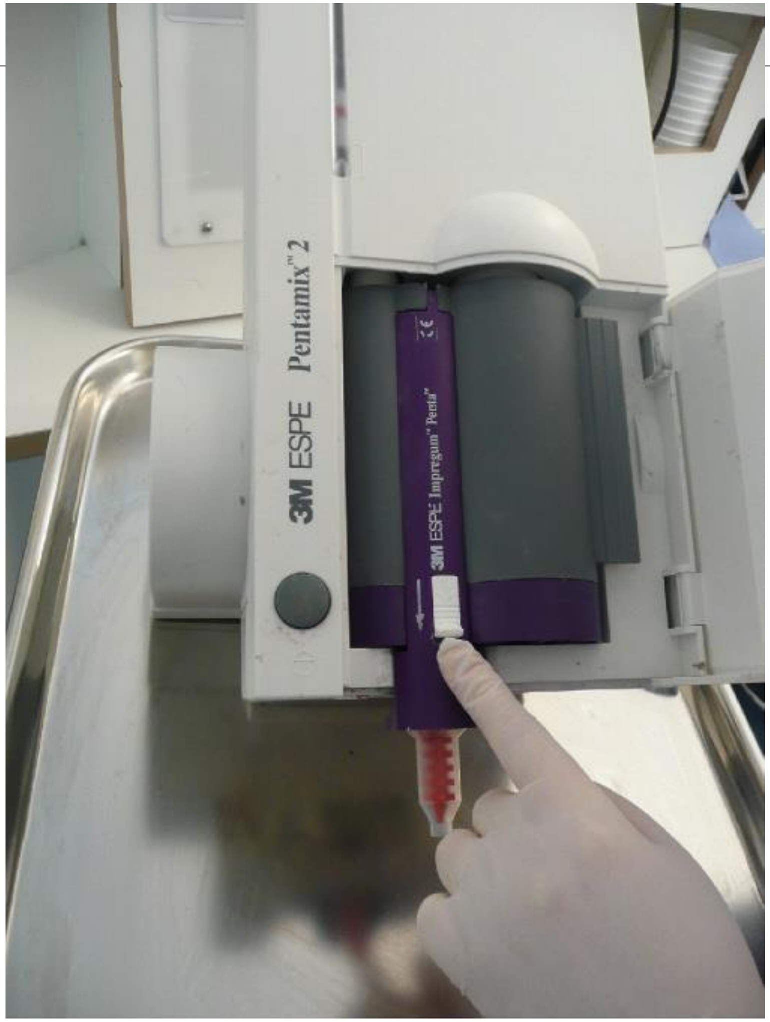
Mixing techniques:

4. Dynamic Mixing:

   ➢ By pressing a button, the material is mixed and extruded through the mixing tip.

Manipulation





Manipulation

Impression techniques:

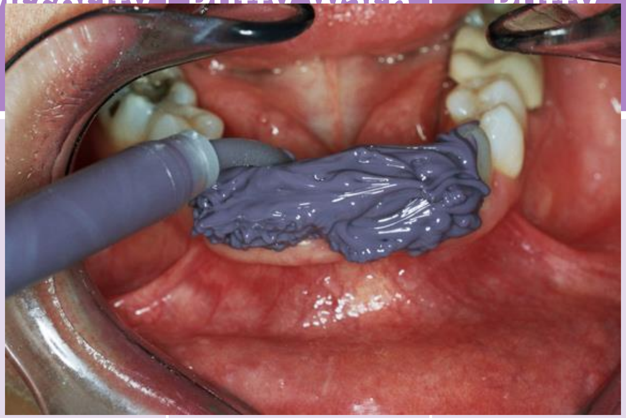
1. One stage single viscosity (monophase):
2. One stage dual viscosity
3. Two stages: Putty-wash
4. One stage: Putty-wash

Manipulation

	One stage single viscosity (monophase)	One stage dual viscosity	Two stages Putty-wash	One stage Putty-wash
Tray	Special tray	Special tray	Perforated stock tray	Perforated stock tray
Viscosity	Medium only	Heavy + light	Putty + light	Putty + light

