Dental Waxes

Learning objective

- By the end of the sessions student will come to know about classification ,characteristics of different waxes .

CONTENT

- Introduction
- Chemical nature of waxes
- Classification
- Characteristic properties
- Pattern waxes
- Inlay waxes
- Casting wax
- Base plate wax
- White/ivorian wax
- Processing waxes
- Beading & boxing wax
- Utility wax
- Sticky wax
- Carding wax
- Block out wax
- Carving wax
- Impression Waxes
- Bite registration wax
- Conclusion

Introduction

- There are many varieties of waxes used, both in clinic and laboratory.
- Each has particular property depending upon the use.
- Their basic constituent are esentially similar but the exact proportion varies.

Chemical nature of waxes

- Complex combinations of organic compounds of high molecular weight such as Hydrocarbons and esters

- Other wax additives are montan, gums, fats,oils, resins and synthetic resins.

Classification

I. According to source/origin :

1) Natural waxes

i) Mineral waxes : paraffin
microcrystalline
bransdahl
ceresin
ozokerite
monton

Classification

ii) Plant waxes : carnauba

candelilla

ouricury

Japanese wax

cocoa butter

iii) Insect waxes : beeswax

iv) Animal waxes : spermaceti

Classification

2) Synthetic Waxes : acrawax

aerosol, OT

castor wax

flexowax C

epolene N-10

albacer

aldo 33

durawax

Classification

3) Additives

i) Fats : stearic acid

glyceryl-tristearate

Oils : terpentine

ii) Natural Resins : dammar

rosin

sandarac

mastic

kauri

Classification

iii) Synthetic Resins : elvax

polyethylene

polystyrene

Classification

II. According to applications :

Pattern	Processing	Impression
■Inlay ■Casting ■Base plate ■Ivorian	■Beading & Boxing ■Utility ■Sticky ■Block out ■Carving	■Corrective ■Bite registration

Characteristic Properties

1) Melting range
2) Thermal expansion
3) Mechanical properties
4) Flow
5) Residual stress
6) Ductility

Melting Range

- Waxes have melting range rather than specific melting point

  Eg. Paraffin wax : 44-62^{o} C

  Carnauba wax : 50-90^{o}C

- By varying compositions, it is possible to change melting ranges suitable according to use

Thermal Expansion

- Largest values of coefficient of thermal expansion (150-400x10^{-6}/^{o}C)
- Contraction of wax pattern by 0.3-0.8% when cooled from 37^{o}C to room temperature leading to inaccuracy of finished restoration
- Poor thermal conductors :: suitable kneading & time is required to heat them uniformly & cool them to room temperature

Mechanical Properties

- Modulus of elasticity, proportional limit, flexibility & compressive strength are low
- improves with rise in temperature

Flow

- Flow increases as melting range of wax is approached

- Depends upon

1.temperature of the wax

2.external deforming force

3. the time the force is applied

Residual Stress

- Waxes tend to return to their original shape after manipulation :: elastic memory.

- When wax is held under compression during cooling, atoms & molecules are forced closer together than when they are under no external stress. After it is cooled on room temp & load is removed, motion of molecules is restricted, & this restriction results in residual stresses in it.

Residual Stress

- When wax is heated, release of residual stresses adds to normal thermal expansion, & total expansion is greater than normal

Ductility

- Increases with an increase in temperature
- Waxes with low melting temperatures have greater ductility than those with higher melting temperature

Pattern Waxes

- Used to prepare predetermined size & contour of an artificial dental restoration which is to be constructed of a more durable material such as cast gold alloys, Co-Cr-Ni alloys or poly methyl methacrylate resin
- Types : Inlay waxes

  Casting waxes

  Base plate waxes

Inlay Waxes

- Used to prepare wax patterns of inlays, crowns, & bridges for the lost wax casting technique.
- Dispensing : supplied as deep blue or purple rods or sticks of about 7.5cm length & 3mm diameter. Also supplied in the form of small pellets & cones.

