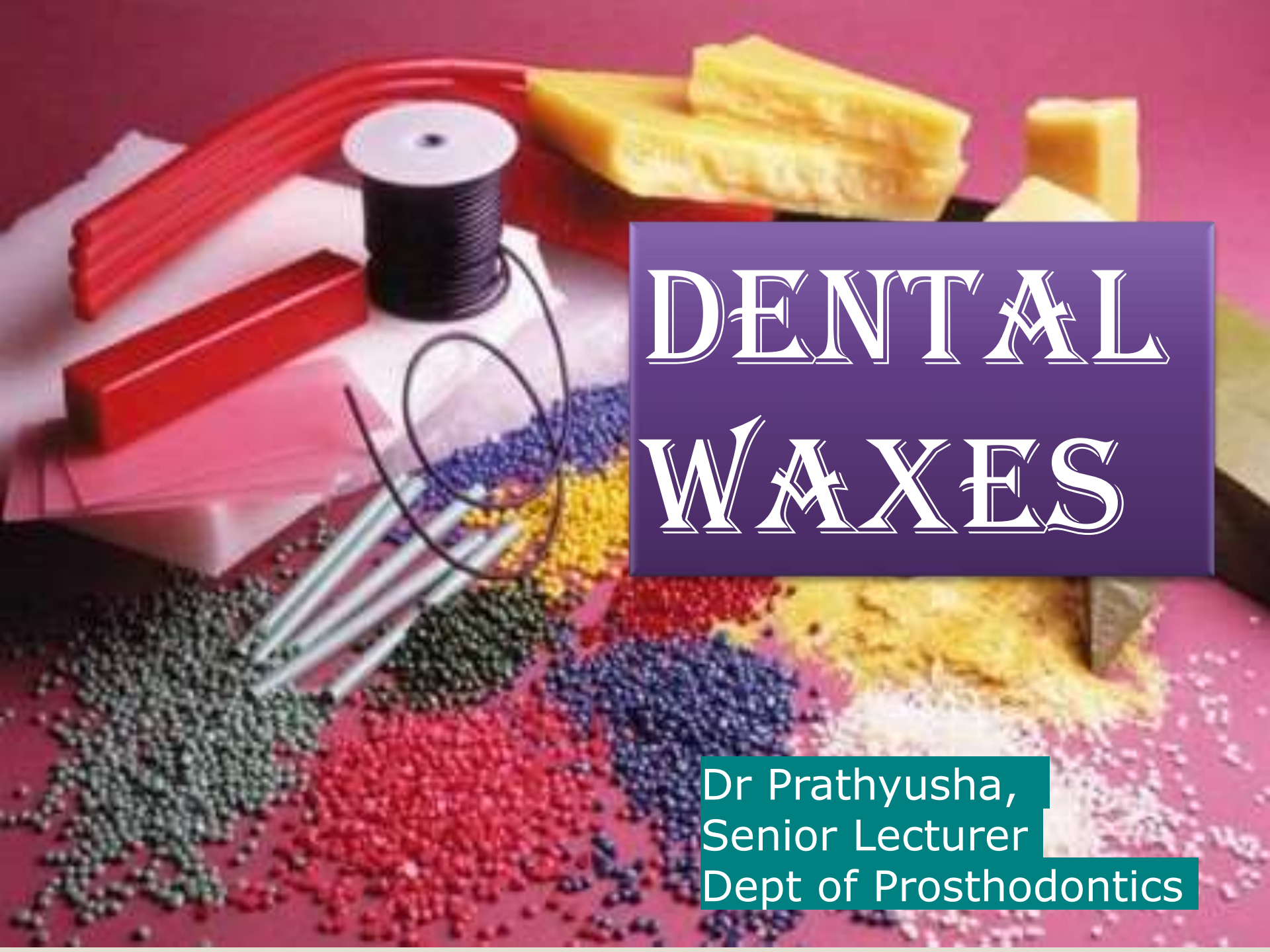


DENTAL WAXES

Dr Prathyusha,
Senior Lecturer
Dept of Prosthodontics

CONTENTS

INTRODUCTION

- ✓ Forming an inlay pattern,
- ✓ making an impression
- ✓ boxing an impression before it is poured in dental stone,
- ✓ registration of occlusal bite relationship

each requires a specially formulated wax.

HISTORY

- The oldest wax used by people is the beeswax
- At approximate 3000 B.C. in Egypt, people already used beeswax in the Egyptian Theben
  - *mummification process* and for protective covering
  - *wax figures of deities* in funeral ceremonies
- In 400 BC Mesopotamia- natural Bees wax

- In Greek and Roman literatures,
  - *sealing ships,*
  - *binder matrix,*
  - *protection coating at art objects,*
  - *tablets.*
- In Roman times **Pliny(**23-79AD) -white bees wax – *dysentery, skin softener*.
- Many Romans were honored by h themselves made in bees wax and Movie Land Wax Museum in Los Ang

- ***Carnauba wax*** -leaves of the carnauba palm trees. The best Carnauba wax comes from the Palm Trees of Brazil.
- ***Candelilla wax*** -Mexico, Panama, Costa Rica, Nicaragua and sometimes in the southwestern United States. It is a brown wax
- ***Lanolin*** -Wool wax from animals esp sheep.
- ***Paraffin wax*** made by removing oils from petroleum

- Waxes were first used in dentistry in early eighteenth century- edentulous impressions.(1855)
- Dr William.H.Taggart formulated a wax pattern compound of excellent properties – invented ***LOST WAX TECHNIQUE 1907.***

DEFINITION

- **Waxes**: (1) a low-molecular-weight ester of fatty acids derived from natural or synthetic components, such as petroleum derivatives, that soften to a plastic state at a relatively low temperature. (2) A mixture of two or more waxes and additives used as an aid for the production of gypsum casts, production of nonmetallic denture bases, registering of jaw relations, and laboratory work. --Phillips
- **Dental waxes** are combinations of various types of waxes compounded to provide desired physical properties.

