Impression Materials
I. Use

A. To register or reproduce the form, dimensions, and spatial relationship of the teeth and oral tissues.

B. To make an accurate replica of the oral tissues; may involve a single tooth to the whole dentition or an edentulous mouth.

C. To make a negative reproduction of the oral structures.
II. Desirable Qualities & Properties

- The fundamental requirement for an impression material is that it can be placed into the mouth as a semi-liquid material, which will flow & adapt itself around the desired structures. The material must then set (harden) into a solid that is rigid enough to be removed from the mouth without becoming permanently deformed.
A. Ease of manipulation and reasonable cost.
B. Adequate flow properties; readily wets oral tissues to reproduce fine detail.
C. Appropriate setting time & characteristics to meet clinical requirements.
D. Sufficient mechanical strength not to tear or permanently deform during removal; adequate elastic properties. (graphic)
E. Good dimensional accuracy to allow for production of a cast or model
F. Acceptability to the patient (pleasant taste & odor).
An undercut at the cervical portion of a tooth being locked into an inelastic impression material.

- Undercut
- Gingiva
- Tooth
- Rigid impression tray
- Impression material

Elastic impression material
- Impression compresses elastically without fracture
- Tray is lifted up

Inelastic impression material
- Fracture of impression
G. Safety (not toxic or irritating).
H. No significant degradation of properties as a result of disinfection.
I. Compatibility with die and cast materials.
J. Good keeping qualities (shelf life); no deterioration of unused material in the dental office.

III. Classification of Impression Materials

** see flow chart **
Edentulous

INELASTIC

ZOE

Impression Compound

Plaster

Dentulous and Edentulous

ELASTIC

Hydrocolloids
1. Reversible (Agar)
2. Irreversible (Alginate)

Elastomers
1. Polysulfide (mercaptan)
   - oldest, not the most accurate or stable, diminished popularity.
2. Condensation Silicone (polysiloxane)
   - silicone rubber, nontoxic bathroom caulking!
3. Addition silicone (polyvinylsiloxane)
   - may be material of choice due to excellent phys. char. & accuracy; operator preference!
4. Polyether
   - very firm, best used for only a few teeth or a quadrant.
5. Urethane polymer (light–cured)
IV. Types and Composition of Impression Mat’ls

A. Inelastic – edentulous patients

1. Impression compound

   a. composition – natural resins, waxes, fillers, pigments.

   setting action -

b. function –

   - acts as a 1º impression; forms a tray to allow another imp. mat’l to be carried into the mouth.
   - popular for border molding mat’l to retain other types of impression mat’ls.
   - acts as an adhesive to assemble or align models or appliances.
2. ZOE

a. composition – zinc oxide, eugenol, rosin, fillers (silica)

setting action -

b. function –
- impression mat’l, periodontal dressing, sedative base, temporary cement, temporary restoration.
- acts as a $2^\circ$ impression – loaded onto the tray that was formed from the impression compound.
- records fine detail due to its ability to be applied in a more fluid application.
3. Plaster – see “gypsum” handout
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... con’t
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B. Elastic – dentulous & edentulous patients

1. Hydrocolloids (2)
   defin: colloid – suspension of fine particles in a liquid.
   hydro = water          particles = kelp!!

   a. Reversible hydrocolloid = Agar
   - changes from SOL → GEL by altering temperature.
   SOL = liquid solution   GEL = rubber-like substance (Jello!)

   Setting action = physical change =

   Physical change – not chemical; reverts back and forth.
   Agar gel at room temp; sol at ↑ temp (~ 150º F)
• Comp: water, seaweed, kelp, borax, potassium sulfate.
• Registers fine details, high accuracy, good for models/casts, crowns, bridges.
• Dimensionally unstable, immed pour-up nec.
• Equipment: hydrocolloid bath, water-cooled trays, hose attachments
• Thermal changes can be uncomfortable
  – ~110°F chilled immediately to 85°F
• More time needed for conditioning of agar – boil, storage, tempering bath.
b. Irreversible hydrocolloid = Alginate

- Comp. – L = water
  - P = potassium alginate = creates gelation
    - calcium sulfate = initiates chemical reaction
    - fillers (diatomaceous earth, zinc oxide) = flexibility
    - sodium phosphate = retards setting
    - potassium titanium fl = hard, smooth surface
    - quartnary ammonium = disinfectant

- Setting action = chemical when P & L united.
- *Gelation* = sol $\rightarrow$ gel; does NOT revert back to sol
  = Irreversible !!
• 1° use = study models, treatment planning
• Provides detail but not enough for crown, bridge prosthetics.
• Minimal “fuss & muss”, not a lot of equipment, easy to handle, more commonly used.