Manipulation

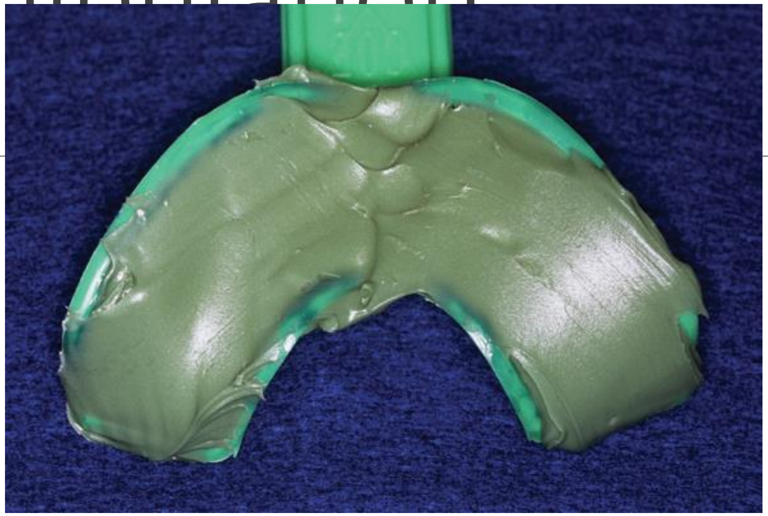
	One stage single viscosity (monophase)	One dual v	Putty-wash	Putty ...e
Method	• The material is mixed. • Part is loaded inside the tray and part is loaded inside a syringe. • The syringe material is injected around the prepared teeth. • The loaded tray is seated inside patient's mouth.			

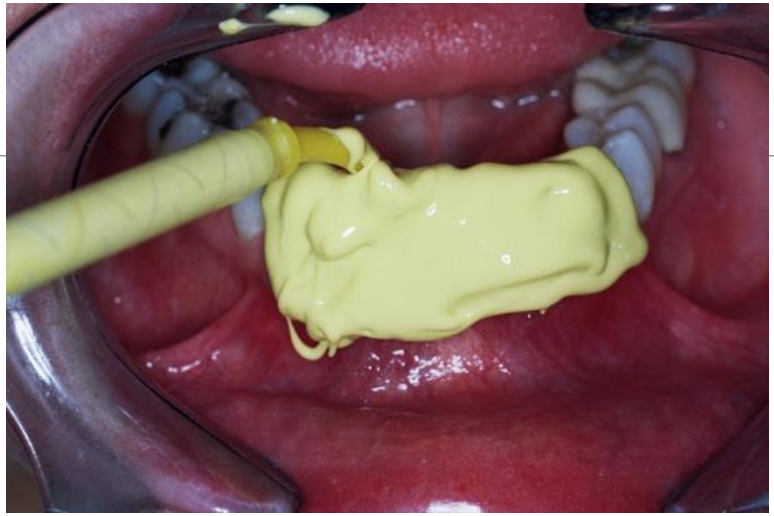


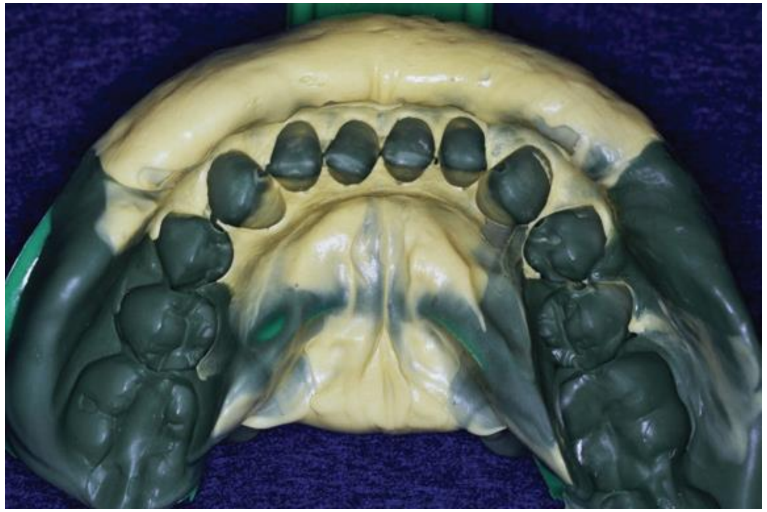
Manipulation

	One stage single viscosity (monophase)	One stage dual viscosity	Two stages Putty-wash	One stage Putty-wash
Method		• The heavy and light consistencies are mixed at the same time by two operators on separate paper pads. • The heavy consistency is loaded inside the tray. • The light consistency is injected with syringe around the prepared teeth • The two consistencies are set at the same time.		