(GPT-8)

- The two principal groups of organic compounds in wax are : ***hydrocarbon and ester.*** ***CH_3-(CH_2)-CH_3 [15-44]***

CLASSIFICATION

According to the origin

According to their applications

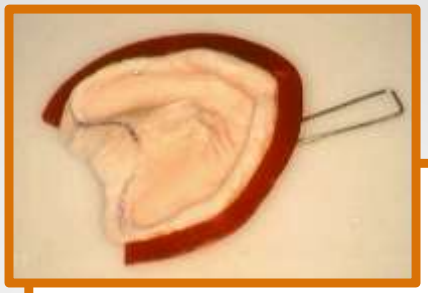
According to the origin:

NATURAL WAXES	SYNTHETIC WAXES
• Mineral • Plant • Insect • Animal	• Acrawax • Aerosol OT • Castorwax • Aldo 33 • Flexo-wax C • Epolene N-10 • Albacer • Durawax 1032

CRAIG'S RESTORATIVE DEANTAL MATERIALS , Robert G.Craig John M Powers, : 11TH EDITION:424-448

According to their applications :

- **PATTERN**
- Inlay (type I& type II)
- Casting
- Baseplate (type I , II & III)



- **PROCESSING**
- Boxing
- Sticky
- Utility

- **IMPRESSION**
- Corrective

- Bite registration

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NATURAL WAXES

Mineral	Plant	Insect	Animal
•Paraffin •Microcrystalline •Ozokerite •Ceresin •montan	• Carnauba •Candelilla •Japan wax •Cocoabutter	•Beeswax	•spermaceti

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Natural waxes

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Powers J M, Craig's restorative dental materials,11th edition:pp424-448

PARAFFIN WAXES

- Obtained from the high boiling point fractions of petroleum straight chain hydrocarbon containing with 26 - 30 carbon atoms.
- Melting range-40 to 71˚c
- Dental paraffin waxes can crystallize in the form of plates, needles, or malcrystals.
- On cooling- transition from needles to plates occurs about 5˚c to 8˚c below their melting temperature.
- During solidification and cooling , volumetric contraction 11% to 15%.

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CERESIN

- wax- bearing distillates from natural-mineral petroleum refining or lignite refining.
- Contains straight and branched- chain paraffins.
- They have higher molecular weight and greater hardness than the hydrocarbon waxes distilled from crude products.
- Used to increase the melting range of paraffin wax.

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CANDELILLA WAXES

- Contains hydrocarbon containing 29-33 carbon atoms, accompanied by free alcohols, acids, esters and lactones.
- Melting range: 68-75 ^{0} c
- Added to increase the hardness of paraffin wax but are not effective in increasing the melting range.

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CARNAUBA WAXES

- Composed of straight-chain esters, alcohols, acids, and hydrocarbons.
- characterized by high hardness, brittleness, and high melting temperatures.
- possess the outstanding quality of increasing the melting range and hardness of paraffin waxes;
- adding 10% of carnauba wax to paraffin wax with a melting range of 20^0C increases the melting range to 46^0C.

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BEES WAX

- Is the primary insect wax used in dentistry.
- Contains a mixture of esters containing mainly of *myricyl palmitate* hydrocarbons and organic acids.
- Melting range:63-70^0 C.
- Brittle at room temperature & becomes plastic at body temperature.(modifes properties of paraffin)
- Main component of sticky wax.

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SPERMACETI WAX

- Is a type of animal wax
- used as a coating in the manufacture of dental floss.

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TABLE 14-2 Characteristics of Various Waxes Used in [illegible]

Wax	Type	Melting Range (° C)	Characteristics in Mixtures with Paraffin Wax
Paraffin	Straight-chain hydrocarbon with 26-30 carbon atoms	40-71	No value
Microcrystalline	Branched-chain hydrocarbon with 41-50 carbon atoms	60-91	Less volumetric change during solidification
Barnsdahl	Microcrystalline wax	70-74	Increases melting range and hardness, reduces flow
Ozokerite	Microcrystalline wax, straight-, branched- and closed-chain hydrocarbons	65	No value
Ceresin	Straight- and branched-chain paraffins	No value	Higher molecular weight, higher hardness, increase melting range
Montan	Long-chain esters with 40-58 carbon atoms, alcohols, acids, resins	72-92	Improves hardness and melting range
Carnauba	Esters, alcohols, acids, hydrocarbons	84-91	Increases melting range and hardness
Ouricury	Esters, alcohols, acids, hydrocarbons	79-84	Increases melting range and hardness
Candelilla	Hydrocarbon with 29-33 carbon atoms, alcohols, acids, esters, lactones	68-75	Increases hardness
Japan wax	Fats—glycerides of palmitic and stearic acids	51	Improves tackiness and emulsifying ability
Cocoa butter	Fats—glycerides of palmitic, stearic, oleic, lauric acids	No value	Improves tackiness and emulsifying ability
Beeswax	Esters—myricyl palmitate, hydrocarbons, organic acids	63-70	Modifies properties of paraffin wax

PROPERTIES OF WAXES

- Melting range
- Thermal expansion
- Flow
- Residual stress
- Ductility

PHILLIPS 11TH EDTION

MELTING RANGE

- Waxes are mixtures of different components, each having a range of molecular weights, they do not melt at a single temperature . So waxes have melting ranges rather than melting points.
- Melting range increase with increase molecular weights.

