#### Lec.8

# <u>Waxes</u>

Wax is a thermoplastic polymer that can be molded with or without a slightly elevated temperature and retain the new shape when cooled to room temperature.

Waxes for dental procedures are a blend of natural and synthetic waxes.

Natural waxes are taken from plants, insects, animals, or minerals (including petroleum). Mineral-based waxes are mostly mixtures of hydrocarbons, whereas waxes from plants, insects, and animals contain hydrocarbons with ester and some with alcohol or acid.

Synthetic waxes are made by the synthesis of polymers or the modification of natural waxes. Synthetic waxes are typically composed of hydrogen, carbon, oxygen, and chlorine. Synthetic waxes are more uniform than natural waxes in their structure and more homogeneous in composition.

## **Classification:**

Dental waxes are classified according to their applications (uses) into:

- 1. Pattern waxes.
- 2. Processing waxes.
- 3. Impression waxes.

### Pattern Waxes:

- a) Inlay waxes
- b) Resin waxes
- c) casting waxes
- d) base plate waxes

### **Inlay waxes:**

- They are used to make inlay, crown, and pontic replicas used in the lost wax casting technique.
- may be softened over a flame or in water at 54 to 60 °C
- Type I inlay waxes are soft : for the indirect inlay technique and sometimes for the attachment of miscellaneous parts.
- Type II inlay waxes are hard waxes: for preparing direct technique.
- Inlay waxes are supplied in geometric and anatomic forms as well as in bulk.







### **Resin waxes**

- higher strength and resistance to flow than waxes
- good dimensional stability
- burnout without residue.
- Full-crown patterns fabricated from pattern resins and inlay waxes have similar marginal discrepancies.

### **Casting waxes**

- are used for thin sections of certain removable and fixed partial denture patterns.
- in the preparation of copings or clasps requiring uniformly thin regions.
- supplied in sheets and rods and in bulk, and preformed patterns are available for partial denture application



#### **Base plate way**

- supplied in sheets
- used in the construction of full denture patterns and for occlusal rims, although an occlusal rim wax is also available.
- Setup wax may be used instead of base plate wax to set denture teeth.
- three types of base plate wax:

type I is a soft base plate wax for veneers and contours type II is a medium-hardness base plate wax for use in temperate climates

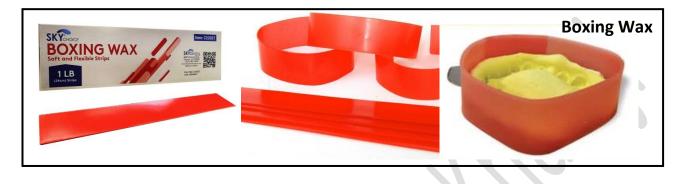
type III is the hardest base plate wax and is for use in tropical climates.

- The hardness is based on the amount of flow the wax shows at  $45^{\circ}$ C (113°F).
- Base plate wax is also used as a mold for the construction of provisional fixed partial dentures, as a bite registration wax, and for some applications in orthodontics.



### Processing waxes

• Boxing wax is a processing wax used for enclosing an impression before a stone cast is poured. Typically provided in pink-colored flat sheets, this wax is relatively soft and pliable and can easily be pressed to the desired contour around the perimeter of an impression and self-sealed at the overlapped area with firm pressure.



• Sticky wax is an orange-colored wax in the form of stick, which is tacky when melted but firm and brittle when cooled. Sticky waxes are used to temporarily fasten (join) gypsum model components, join and temporarily stabilize the components of a bridge before soldering, or attach pieces of a broken denture prior to a repair.



• Carding wax is used for attaching parts and in some soldering techniques.



• Blockout wax is used to fill voids and under-cuts for removable partial denture fabrication



• White wax is used for making patterns to simulate a veneer facing.



• Utility wax is used in various laboratory procedures. It is a moldable wax that can adhere to various dry surfaces when pressed on. This wax transforms a standard perforated impression tray for use with hydrocolloids into a more desirable contour and protects soft tissue from the periphery to extend or post dam impression trays. Utility wax can be used to repair small imperfections in wax patterns, to fill holes, or to apply sprues to sprue bases.



# <u>Impression Wax</u>

- They tend to distort if they are withdrawn from undercut areas.
- Thus they are limited to use in edentulous sites of the mouth or in occlusal surface areas.
- They have enough body to register the detail of soft tissues
- They are rigid at room temperature.
- Corrective waxes are used as wax washes to record detail and displace selected regions of soft tissue in edentulous impressions.
- Bite waxes are used in bite registration.