Manipulation



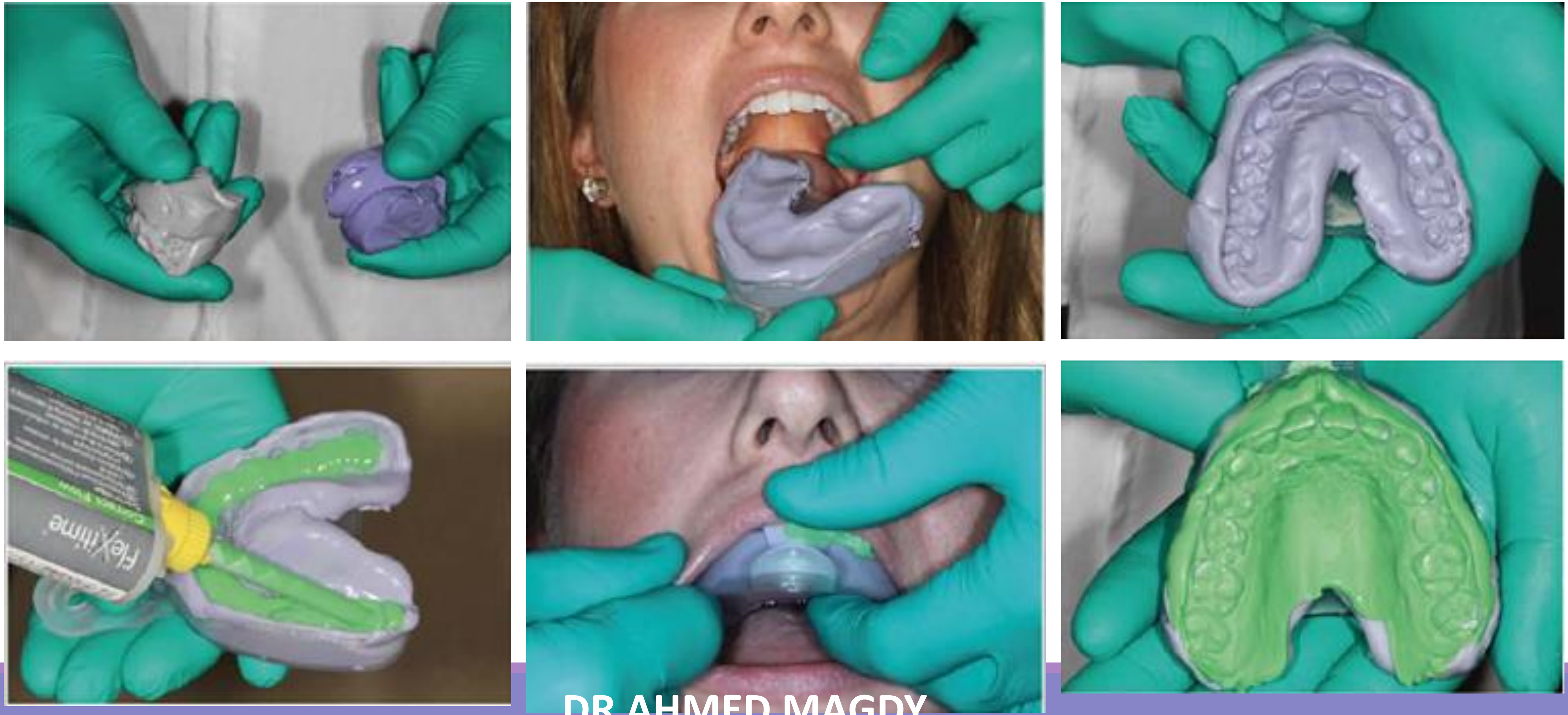




Manipulation

	One stage single viscosity (monophase)	One stage dual viscosity	Two stages Putty-wash	One stage Putty-wash
Method			• The putty is mixed and loaded inside the tray then preliminary impression is taken. • The light consistency is mixed then injected around the prepared teeth and loaded over the putty impression. Then the tray is repositioned inside patient's mouth.	

Manipulation



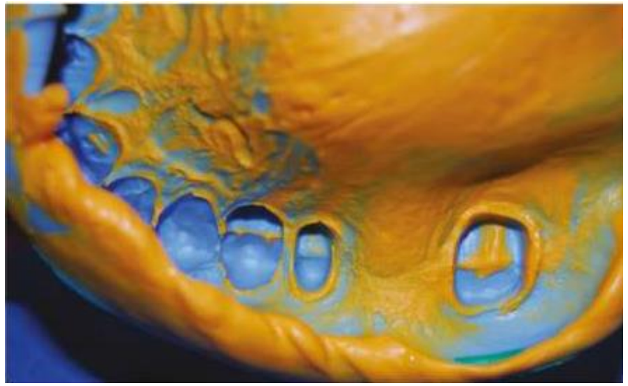
Manipulation

	One stage single viscosity (monophase)	One stage dual viscosity	Two stages Putty-wash	One stage Putty-wash
Method				• The putty and light consistencies are mixed at the same time by two operators. • The putty is loaded around the tray. • The light is injected around the prepared teeth. • The tray loaded with the putty is inserted inside patient's mouth over the light injected over prepared teeth.