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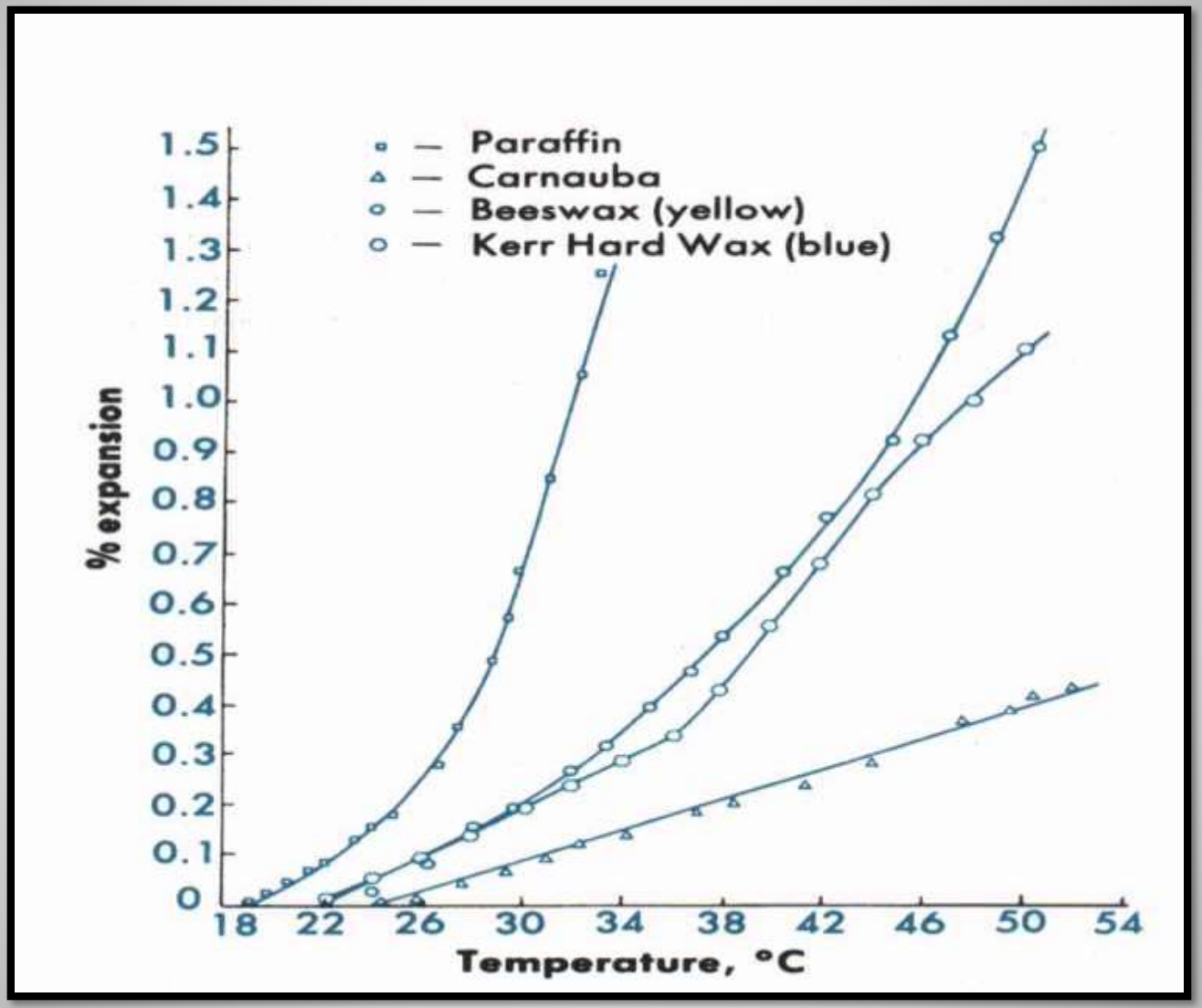
THERMAL EXPANSION& CONTRACTION

- Waxes expand when subjected to rise in temperature& contract as the temperature is decreased.

- Mineral waxes generally have higher coefficients of linear expansion than plant waxes
- **Expand** as much as **0.7%** with an increase in temperature of 20 °C
- **Contract** as much as ***0.35%*** when it is cooled from 37 °C to 25 °C.

- the linear coefficient of thermal expansion of 350 $\times 10^{-6}$/K(217 to 512 $\times$ 10^{-6}/K).

▪Phillips science of dental materials, Anusavice;11th edtion, page 283-292



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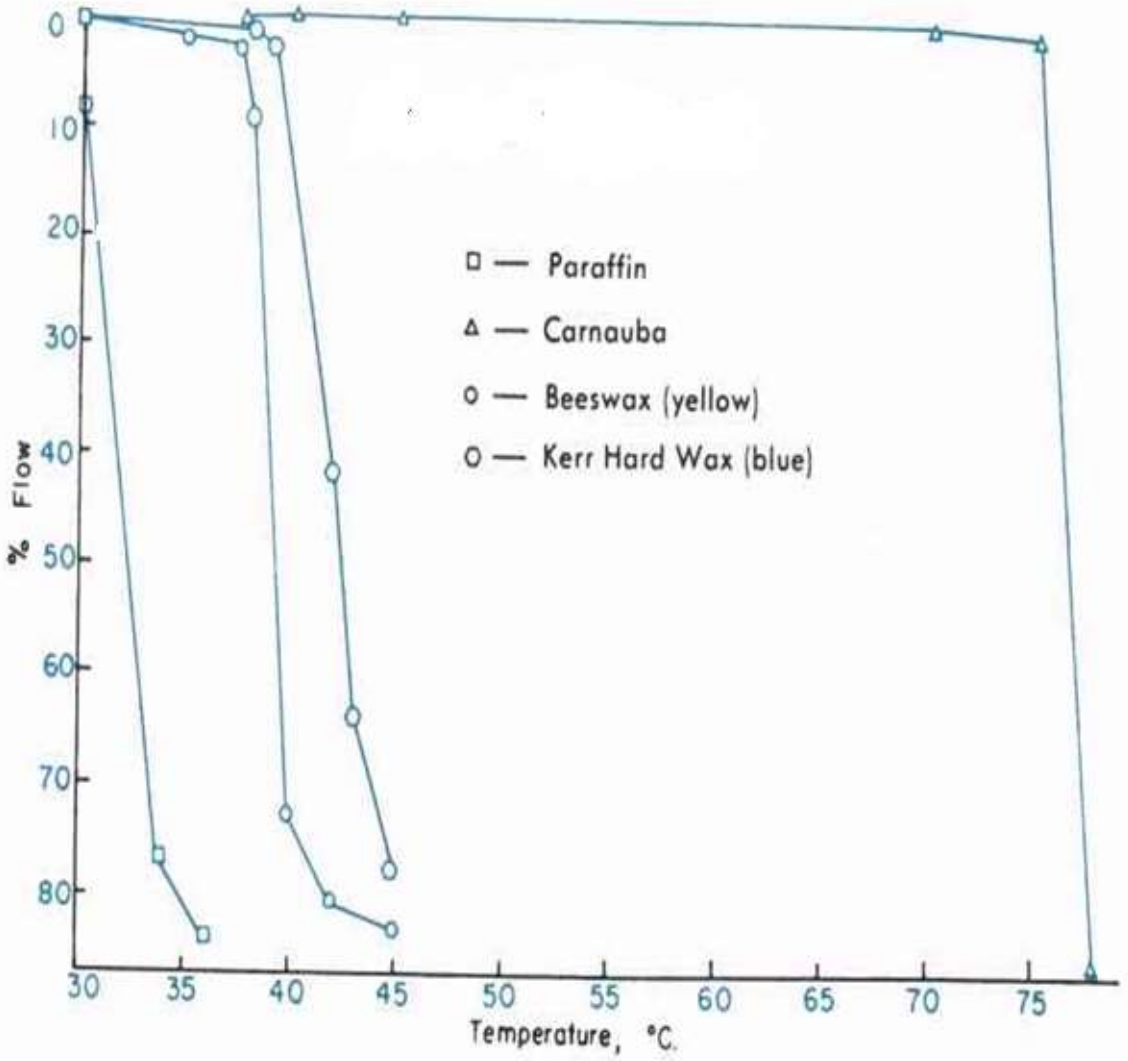
FLOW