# **Requirements of Wax:**

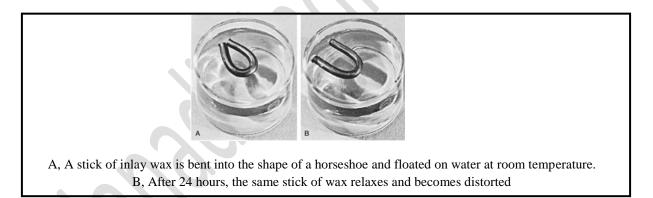
- 1. The wax should be uniform when softened.
- 2. The color should contrast with die materials or prepared teeth to facilitate proper finishing of the margins.
- 3. The wax should not fragment into flakes or similar surface particles during carving after cooling.
- 4. The wax must not be pulled away by the instrument or chip during carving.

5. During the burnout phase, the wax must burn completely by oxidizing residual carbon to volatile gases. Ideally, the wax should not leave a solid residue that amounts to more than 0.10% of the original weight of the specimen after the burnout phase.

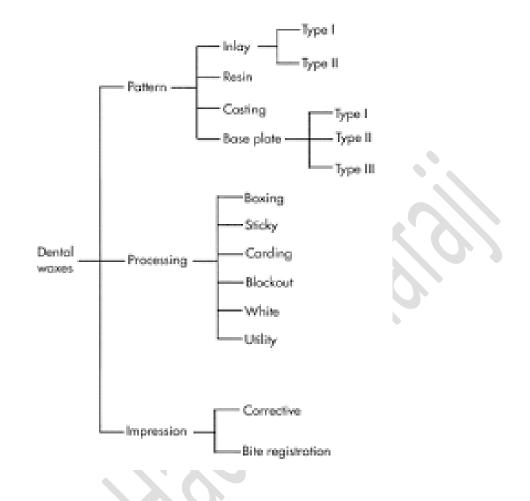
# **Properties**:

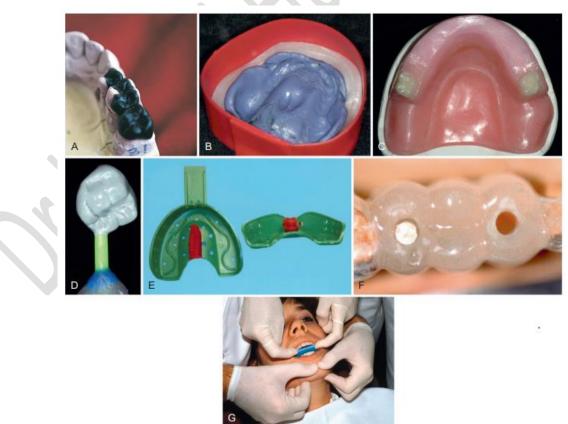
- 1. Waxes melt over a range of  $5^{\circ}$ C to  $30^{\circ}$ C.
- 2. Waxes have the highest coefficients of thermal expansion of any dental material.
- 3. The total wax shrinkage on cooling from liquid to solid at room temperature may be as great as 0.4%
- 4. Flow is a measure of a wax's ability to deform under light forces and is analogous to creep. Flow increases with increasing temperature and force. At a temperature close to its softening range, a wax may flow under its own weight. In liquids, flow is measured by viscosity, and in solids is measured by the degree of plastic deformation over a fixed period of time.
- 5. Wax Distortion:

Waxes are partly elastic in behavior and tend to return to their original shape after deformation. A straight bar of wax bent into a horseshoe shape will slowly straighten out at room temperature. This behavior is called the memory effect.



Residual stresses as a result of nonuniform heating also contribute to later distortion. Because of low thermal conductivity, the outer layer of the wax cools first while the core remains in a liquid state and continues to contract. When the core finally cools to a solid, the contraction process is constrained by the already-solid external layers, resulting in residual stress. A newly made wax pattern not retained on the die tends to change its shape over time, a sign of stress relieving to reach a state of dimensional stability. Thus it is important that the wax pattern be retained on the die for several hours to avoid distortion and ensure that equilibrium conditions are established. A casting will fit most accurately when the pattern is invested immediately after its removal from the preparation or the die. Any delay in investing the pattern can lead to a distortion of its form because of stress-relaxation effects.





Applications of waxes in dentistry. **A**, Inlay pattern wax. **B**, Boxing wax. **C**, Baseplate. **D**, Casting wax. **E**, Utility wax. **F**, Sticky wax. **G**, Bite wax.