Manipulation

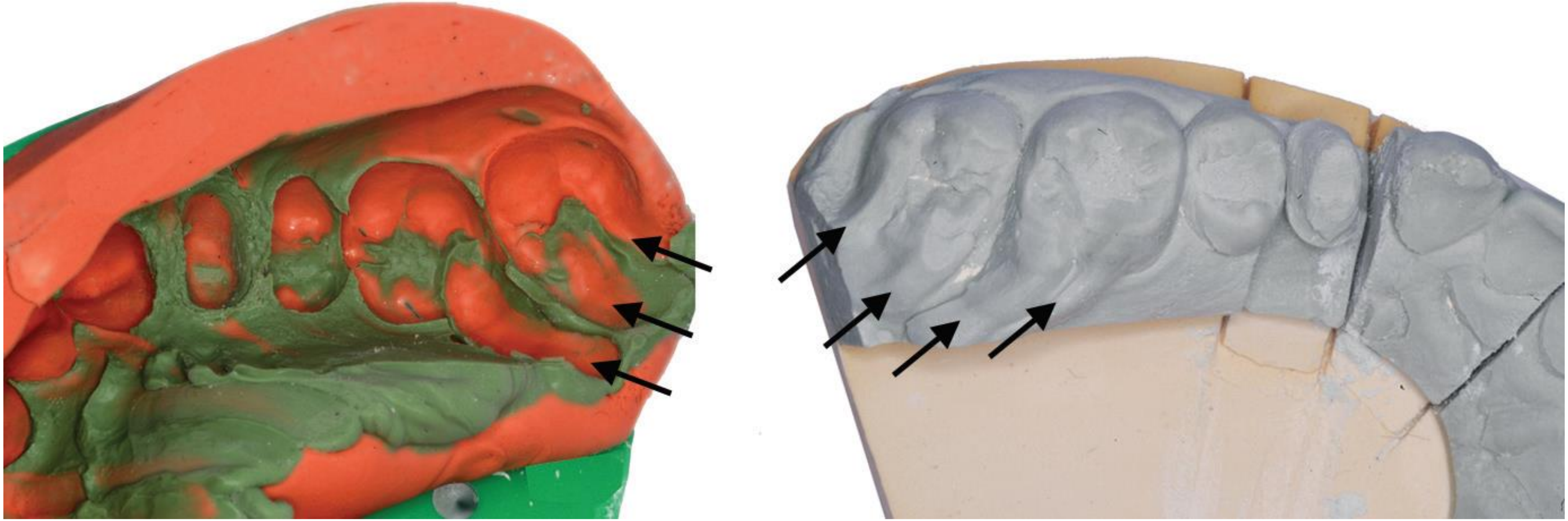






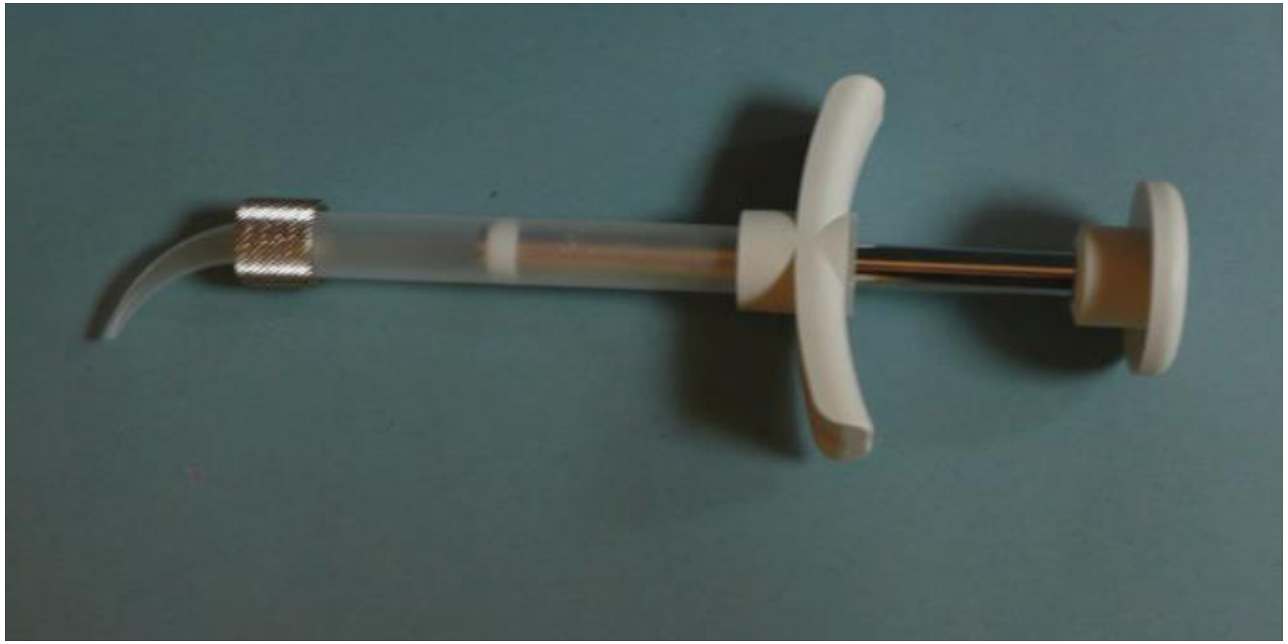
Manipulation

Seating trails



Manipulation

Syringe loading for intraoral application



Manipulation

