

# Dental Material 1

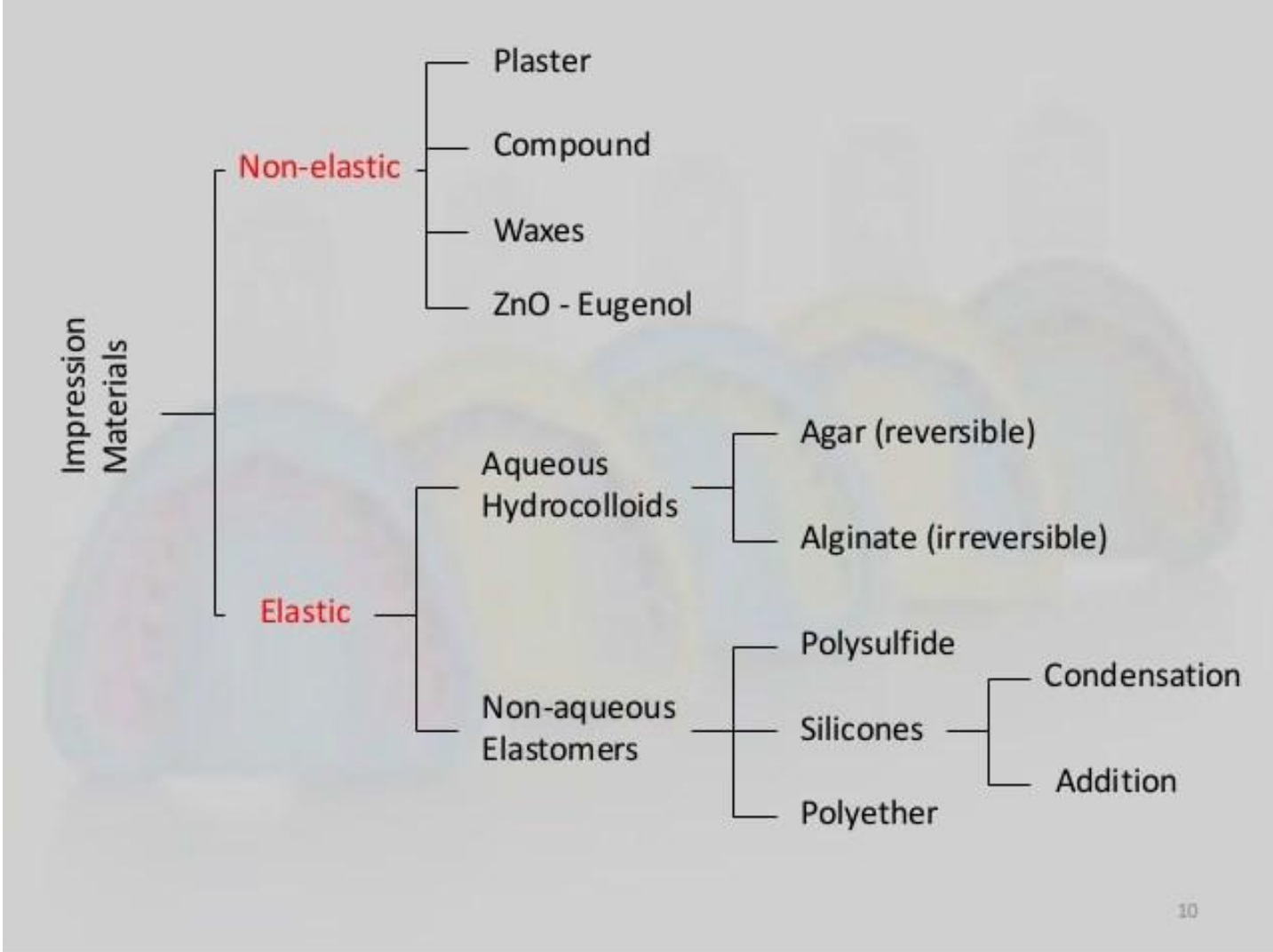
HYDROCOLLOID IMPRESSION

MATERIALS

ALGINATE

DR NOUR ALFAKS

# CLASSIFICATION OF IMPRESSION MATERIAL



# Elastic impression materials

Two colloidal impression materials made from **polysaccharide particles** suspended in **water** are used in dentistry, based on the **mode of gelation**, they are classified as:

1. **Reversible hydrocolloids**, e.g. **agar**: they are called reversible because their physical state can be reversed. This makes them **reusable**.
2. **Irreversible hydrocolloids**, e.g. **alginate**: once these set, it is usually permanent, and so is known as irreversible.

# Irreversible hydrocolloids (Alginate)

Alginate The word alginate comes from “alginic acid” which is a mucous extract yielded by species of brown seaweed.

**alginic acid** is a naturally occurring **hydrophilic colloidal polysaccharide**.

alginate was developed as a substitute for agar after world war II.

**Currently alginate is the most widely used impression material in the world because it is simpler to use.**

## Supplied as •

A powder that is packed

- In bulk containers (tins, bins or sachets)
- In preweighed packets for single impression.

A plastic scoop is supplied for dispensing the bulk powder, and a plastic cylinder, is supplied for measuring the water



# Applications

They are used for making impressions for:

1. removable partial dentures with clasps
2. preliminary impressions for complete dentures
3. orthodontic models
4. Study models.

They are **not** accurate enough **for fixed** partial denture impressions.

**In medical practice it used widely to take impression or other parts of face like **Nose, Ear, Eyes** etc. to help make prosthetic organs.**

# Composition of Alginate

ingredients	%wt	functions
Sodium or potassium alginate	12% to 15%	Dissolves in water and reacts with calcium ions
Calcium sulfate dehydrate (reactor)	8% to 12%	Reacts with potassium alginate and forms insoluble calcium alginate
Inert filler-such as diatomaceous earth	%70	to control the stiffness of the set gel
Sodium phosphate (retarder)	%2	Reacts preferentially with calcium sulphate
Coloring and flavoring agents	traces	e.g. wintergreen, peppermint and anice, orange etc.
quarternary ammonium compounds or chlorhexidine	traces	to provide self-disinfection
organic glycol	traces	to coat the powder particles to minimize dust during dispensing

# Setting reaction

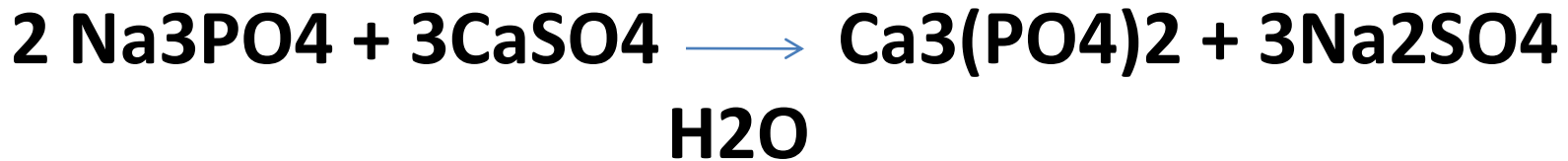
When alginate powder is mixed with water a sol is formed which later sets to a **gel** by a **chemical reaction**.

The final gel, insoluble **calcium alginate** is produced when soluble **sodium alginate** reacts with **calcium sulphate (reactor)**.

However, this reaction proceeds **too fast**. There is not enough working time.

So the reaction is delayed by addition of a **retarder (sodium phosphate)** by the manufacturer.

In other words, two main reactions occur during setting:



First, sodium phosphate reacts with the calcium sulphate to provide adequate **working time**.

Next, after the sodium phosphate is used up, the remaining calcium sulphate reacts with sodium alginate to form insoluble **calcium alginate** which forms a **gel with water**.