• Immediate pour-up nec. - dimensional change & loss of stability within 1 hour.
  – *Syneresis* – loss of moisture; drying out
  – *Imbibition* – uptake of moisture; sorption (*baby*)
• Shelf life = 1 year, deteriorates rapidly in ↑ temp & humidity (moisture).
2. Elastomers (4)

• General notes:
  – Synthetic rubber not gels
  – Setting action = polymerization = chemical
  – Various consistencies used:
    • light syringing
    • medium syr &/or tray
    • heavy – bodied tray
a. Polysulfide (mercaptan)

- Comp – polysulfide polymer, silica, oils, lead dioxide, sulfur.
- Oldest elastomer
- Longest setting time
- Not very accurate or stable – immed pour-up
- Stains clothing & skin; smells
- Diminished popularity.
b. Condensation silicone (polysiloxane)

- Comp – dimethyldisiloxane (silicone liquid), fillers, chemicals for chem reaction, pigments.
- Dental & medical grades are nontoxic as opposed to commercial grades (bathroom caulking!)
- Curing produces alcohol as a by-product; alcohol evaps, **result**: shrinkage & poor dimensional stability.
- Pour-up: immediate
- Loss of popularity due to PVS (upgraded mat’l)
c. Addition silicone (polyvinylsiloxane)

• Comp: same as condensation silicone with addition of vinyl molecules & silane hydrogen.
• Hydrophobic - addition of surfactant (soap!) allows for wetting for the gypsum pour-up.
• Excellent dimensional stability.
• Delayed pour-up due to out gassing of hydrogen - bubbles will form on surface of cast.
• Most popular material – accurate, stable, no taste or smell.
d. Polyether

- Comp – polyether, fillers, sulfonic acid, oils, pigments.
- Firmer, more rigid material – best utilized when a few teeth or quad involved in impression – can be difficult to remove.
- Accurate, compatible with gypsum – immediate pour-up.
- Popular material, but unpleasant taste.
V. Characteristics of Impression Materials

* 7 general characteristics & properties:

1. **Flexibility** – measure of stiffness allows for deformation w/out permanent distortion. 
   Ex: rubber band

2. **Accuracy** – elastic recovery – “spring back” action

3. **Tear strength** – removal from mouth
   - area of least resistance?????

4. **Stability** – retaining dimensional accuracy over an extended period of w/out distortion.

Which impression mat’ls would be the least stable???????
5. Dimensional change – accompanies the setting of elastomer impression materials. Polymerization = shrinkage


7. Working & setting time – ideally: long working time & rapid setting time
   **WHY?** - mixing, placing, and pt. comfort
VI. Mixing & Handling of Imp Mat’ls

a. Elastomers

- 4 mat’ls – what are they: _____, _____, _____, _____.

  1. Setting mechanism – polymerization = chemical reaction
  2. 2 paste system: equal length of base & catalyst spatulated into homogeneous mixture loaded into syringe or tray.

  **Pour – up:** immediate EXCEPTION: PVS wait 1 hour for release of hydrogen gas (bubbles in cast); can be delayed for several weeks.
b. Hyrdocolloids

1. Agar

   a. setting mechanism:

   sol ↔ gel ↔ sol ↔ gel

   Sol: _______            Gel: _______

   b. armamentarium:

   c. pour – up: _______     WHY? _______
2. Alginate AKA: ________________________________
   a. setting mechanism: ____________________________
      sol → gel
   b. commonly used for ____________________________
   c. storage: bulk – canisters; pre-measured packets; store in cool dry location, tightly sealed.
   d. types: fast or normal set WHY?
   e. armamentarium:
f. mixing & handling:
1. measure powder & water
2. place water in rubber bowl 1st – WHY??
3. spatulate – 1 minute; homogenous mix
4. load tray
5. seat intraorally
   - which arch 1st & WHY??

4 more slides to go!!
6. setting time: normal set – 4-5 minutes

7. remove with a “snap” – maintains strength, minimizes distortion.

8. pour – up ASAP; if unable, store in 100% humidity, no longer then 1 hour (wet towel in plastic bag)
g. disinfection - breaks any cross-contamination

- Immersion or spray technique
- Best cast when sprayed (surface of cast/model)
- Disinfectant agents:
  - Iodophor
  - 2% glutaraldehyde
  - Sodium hypochlorite {bleach} MUST be mixed daily (24 hrs)
- 10 minutes in a sealed bag
h. Closing notes….

- 2 significant factors:
  - Overall strength & stability of an alginate impression depend upon:
    1. Correct water/powder ratio

2. Proper mixing technique
   1. Overmix – breaking up of forming gel
   2. Undermix – grainy
   3. RESULT if not mixed correctly – low strength, tearing upon removal, & grainy mix.
**Grid for Impression Materials**

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*Also – review handout for troubleshooting alginate*
Any questions on Impression Materials??

Have a nice day!