Syringe loading for intraoral application

Manipulation

Syringe loading for intraoral application

Manipulation

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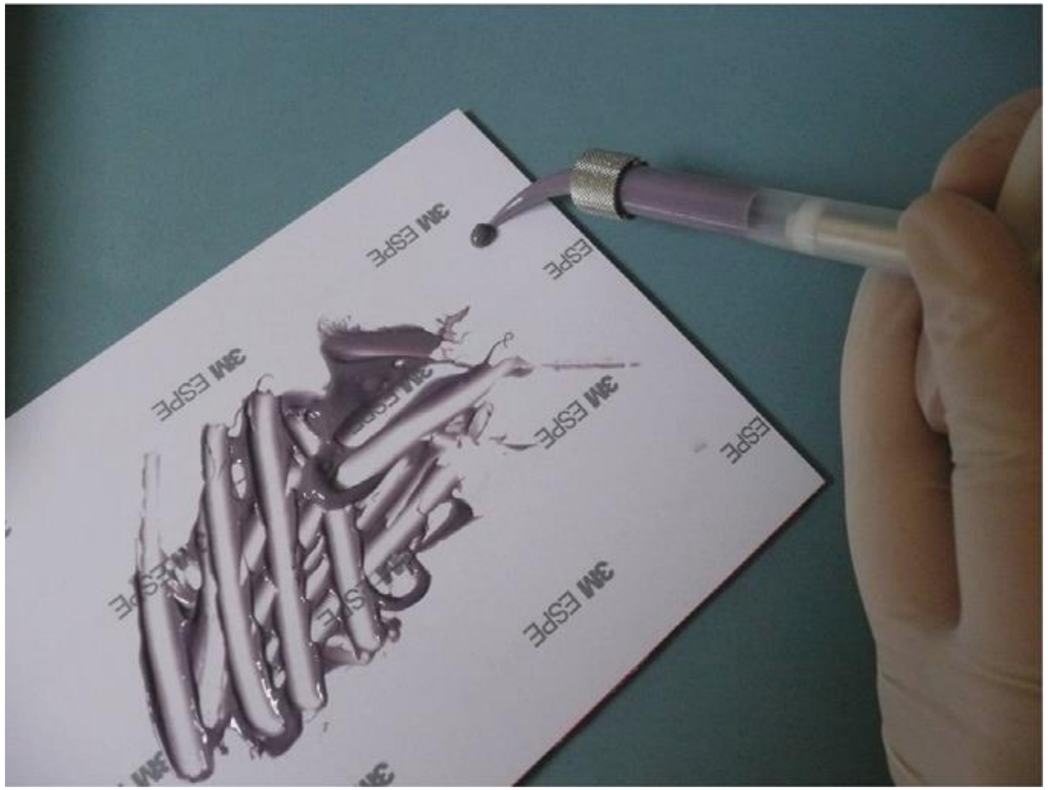
Manipulation