Classification

- According to ADA specification No. 4

Type I : medium wax, used in direct technique

Type II : soft wax, used in indirect technique

Composition

Ingredients	Weight %	Functions
1. Paraffin wax	60 %	Used to establish melting point. Likely to flake when trimmed & does not give glossy surface
2. Carnauba wax	20 %	Increases melting range, decreases flow at mouth temperature provides glossiness of wax surface
3. Ceresin wax	5 %	Improves carving characteristics & modifies the toughness

Composition

Ingredients	Weight %	Functions
4. Bees wax	5 %	Reduces flow at mouth temperature & reduces its brittleness
5. Gum dammar	3 %	Improves surface smoothness, gives more resistance to flakiness & provides toughness
6. Synthetic resins	2 %	Gives stable flow properties to the wax

Desirable Properties

- When softened, wax should be uniform
- Color should contrast with die material or prepared tooth
- There should be no flakiness or surface roughening when wax is molded for softening
- In Type I waxes, it should be sufficiently plastic at a temperature slightly above mouth temperature & become rigid at mouth temperature

Desirable Properties

- It should have a flow not less than 70% at 45°C & not more than 1% at 37°C
- Wax should not pull or chip with the carving instrument when it is carved
- After the mold has been formed, wax should burn out, forming carbon, which is later eliminated by oxidation of volatile gases
- Wax pattern should be completely rigid & dimensionally stable at all times until it is eliminated.

Properties of Inlay Wax

- Flow
- Thermal conductivity
- Coefficient of thermal expansion
- Wax distortion

Flow

- The flow of wax is a measure of its potential to deform under a small static load, even that associated with its own mass
- Type I inlay wax exhibits marked plasticity or flow at a temperature slightly above mouth temperature

- Maximum flow for Type I waxes at 37°C is 1%
- Both Type I & Type II waxes must have flow between 70% & 90% at 45°C, i.e., when waxes are inserted into the prepared cavity

Thermal Conductivity

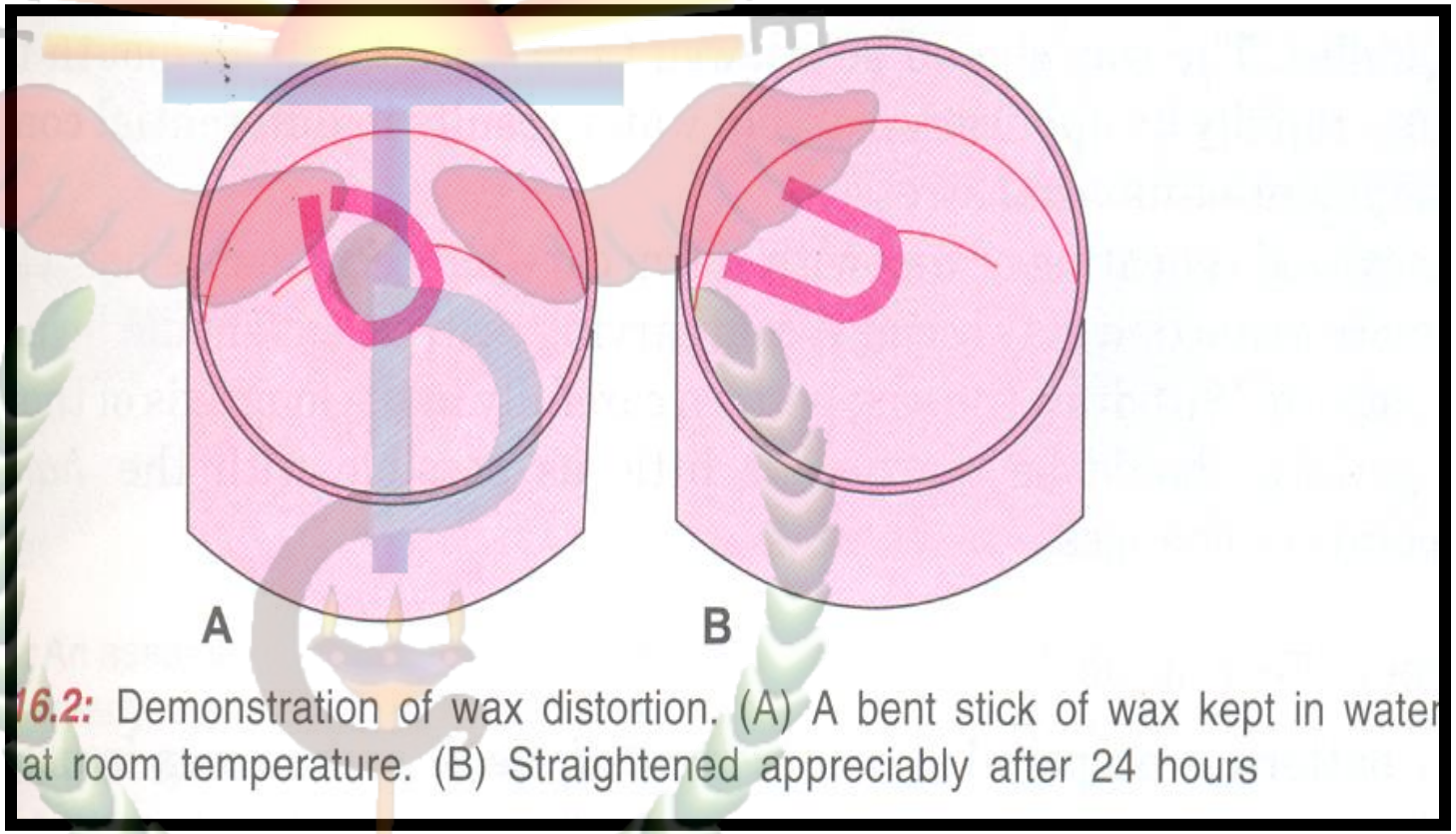
- Thermal conductivity of waxes is low, sufficient time is required both to heat them uniformly throughout & to cool them to body or room temperature