- Flow is a change in shape or dimension in response to an applied force".
- It results by the slippage of molecules over each other.
- Flow is dependent on:

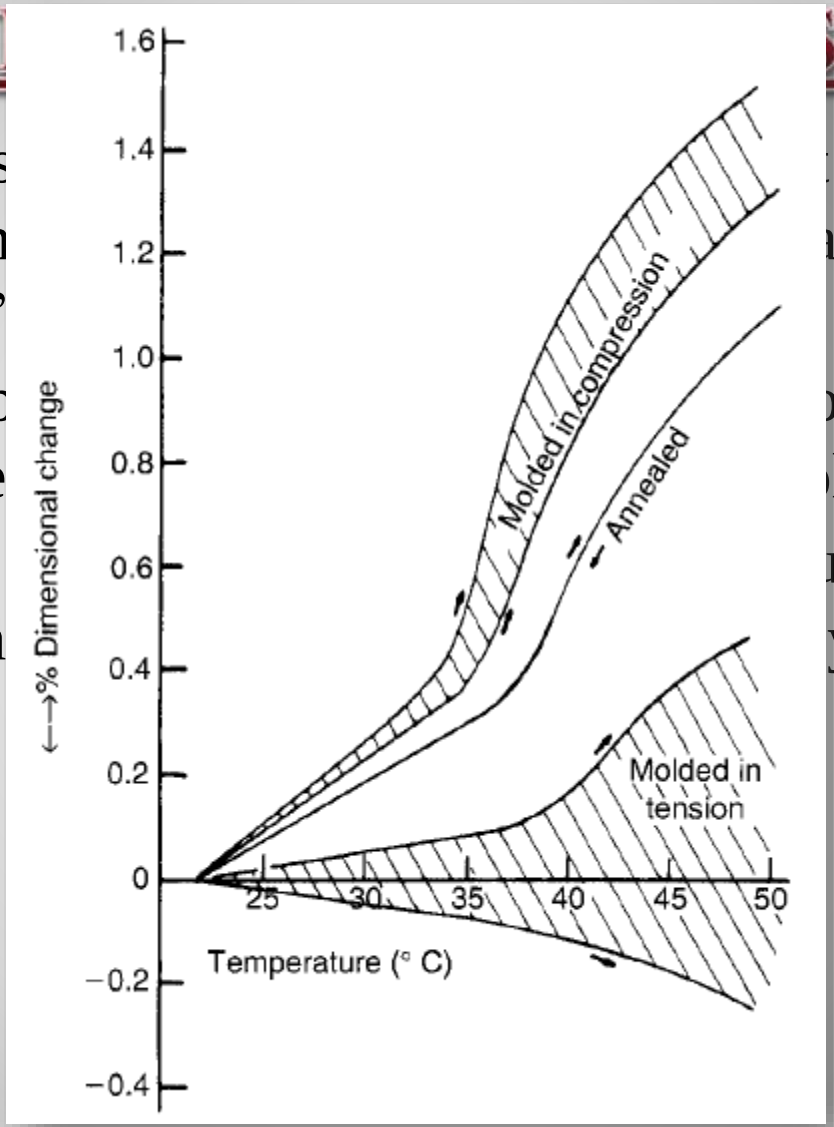
1. Temperature of the wax
2. Force applied
3. Time of force

- Flow is greatly increase as the melting point of the wax is approached.



R.G.CRAIG,EICK,PAYTON; J.Dent.reserch,1965, vol-44, no-6,1308-1316.

- " It is the stres of manipulation during heatin arving or other manipulation"
- During manip ons change. and cannot change lid state.
- This stresses ure of the wax increases & th y



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- Precautions to prevent the formation of stresses

1. Wax patterns should be carved with a warm (37˚c) instrument.
2. Waxes should not be carved or burnished at temperatures well below their melting range.
3. Melted waxes should be added in small increments to prevent rapid or uneven cooling.

DUCTILITY

- It is the property that has been related to the workability of a material
- Ductility increases as the temperature of the wax is increased
- Waxes with lower melting temperature have a greater ductility.