The **sodium phosphate** acts as a **retarder**, and the **amount** included can be varied to produce **regular** (or normal) and **fast** setting

# Properties

## Taste and odor

Alginate has a **pleasant** taste and smell. Over the years, manufacturers have added a variety of colors, odors and tastes to make it as pleasant as possible to the patient. Flavors include **strawberry, orange, mint, vanilla, etc.**

## Flexibility

It is about **14%** at a stress of 1000 gm/cm<sup>3</sup>. However, some of the hard set materials have lower values (5% to 8%).

Lower W/P ratio (thick mixes) results in lower flexibility.

## Elasticity and elastic recovery

Alginate hydrocolloids are highly elastic (but less when compared to agar) and about **97.3%** elastic recovery occurs.

Thus **permanent deformation** is more for alginate (about **1.2%**).

Permanent deformation is less if the set impression is removed from the mouth **quickly**.

## Reproduction of tissue detail

Detail reproduction is also **lower** when compared to **agar hydrocolloid**.

The ADA (American dental association) requires the material to reproduce a line that is 0.075 mm in width.

A number of products exceed this minimum value.

And thus they are **not** recommended for **crown and bridge work**. However, they are very popular for partial denture work.

## Strength

Alginate gels have poor mechanical properties and are **liable to tear** when removed from deep undercuts, particularly in **interproximal and subgingival areas**.

## **Factors affecting gel strength;**

- Water/powder ratio, too much or too little water reduces gel strength.
- Mixing time, over and under mixing both reduce strength.
- Time of removal of impression, strength increases if the time of removal is delayed for few minutes after setting.

## **Dimensional stability**

Set alginates have poor dimensional stability due to **evaporation, syneresis and imbibition.**

**Therefore, the cast should be poured immediately.**

**If storage is unavoidable, keeping in a humid atmosphere of 100% relative humidity results in the least dimensional change.**

## Biological properties

Silica particles present in the dust which rises from the can after fluffing alginate powder, are a possible **health hazard**.

Avoid breathing the dust. Presently, some manufactures supply “**dust free**” alginate. **Dustless alginates contain glycol**. It acts by coating the powder.

## Adhesion

Alginate does not adhere well to the tray.

Good adhesion is important for the accuracy of the impression.

Retention to the tray is achieved by **mechanical locking** features in the tray or by applying an **adhesive**.

# Manipulation

Fluff the powder by **inverting the can several** -  
**times. This ensures uniform distribution of the**  
**filler before mixing.**

The top of the can should be taken off carefully -  
to prevent the **very fine silica particles** from  
being inhaled.

- For mixing, we need:
- A clean flexible plastic bowl and
- A clean wide bladed, reasonably stiff metal spatula.