Coefficient of Thermal Expansion

- Inlay waxes have a high coefficient of thermal expansion
- Linear expansion of 0.7% with increase in temperature of 20°C & contract as much as 0.35% when cooled from 37°C to 25°C
- ADA specification No.4 contains no requirements for thermal expansion for Type II waxes. A maximum of 0.6% linear change in dimension is permitted for Type I waxes when they are heated from 25°C to 37°C

Wax Distortion

- Most serious problem



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

Wax Distortion

- Results from thermal changes & release of stresses that arise from :

1. Non-uniform contraction on cooling if wax is not held under uniform pressure
2. Occluded gas bubbles
3. Non-uniform heating during insertion in the cavity :: some parts of wax pattern may contract more than others when stresses are introduced
4. change of shape during molding, carving, & removal

Wax Distortion

- Methods to minimize wax distortion :

1. Proper selection of waxes (Type I for direct & Type II for indirect technique)
2. Soften the wax uniformly
3. Place the soften & molten increments quickly to bound with earlier increment
4. Invest the pattern immediately after removal from cavity (or store it in cold water in a refrigerator)

Manipulation
Direct technique (Type I wax)

- Wax is softened with dry heat over a flame (rather than in water bath) taking care not to volatize it
- It should be twirled until it becomes shiny
- Kneaded together & shaped to the prepared cavity
- Type I wax has adequate plasticity in a temperature range safely tolerated by the pulp

Manipulation
Direct technique (Type I wax)

- Hold under pressure until it sets either with finger or by the patient biting on the wax