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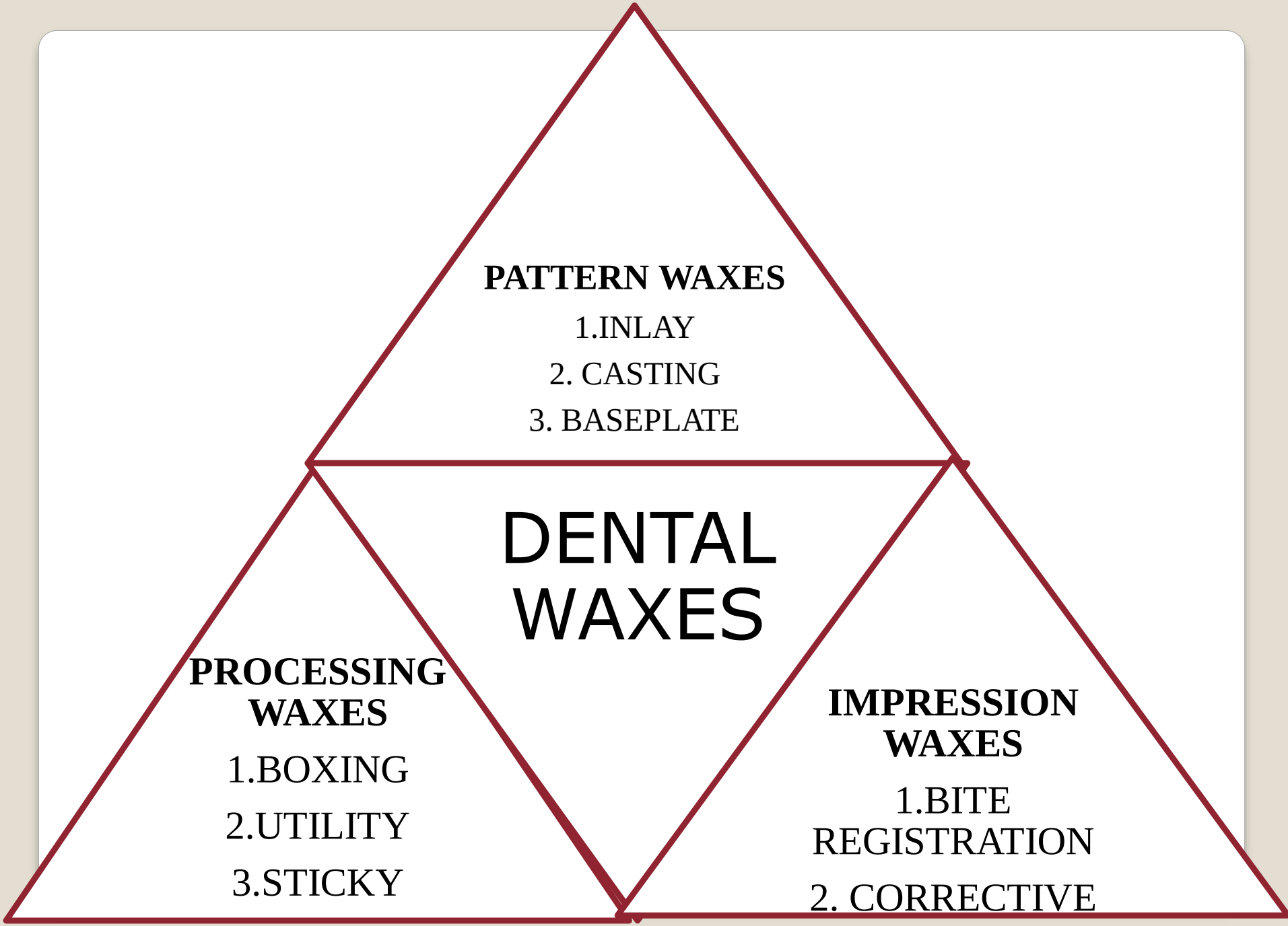

PATTERN WAXES
1.INLAY
2. CASTING
3. BASEPLATE
DENTAL WAXES
PROCESSING WAXES
1.BOXING
2.UTILITY
3.STICKY
IMPRESSION WAXES
1.BITE REGISTRATION
2. CORRECTIVE

INLAY PATTERN WAX

- A pattern of the wax is first constructed that duplicates the shape and contour of the desired casting .
- —A specialized dental wax that can be applied to dies to form direct or indirect patterns for the lost-wax technique, which is used for the casting of metals or hot pressing of ceramics.

Phillips 12th edition

Composition of Inlay Wax

- PARAFFIN -60%
- CARNAUBA -25%
- CERESIN -10%
- BEES WAX -5%
- DAMMAR RESIN – 3%
- MICROCRYSTALLINE WAX

PARAFFIN WAX

- ✓ Main ingredient
- ✓ Establish melting point

CARNAUBA WAX

- ✓ Increases melting range, hardness
- ✓ Gives glossiness to surface

CERESIN WAX

- ✓ Increases toughness
- ✓ Easy to carve

DAMMAR RESIN

- ✓ Natural derivative from pine trees
- ✓ Increases resistance to cracking
- ✓ Gives a smooth surface

Available as:

- Deep blue, green or purple rods or sticks about 7.5 cm long & 0.64 cm in diameter
- Small pellets or cones .
- In small metal ointment jars
- Even in bulk

Gold inlays, crowns & bridge units are formed by a casting process that uses the lost- wax technique.

A pattern wax is first constructed

The pattern then is embedded in a gypsum-silica investment material to form a mold with an sprue leading from the outer surface of the investment mold to the pattern.

The wax is subsequently eliminated by heating & softening and the mold is further conditioned to receive the molten metal..

DESIRABLE PROPERTIES

1)When softened ,wax should be uniform.
2)color should be in contrast to die.
3)Should not show flakiness
4)Should be carvable without chipping off.
5)No wax residue should be left in mould
(ANSI/ADA at 500^0 C no residue is left.)
6) Should be dimensionally stable.
7)Should have good thermal conductivity.

TYPES OF INLAY WAX

- BY TECHNIQUE

Revised ANSI/ADA Specification No. 4 for dental inlay casting wax.

- TYPE I-DIRECT
- TYPE II-INDIRECT

- BY FLOW

1)HARD

2)REGULAR

3)SOFT

Flow can be reduced by

- ✓ more carnauba wax
- ✓ higher melting paraffin waxes.

Flow

TABLE 14-5 Flow Requirements for Dental Inlay Casting Wax (Flow, in %)

	Wax Temperature					
	30° C	37° C	40° C		45° C	
	Maximum	Maximum	Minimum	Maximum	Minimum	Maximum
Type 1 (soft)	1.0	—	50	—	70	90
Type 2 (hard)	—	1.0	—	20	70	90

Adapted from Dental casting wax ISO 1561:1995(E).

- The working temperature for making direct wax pattern must not to be so high as to cause damage to the vital tooth structure.
- At mouth temp., direct inlay wax must have essentially no flow to minimize the possibility of distortion of the pattern during removal from the tooth cavity