1. Scoop out the alginate
2. Scrape off evenly with the spatula



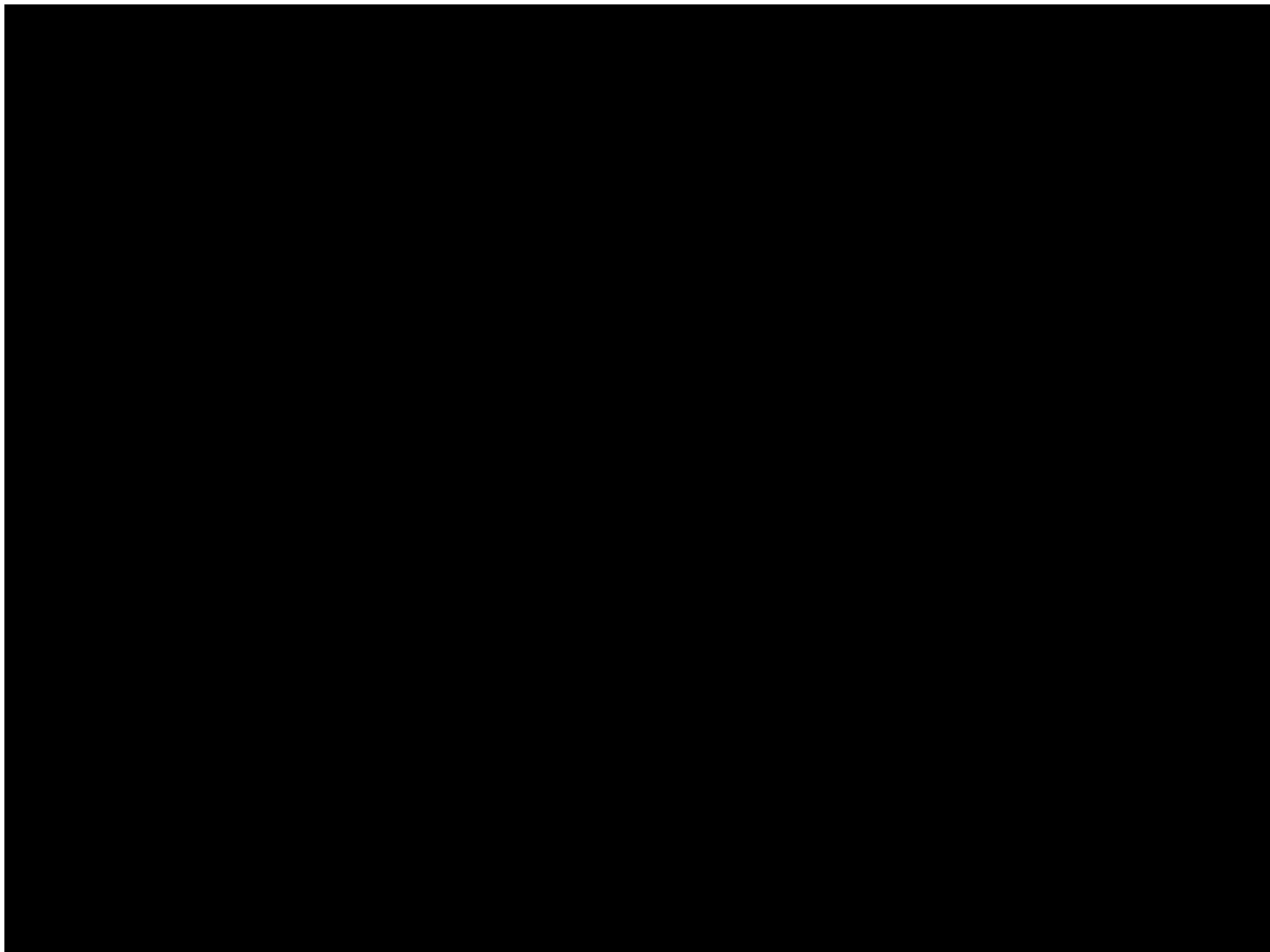


- The mixing is started with a stirring motion to wet the powder with water.
- Once the powder has been moistened, rapid spatulation by **swiping or stropping** against the side of the bowl is done.
- A vigorous **figure-eight** motion can also be used.
- **This helps:**
  - remove most of the air bubbles.
  - Wipe dissolved alginate from the surface of the yet undissolved alginate thereby promoting **complete dissolution**.

**Mechanical devices** are available for spatulating alginate. Their main advantages are:

- Speed
- Convenience
- Elimination of the human variable.

A proper mix is **smooth and creamy** with minimum voids and does not drip off the spatula when it is raised from the bowl.



# Mixing time

- For **fast** set alginate is about **45 seconds**
- For **normal** set alginate is about **60 seconds**.

## **Over mixing results in**

- Reductions in final strength as the gel fibrils are destroyed.
- Reduction in working time.

## **Under mixing results in**

- Inadequate wetting, lack of homogeneity and reduced strength.
- The mix being grainy and poor recording of detail.

The proper W/P ratio as specified by the manufacturer should be used (usually one measure water with one scoop of powder).

The water measure and scoop are supplied by the manufacturer.