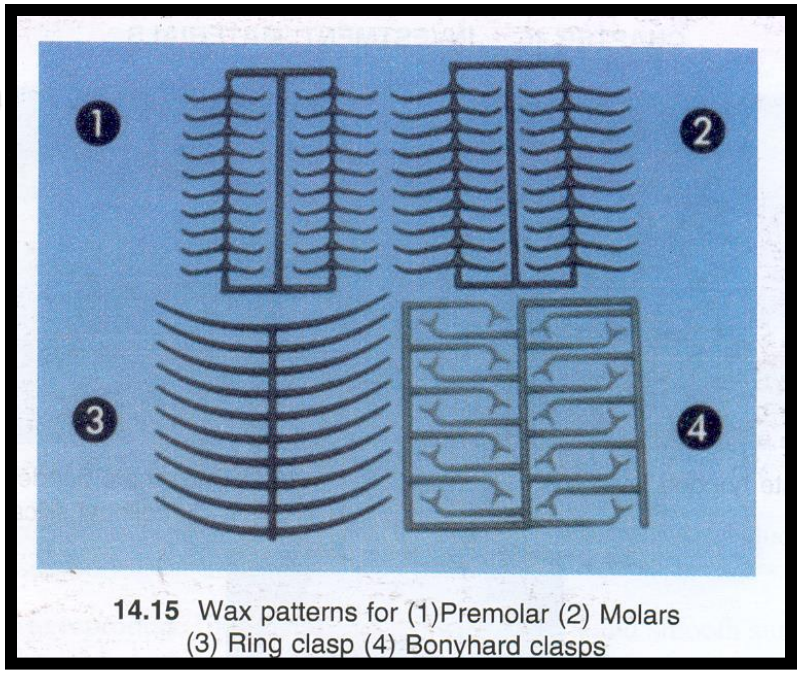
- Allow it to cool gradually at mouth temperature (not by cold water) & invest the pattern as early as possible

Manipulation
Indirect technique (Type I wax)

- Impression of prepared cavity is made with a rubber base impression material & die is made
- Die is coated with a lubricant (containing wetting agent)
- Melted wax may be added in layers with spatula or it may be painted on with a brush
- Prepared cavity is overfilled, & and wax is then carved to proper contour
- Wax pattern is removed & invested as early as possible

Casting Wax

- It is one of the pattern waxes used to prepare wax patterns for metallic framework of removable partial dentures
- They are highly ductile



14.15 Wax patterns for (1)Premolar (2) Molars (3) Ring clasp (4) Bonyhard clasps

- Mode of supply :

Sheets : 0.4 & 0.32 mm thickness

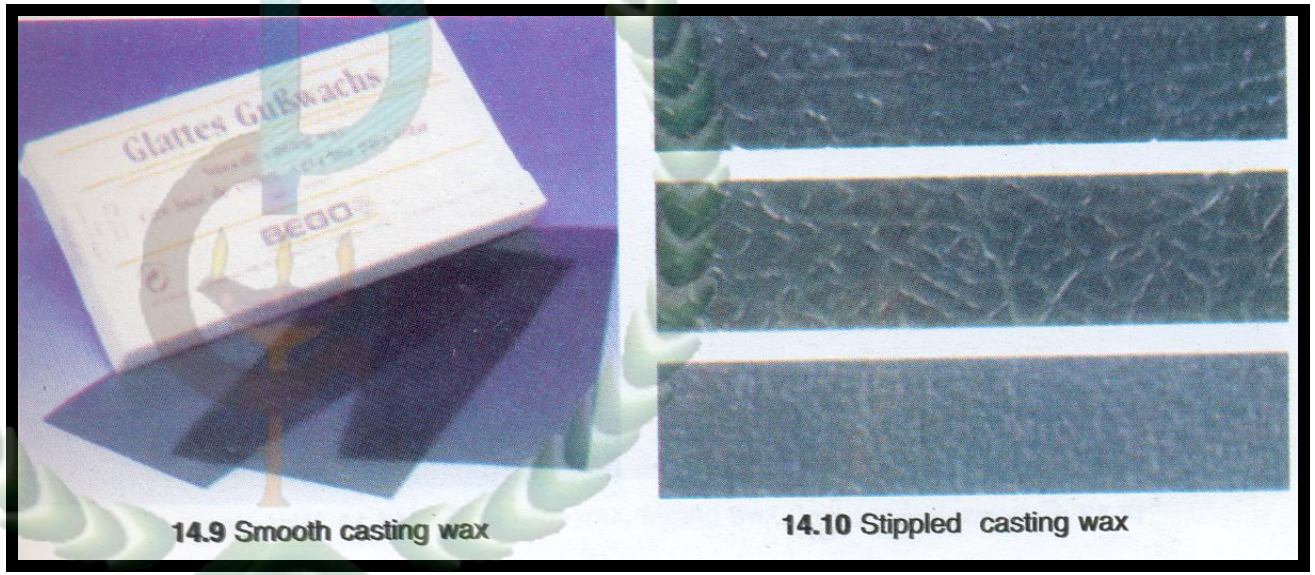
Readymade shapes : round rods (10 cm long)