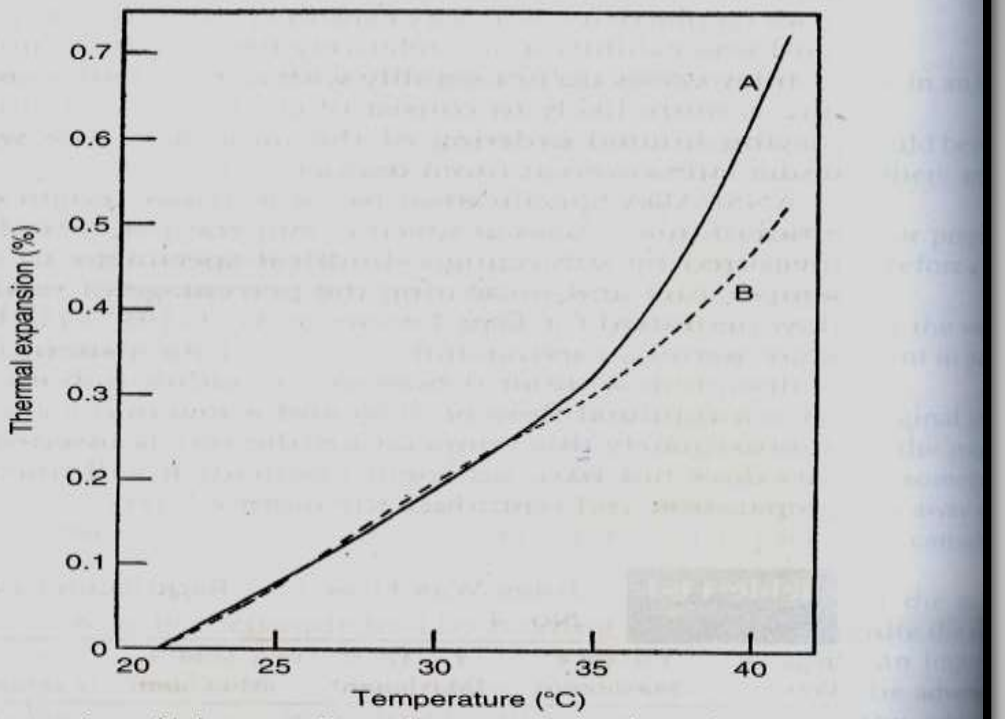
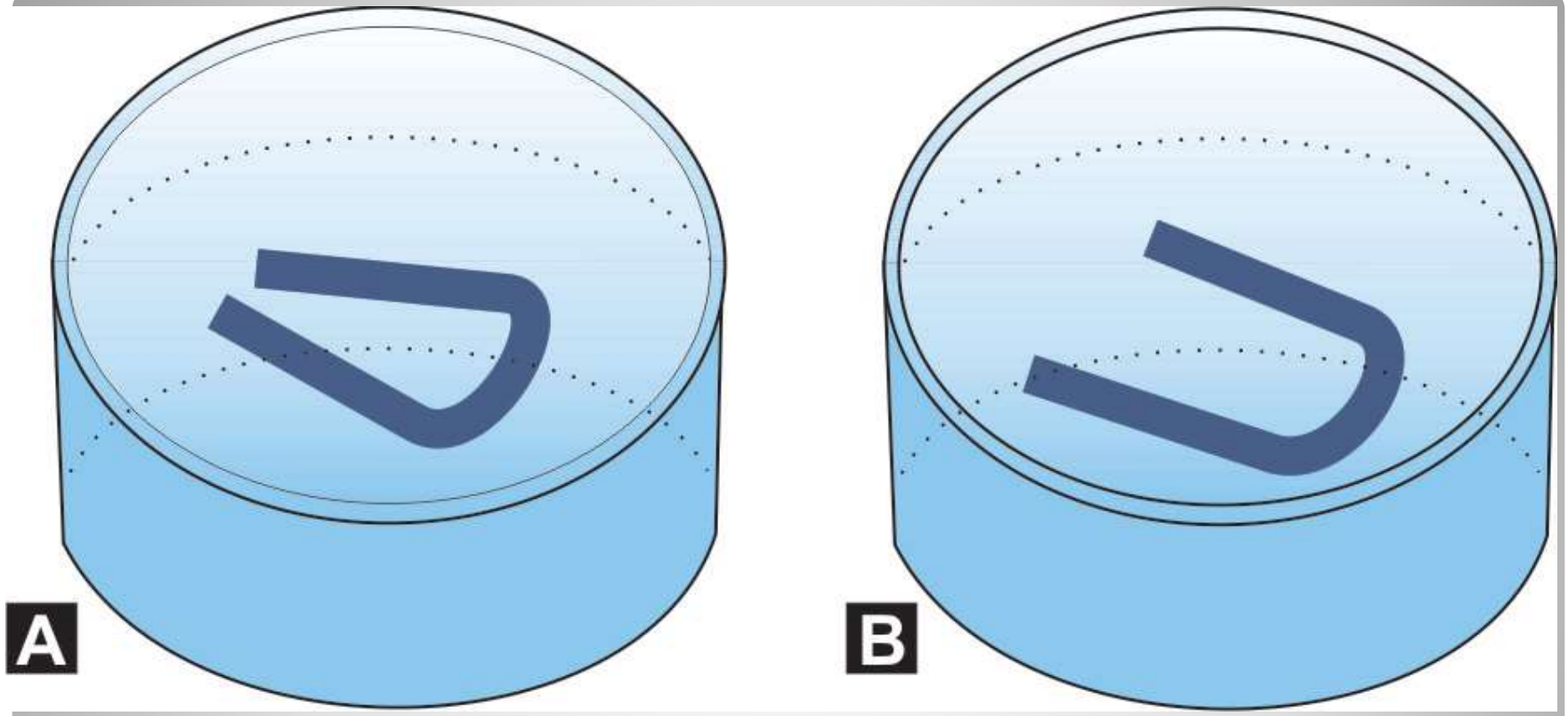


Fig. 11-2 Thermal expansion of inlay wax. **Curve A** represents the thermal expansion when the wa held under pressure while it is cooling from the liquid state. When the same wax is allowed to cool without pressure and again heated, **curve B** results.

Wax warpage

- Waxes like other thermoplastic materials have elastic memory effect
- They tend to partially return to their original shape
- The distortion is increased as the time and the temperature of storage increases.
- Related to the release of residual stress developed in the pattern during the process of formation.
- In general the higher the temperature of the wax at the time the pattern was adapted and shaped, the less will be the tendency for distortion.



Demonstration of wax distortion.
(A) Bent stick of wax kept in water at room temperature,
(B) Straightened appreciably after 24 hours.

MANIPULATION OF INLAY WAX

- DIRECT TECHNIQUE
  - Wax pattern is directly prepared inside the oral cavity , the pattern is then invested
  - Reduces time
- INDIRECT TECHNIQUE

Following are the steps:-

1. Die is prepared from the impression
2. Die Spacer Coating
3. Dipping Method
4. Addition Technique
5. Polishing

NOTE: All wax patterns should be invested as soon as possible to avoid distortion.