Syringe loading for intraoral application



Manipulation

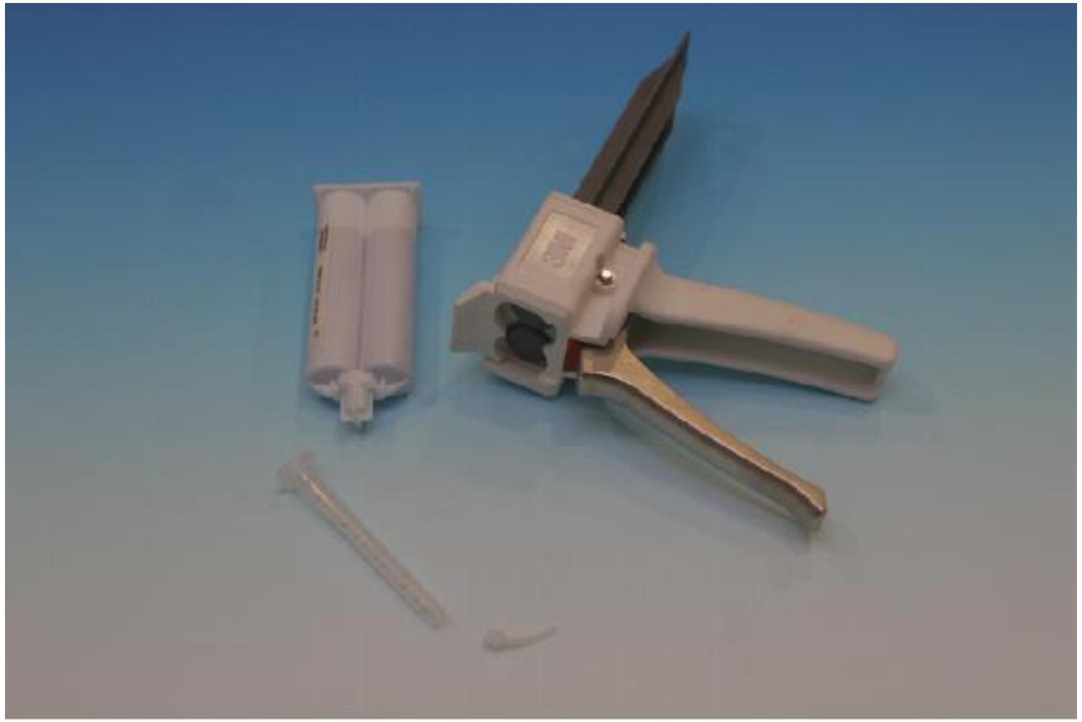
Syringe loading for intraoral application

Manipulation

Intraoral application by static mixer

Manipulation

Intraoral application by static mixer



Manipulation

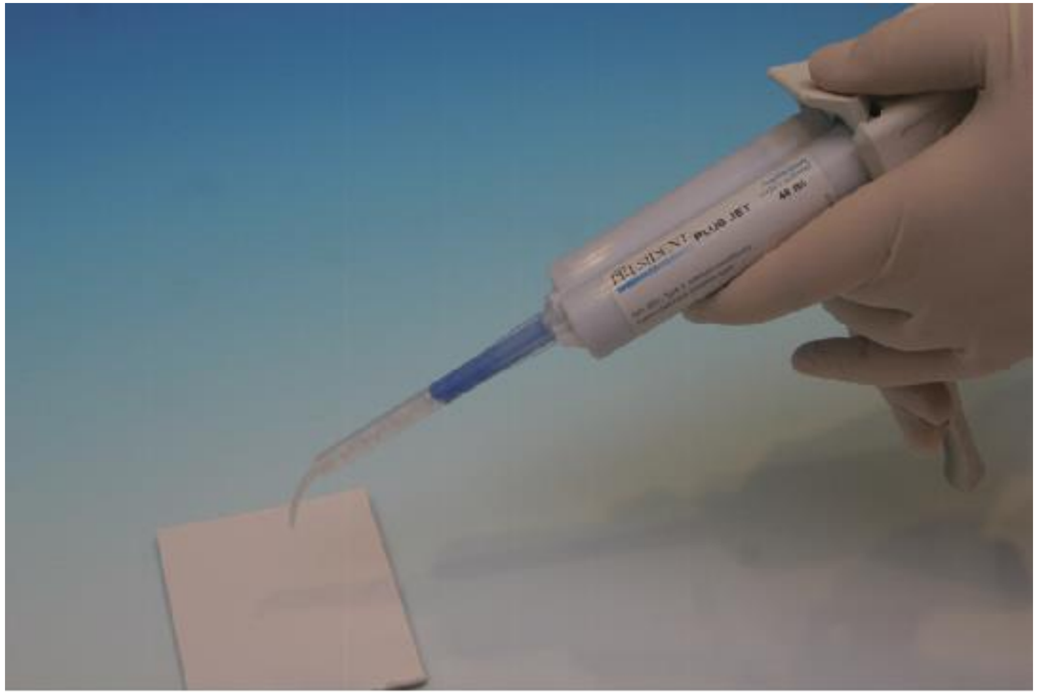
Intraoral application by static mixer

Manipulation

Intraoral application by static mixer

Manipulation

Intraoral application by static mixer



Manipulation

Intraoral application by static mixer

General properties of elastomers

1. **Flow:**

- Their flow depends on the consistency. Light consistency has high flow.
- The passage of the impression material through mixing tips or syringe tip increases its flow due its pseudoplastic nature.