half round rods

half pear shaped rods

Bulk form : for sprues & vent sprues

Preformed wax patterns : for cast RPD frameworks



14.9 Smooth casting wax

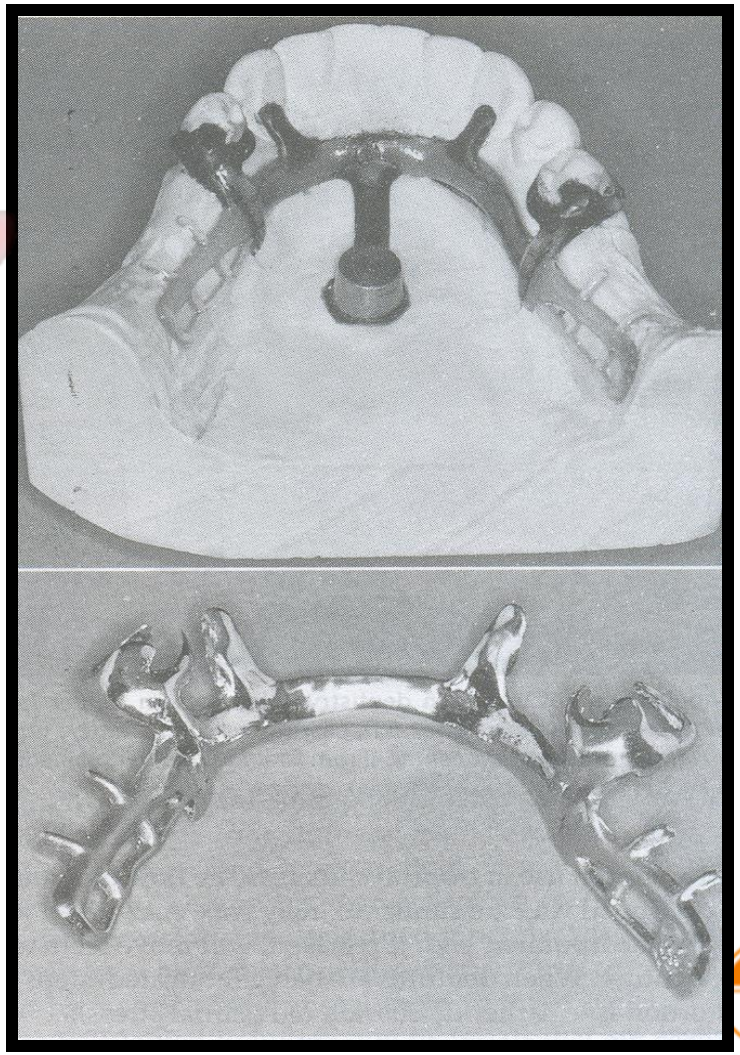
14.10 Stippled casting wax

Composition

Ingredients	Functions
1. Paraffin wax	To establish melting point
2. Ceresin wax	Improves carving characteristics
3. Bees wax	Reduces flow at mouth temp & reduces brittleness
4. Natural resins	Gives suitable flow properties to wax

Uses

- To make metallic framework of removable partial dentures
- To provide uniform minimum thickness in certain areas of partial denture framework



Base plate wax

- Also known as Modelling wax

- Mode of supply : sheets of pink/red color

  width- 7.5 cm

  length- 15 cm

  thickness- 0.13 cm

Composition

Ingredients	Weight %	Functions
1. Ceresin wax	80 %	Improves carving characteristics
2. Bees wax	12 %	Reduces brittleness & reduces flow at mouth temp & gives glossy surface
3. Natural or synthetic resin	3 %	Gives stable flow properties
4. Microcrystalline wax	25 %	To establish required melting point