SCULPTURING WAXES

- Low shrinkage
- Quick to apply and quick to cool
- High surface tension
- Excellent carving properties
- Wide assortment of colors

AVAILABLE AS

1)UNIVERSAL

2)Specific purpose like

a)occlusal

b)cervical

c)underlay

UNIVERSAL

- Ideally suited for quick coverage of large areas with wax
- Low surface tension
- Low melting point
- Small contraction on hardening
- Excellent flow properties

OCCLUSAL

- High strength
- High rigidity
- High surface tension
- Opaque appearance

CERVICAL

- Low shrinkage
- Stable
- Can be adapted precisely and thinly to the preparation border
- Excellent carving properties

UNDERLAY

- For small undercuts and cavity coverage
- Significantly softer than cervical wax
- Gentle elasticity
- Good adaptation and carving properties

DIPPING WAX

- High precision via low shrinkage Optimum viscosity at 89–91°c
- Precise-fitting copings with an even layer thickness
- High stability and elasticity
- Easy to cut off the preparation border

CASTING WAX

- Casting wax contain various waxes with desired properties for making wax patterns to be formed into metal castings.

-(GPT-8)

COMPOSITION: Variable

Paraffin wax 25%

Ceresin wax 25%

Bees wax 25%

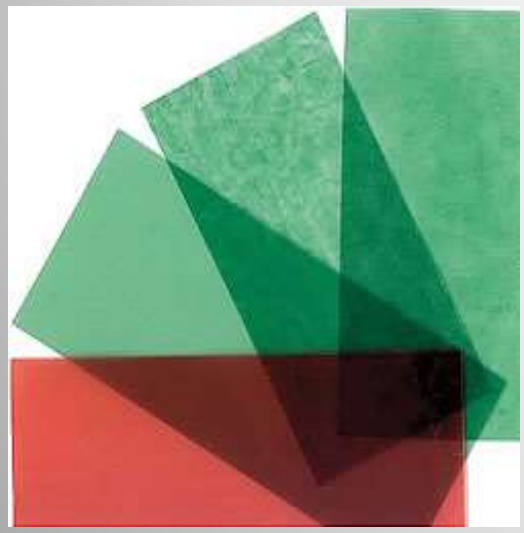
Resin 25%

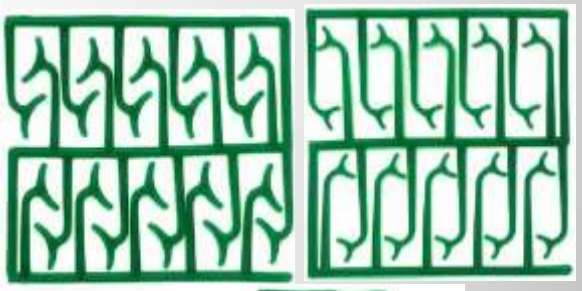
USES:

- To make patterns of the metallic framework of cast partial dentures.

Available as:

1. Sheets
2. Readymade shape – round , half round, half pear shaped, rods, wires of various gauges. 10 cm length.
3. In bulk





Types: casting waxes:

(Federal specification no. U-W-140)

- Class A – 28 gauge , pink
- Class B- 30 gauge , green
- Class C – ready-made shapes , blue

WORKING PROPERTIES

- Pliable and readily adaptable at 40^{o} to 45^{o}C
- It accurately records the surface against which is pressed.
- Shall not be brittle on cooling
- Vaporize at 500^{o} C, leaving no film other than carbon.

CRAIG'S RESTORATIVE DENTAL MATERIALS , John M Powers, Ronald L Sakaguchi: 12TH EDITION: Pg no:350

Flow :Casting wax

- Maximum 10% flow at 35˚c
- Minimum 60% flow at 38˚c

Ductility :casting wax

- Ductility of the casting wax is high
- Casting waxes be bent double on itself without fracture at a temperature of 23˚c .

Baseplate wax

- Dental wax provided in sheet form that is used to establish the initial arch form in the construction of complete dentures. (GPT-8)

COMPOSITION:

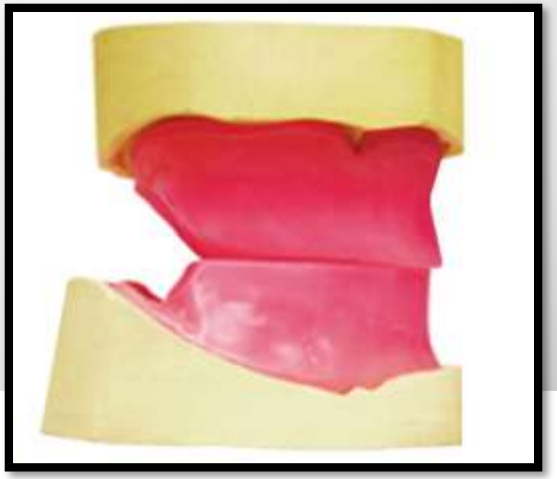
Paraffin wax	75%
Bees wax	12%
Shellac resin	3%
Aluminum fibers	
Polystyrene	

SUPPLIED AS:

- Sheets of pink or red color.

Uses of baseplate wax:

1. To make baseplate tray to establish vertical dimension, plane of occlusion & initial arch form in the technique for the complete denture restoration.
2. Used to form all or a portion of the tray.
3. To produce desired contour of the denture after teeth are set in position
4. Patterns for orthodontic appliances and prosthesis.



Types:
ANSI/ADA Specification No.24

- Type 1 : soft wax for building contours & veneers.
- Type 2 : hard wax to be used for patterns to be tried in the mouth in temperate climates
- Type 3 :extra-hard wax for patterns to be tried in the mouth in tropical weather.

PROCESSING WAXES

- Used primarily as auxillary aids in the construction a variety of restorations and appliances either clinically or in the laboratory
- Waxes used in the fabrication of models and impressions and in soldering

Types:

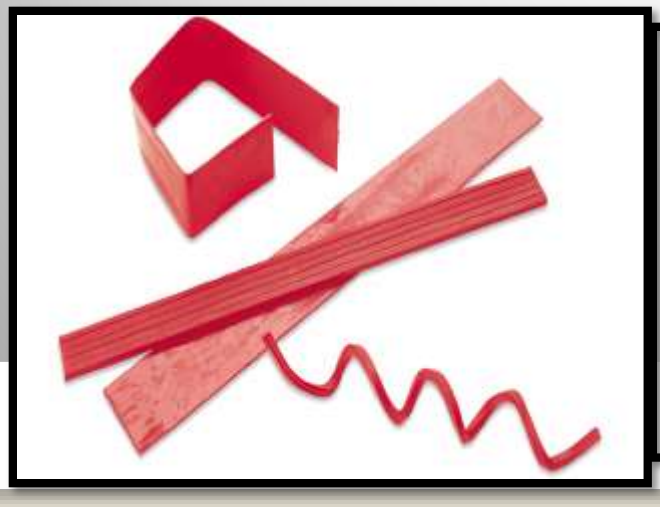
a) Boxing and Beading Wax
b) Utility Wax
c) Sticky Wax

BOXING AND BEADING WAX

- Beading Wax is adpated around the impression borders
- Boxing wax is used to build up vertical walls around the impression
- They are pliable and can be adapted easily. A slight tackiness allows it to stick to the impression.