- Add powder to the bowl first
- Then add water to powder.
- The measured quantity of the powder is sprinkled in the measured amount of water in the rubber mixing bowl and the lid of the metal can is replaced immediately.

## Working time

- Fast set alginate is about 1, 1/4 minutes.
- Normal set alginate is about 2 minutes.

## Gelation time (setting time)

- Type I (fast set) is about 1-2 minutes.
- Type II (normal set) is about 2-4.5 minutes.

# Control of gelation time

Ideal gelation time is **3-4 minutes** (at 20o C room temperature).

- Gelation time is best controlled by adding **retarders** (which is in manufacturer's hands).
- The dentist can best control the setting time by altering the **temperature of the water for mixing alginate material**.
  - Colder the water--- longer is the gelation time.
  - Warmer the water--- shorter is the gelation time.

Even the mixing bowl and spatula can be cooled.

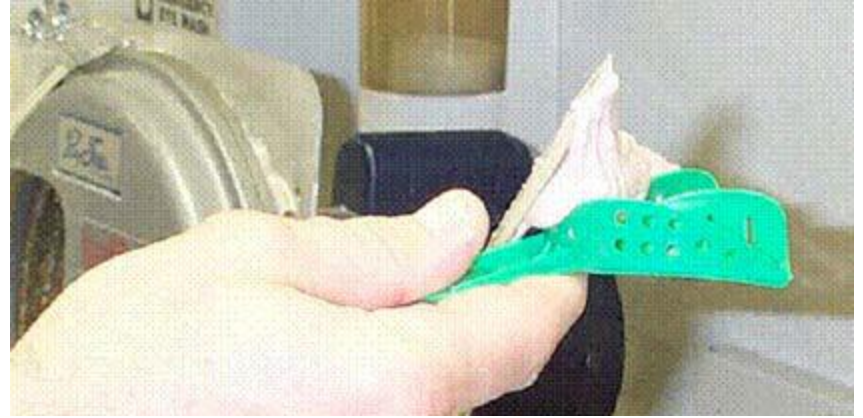
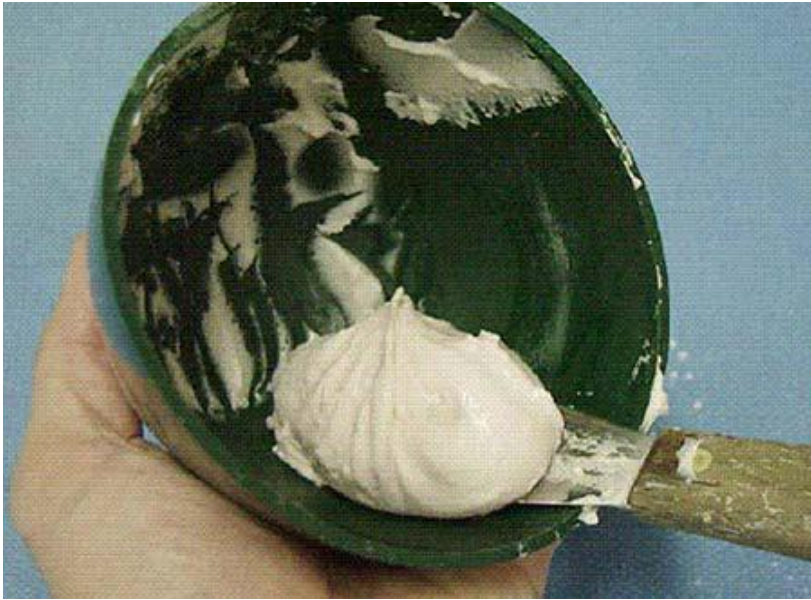
# Tray selection

Since alginate has poor adhesion, tray selection is very important. Alginate can be retained by:

- Mechanical locking features in the tray
  - A rim lock
  - Perforations (holes or slits) in the tray
- Applying a suitable adhesive ( available as liquid or sprays)
- A combination of the above.