Classification

- According to ADA specification No.24, they are classified as :

  Type I Soft - for building veneers

  Type II Medium – tried in mouths in temperate climatic conditions

  Type III Hard – for trial fitting in the mouth in tropical climates

Uses

- To make occlusion rims, which is used on base plate to establish vertical dimensions, plane of occlusion & initial arch form in complete denture fabrication
- To produce desired contour of denture after teeth are set in position
- To make patterns for orthodontic appliances & prosthesis other than complete dentures
- To check various articulating relations in the mouth & to transfer them to mechanical articulators

White/Ivorian Wax

- Used for making patterns to simulate a veneer spacing

- For diagnostic wax-up

Processing Waxes

- Used mainly as accessory aids in construction of a variety of restorations & appliances either in the clinic or in the laboratory
- These are :

  Beading & Boxing wax

  Utility wax

  Sticky wax

  Carding wax

  Blockout wax

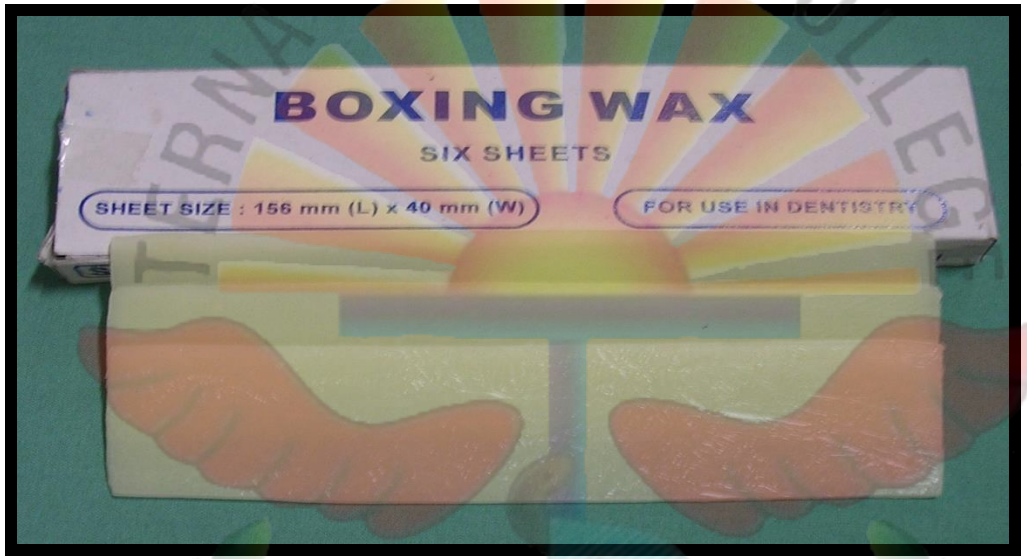
  Carving wax

Beading & Boxing Wax

- Used mainly to bead & box the impression to produce desired size & form of the base of the cast

- Mode of supply :