SUPPLIED AS:

- Sheets & Sticks



Composition of Beading and Boxing

- Bees Wax
- HydroCarbon Wax

Advantages of Beading and Boxing

- Gives definite form, thickness to base and borders
- Preserves anatomic contours and extensions
- It conserves the artificial stone

Working properties:

- Federal specification No U-W -138
- Smooth, glossy surface on flaming
- Pliable at 21^{o} C, retain shape at 35^{o} C
- Seals easily to plaster with hot spatula

CRAIG'S RESTORATIVE DENTAL MATERIALS , John M Powers, Ronald L Sakaguchi: 12TH EDITION: Pg no:353

UTILITY WAX

- composition

  beeswax,

  petrolatum

  soft waxes

Uses

A standard perforated tray for use with the hydrocolloids may easily be brought to more desirable contour by utility wax.

Utility wax: Working properties

- Federal Specification No U-W- 156
- Pliable at 21^{o} c to 24^{o}c which makes it workable and easily adaptable at normal room temperature.
- Tacky at 21^{o}c to 24^{o}c, sufficient adhesion to build up
- Flow should not be less than 65% or more than 80% at 37.5˚c

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STICKY WAX

- COMPOSITION:

  Bees wax

  Rosin

  Natural resins (Gum Dammar)

- SUPPLIED AS:

  Sticks of bright yellow/ orange color.

USES OF STICKY WAX

- Used to assemble metallic or resin pieces temporarily in position
- Align fractured parts of acrylic dentures prior to denture repair.
- Temporarily join the metals prior to soldering.

Working properties:

- It is adhesive, firm & brittle at room temp.
- Sticky when melted with maximum flow 5% at 30 degrees and 90% at 43 degrees
- Not more than 0.2% residue on burnout
- Not more than 0.5% shrinkage from 43^{o} to 28 C^{o}

CRAIG'S RESTORATIVE DENTAL MATERIALS , John M Powers, Ronald L Sakaguchi: 12TH EDITION: Pg no:354

Carding wax

- Was original material on which porcelain teeth were fixed when received from manufacturer

STANSBURY described first *functional chew-in technique* which is a method to achieve harmonious balanced occlusion.

- He suggested using compound maxillary rim trimmed buccally and lingually so that occlusion is free in lateral excursion
- carding wax is added to compound rim and instruct the patient to perform eccentric chewing movements.
- Carding wax is slowly molded to functional movements while compound in central fossa acts as guide to preserve vertical dimension

Essentials of complete denture –**SHELDON WINKLER** 2nd edition

Fabrication of Radiographic Template

1. A diagnostic impression using alginate is made of the edentulous mandibular ridge .
2. Two metal balls was placed on the premolar area of ridge and fixed with help of carding wax.
3. A template if fabricated over the metal balls using autopolymerising resin

Fig. 1: Metal balls attached to mandibular cast with carding wax

Fig. 2: Radiographic stent made with self-polymerizing acrylic resin

IMPRESSION WAX

- Any thermoplastic wax used to make impressions for dental use(GPT -8)

Types:

- Corrective Impression Wax
- Bite Registration Wax

CORRECTIVE IMPRESSION WAX

- COMPOSITION:

  Paraffin wax

  Bees wax

  Ceresin

  Metal particles.

PROPERTIES:

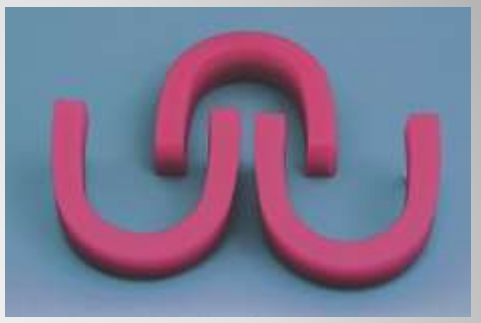
- The flow at $37^{O}C$ is 100%.
- The waxes distorts on removal from the mouth.
- They should pour immediately.

CORRECTIVE IMPRESSION WAX

USES:

- As a wax veneer on original impression to contact & register details of soft tissues.
- To make functional impression of free end saddles (class 1 & class 2 partial dentures).
- To record posterior palatal seal in dentures.

BITE REGISTRATION WAX



COMPOSITION:

Paraffin wax

Bees wax

Ceresin

Aluminum or copper particles

SUPPLIED AS:

- U-shaped rods or wafers.

USES:

- To record the relationship b/w upper & lower teeth.

BITE REGISTRATION WAX

Advantages:

- Easy to use
- Used in patients with poor muscle control
- Do not offer resistance to jaw closure

Disadvantages:

- Distorts easily

Summary

General Class of WAXES:	Dental Name:	A.D.A. Specification Name:	General Application:	General Form:	General Color:
PATTERN	• Inlay Wax	Type A (Hard)	Direct patterns in mouth	Sticks, Cones	Blue, Green, Purple
		Type B (Med) - Type I (Hard)	Indirect patterns on dies	Sticks, Cones, Other	"
		Type C (Soft) - Type II (Reg)	"	"	"
	• Casting Wax		Acrylic buildups, clasps, bars, etc.		Blue, Pink, White
	• Baseplate Wax	Type I	Impr in cool climates	Sheets	Pink
		Type II	Impr in warm climates	"	"
		Type III	"	"	"
IMPRESSION	• Corrective Wax		Edentulous Impr.	Sheets, sticks	Or, Wh, Gr
	• Biteplate Wax		Occlusal Regist.	"	"
PROCESSING	• Boxing Wax		Denture master casts, Impr tray borders	Sheets, ropes	Gr, Black
	• Utility Wax		Impr tray borders	Ropes	Or, Dark red
	• Sticky Wax		Sprues, wax connection	Sticks	Dark colors

CONCLUSION

- Dental Waxes form an essential prerequisite in restorative dentistry as most of the procedures require wax in one or the other form. It is mandatory for the operator to fully comprehend the workability & application of these waxes to make dental treatment procedures more effortless and effective.

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Thank you… ☺