General properties of elastomers

2. **Dimensional accuracy:**

- Their polymerization reaction is accompanied by polymerization shrinkage which is greater in condensation types (polysulfide and condensation silicon).

General properties of elastomers

3. **Elastic recovery:**

- Elastomers are viscoelastic material (strain-rate sensitive).
- To decrease the permanent deformation results from impression removing from the undercuts, the impression should be removed rapidly with sharp snap movement in direction parallel to long axis of the teeth.

General properties of elastomers

- Elastic impression materials are removed from patient's mouth with sharp snap movement to:

1. Increase tear strength.
2. Decrease permanent deformation.

General properties of elastomers

4. **Dimensional stability:**

- The evaporation of byproducts in condensation types (polysulfide and condensation silicon) increases their inaccuracy.
- Thermal shrinkage occurs due to change between mouth and room temperatures.

General properties of elastomers

4. **Dimensional stability:**

- The condensation types should be poured within 30:60 minutes. While addition types can be poured up to 24 hours.
- Polyether impression should be stored in dry conditions due to its hydrophilic nature.

Limitations of elastomers

1. **Polysulfide:**

- It has an unpleasant smell and taste due to sulfur content.
- It has long setting time.

N.B: The use of polysulfide is limited nowadays.

Limitations of elastomers

2. **Addition silicon:**

- **Hydrophobicity** results in poor wetting to tissues during impression making and poor wetting with gypsum during cast making. This results in a cast with poor details.
- The manufacturers added surfactant to the composition to decrease this hydrophobicity.

Limitations of elastomers

2. **Addition silicon:**

- **Sulfur contamination** from natural latex and some vinyl gloves inhibits polymerization reaction. So avoid touching the impression material or prepared teeth with gloves.
- Wearing latex-free glover or over-gloves during kneading the putty can solve this problem.

Limitations of elastomers

2. **Addition silicon:**

- **Hydrogen gas release** during setting reaction. It may occur if the proportions of the material are unbalanced. The hydrogen gas causes poor surface details of the cast.
- To avoid this effect, the manufacturers added palladium to absorb the gas and recommend pouring the impression after 30 minutes to ensure evolution of the hydrogen gas.

Limitations of elastomers

2. **<u>Addition silicon:</u>**

- ➢ **Hydrogen gas release**

Limitations of elastomers

2. **Addition silicon:**

- N.B: The hydrogen gas is **not** a byproduct of polymerization reaction.