The tray should cover the entire impression areas and provide a space of at least **3 mm** on all sides.





## Seating the tray

Since the material sets from tissues towards periphery any movement during gelation may result in distortion. So once the tray is seated, it must be held in place firmly without any movement.

## Test for set

The material loses its **tackyness** when set. It should rebound fully when prodded with a blunt instrument.

**Color indicators:** some alginates are available which on mixing is one color and on setting change to a different color.

## **Time of removal**

The alginate impression should be left in the mouth for at least **2-3 minutes after initial gelation**.

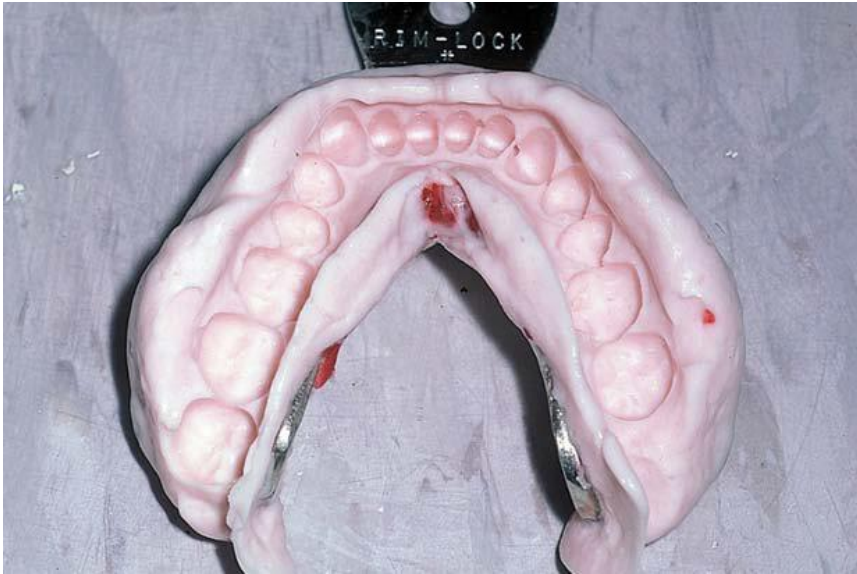
The strength and elasticity of the alginate gel continues to increase for several minutes after initial gelation.

## **Removal of the impression**

An alginate impression when set, develops a very effective peripheral seal, this seal should be freed by running the finger round the periphery. The impression must be removed suddenly, with a jerk. The brush-heap structure of a gel responds more favorably to a sudden force.

# **After removal from the mouth, the impression should be:**

- Washed with cold water to remove saliva.
- Disinfected by immersion in a suitable disinfectant.
- Covered with a damp napkin to prevent drying.
- Cast should be poured as soon as possible, preferably within 15 minutes after making the impression.



# Impression disinfection

Disinfection of impression is a concern because of viral diseases such as hepatitis B, AIDS and herpes simplex.

The viruses can contaminate the gypsum models and present a risk to dental laboratory and operating personnel.

The irreversible hydrocolloids may be disinfected by 10 minutes immersion in, or spraying of, some antimicrobial agent (e.g. **sodium hypochlorite, glutaraldehyde**) without significant dimensional changes.

# Advantages and disadvantages of alginate

## Advantages

Alginate is a popular material because:

1. It is easy to mix and manipulate.
2. Minimum requirement of equipment.
3. Flexibility of the set impression.
4. Low cost
5. Hydrophilic
  - displace moisture, blood, fluids
6. Stock trays

## **Disadvantages**

- 1. Tears easily**
- 2. Dimensionally unstable**
  - Immediate pour**
  - Single cast**
- 3. Lower detail reproduction**
- 4. unacceptable for fixed prosthodontics.**
- 5. High permanent deformation**
- 6. Difficult to disinfect.**

**THANK YOU  
FOR LISTINING**