Limitations of elastomers

2. **Addition silicon:**

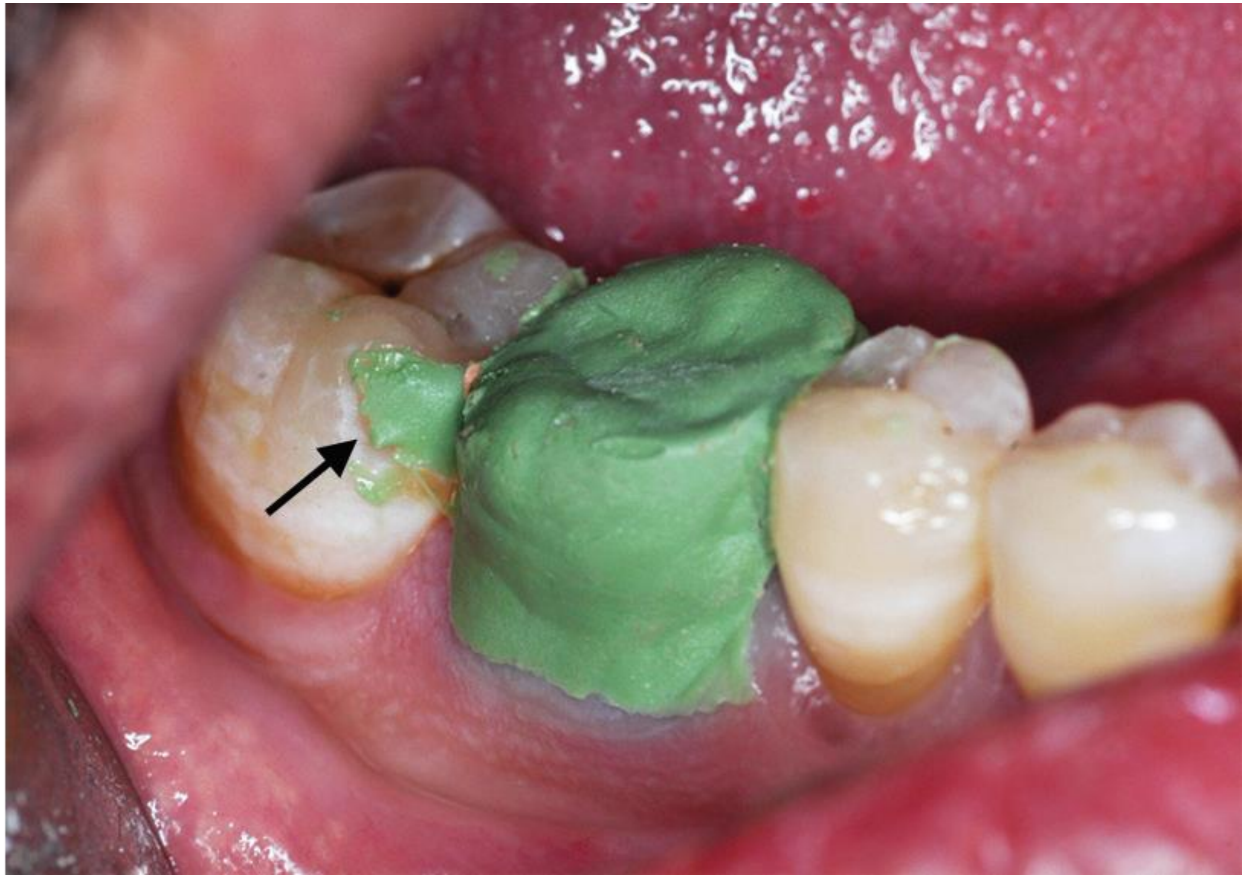
- Interaction with resin based provisional crown material:
- If the putty impression is used for construction of the provisional resinous crown, the surface layer of the crown will not be polymerized (air inhibited layer).

Limitations of elastomers

2. **Addition silicon:**

- If this oily surface layer is left at the impression, it will prevent the bond between the putty and light wash leading to failure of the secondary impression.

Limitations of elastomers



Limitations of elastomers

3. **Polyether:**

- The higher stiffness of the polyether (flexibility 3%) makes its difficult during removing from undercuts and may break the cast during separate the cast from the impression.
- The impression thickness is recommended to be 4mm to facilitate its removing from undercuts.

Polyvinyl Ether Silicone (PVES):

- It is a combination between polyvinyl siloxane and polyether.
- The material combines the benefits of both polyvinyl siloxane and polyether impression materials such as higher flowability, hydrophilicity, dimensionally accuracy, elastic recovery and easy removal from the mouth.

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Flow	Discussed before			

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Dimensional accuracy	0.25% polymerization shrinkage (in 24 hours)	0.6% polymerization shrinkage (in 24 hours)	0.05% polymerization shrinkage (in 24 hours)	0.3% polymerization shrinkage (in 24 hours)

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Elastic recovery	98%	99.5%		98.9%

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Flexibility	Most flexible	Less flexible		Least flexible Its thickness should be 4 mm for easily removal from the mouth.

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Adhesion to the tray	Needs adhesive	Needs adhesive Perforated stock tray (with putty only)		Needs adhesive

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Dimensional stability	Discussed before			

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Compatibility with gypsum products	Incompatible due to their hydrophobicity. Surfactant should be used to improve their wetting.			Compatible due to its hydrophilicity

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Tear strength	Highest	Least		lower

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Tear strength	Highest	Least		lower

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Electroplating	Can be electroplated with silver			Cannot be electroplating due to its hydrophilicity

Elastomeric impression materials

	Polysulfide (Mercaptan)	Condensation silicon	Addition silicon (PVS)	Polyether
Disinfection	Can be disinfected by immersion in 10% sodium hypochlorite not more than 30 minutes.			Spray disinfectant is recommended due to its hydrophilicity.

Elastomeric impression materials

<table>
<tr><th></th><th>Polysulfide (Mercaptan)</th><th>Condensation silicon</th><th>Addition silicon (PVS)</th><th>Polyether</th></tr>
<tr><td>Uses</td><td colspan="4">Making secondary impression for dentulous and edentulous patients.</td></tr>
</table>

Thank You