Boxing wax :: Sheets of width- 3 cm

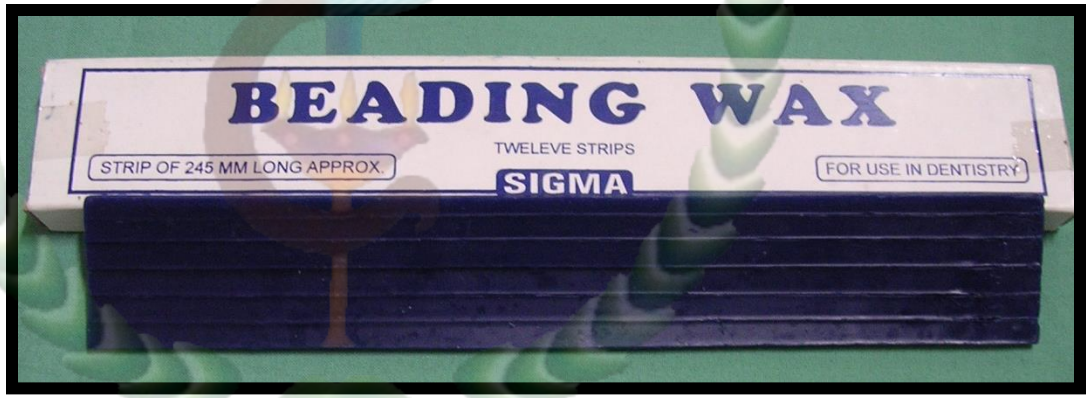


15 to 30 cm

ss- 3 mm

Beading wax :: Ropes of thickness- 3 to 4 mm

length – 20 to 30 cm

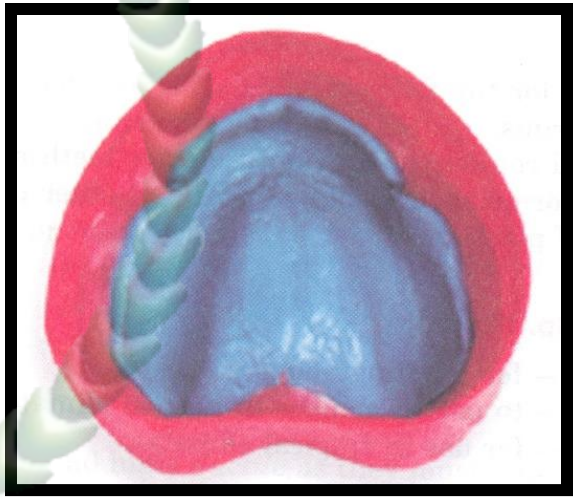


Properties

- Preserves the extensions
- Controls the form & thickness of the base of cast
- Can be adapted easily as it is pliable
- Its tackiness allows it to attach to the impression
- It conserves the dental stone

Adaptation to the Cast

- Beading wax is adapted around the periphery of the impression
- Should be appx. 4 mm wide & 3-4 mm below the borders of the impression
- Height is adjusted until a boxing wax strip extends appx. 13 mm above the highest point on the impression



Uses

- To build up vertical walls around the impression
- To produce desired size & form of the base of the cast
- To preserve certain landmarks of the impression

Utility Wax

- Consists mainly of bees wax, mineral wax & other soft waxes in various proportions
- Can be molded at room temperature, as it is pliable
- Its tackiness allows it to stick to the impression
- Mode of supply : cakes, sticks & sheets

Uses

- To provide desirable contour to a perforated tray for use with hydrocolloids

- To build up flange of tray & raise the palatal portion of the tray posteriorly in recording impression of patients with deep palate

Sticky Wax

- Also known as adhesive wax or model cement
- Consists of yellow bees wax, rosin & natural resins such as gum dammar
- It is sticky when melted & adheres closely to the surface upon which it is applied
- At room temperature, it is free from tackiness & is brittle

Uses

- To assemble metallic pieces temporarily in position or to seal a plaster splint to stone cast in the process of forming porcelain facings
- To join fragments of broken denture before repair
- As it is brittle at room temperature, it will break rather than become distorted if the assembled pieces move– these pieces can then be rejoined in their proper relationship, rather than unknowingly using it in a distorted relationship

Carding Wax

- Used for attaching broken parts of the denture before denture repair procedure
- Used to join metal pieces in soldering procedures
- Used to attach artificial teeth

Block out Wax

- Used to fill voids & undercuts during fabrication of removable partial denture

Carving Wax

- Used for tooth carving procedures in dental anatomy, laboratory procedures

Impression Waxes

- Used to record non-undercut edentulous portions of the oral cavity & are generally used in combination with other impression materials like polysulfide, ZOE impression paste or impression compound
- Important impression waxes are :

  corrective impression waxes

  bite registration waxes

Corrective Impression Waxes

- Used as a wax veneer over an original impression to contact & register the details of the soft tissues
- Consists of paraffin, ceresin & bees wax
- Flow at 37^{o}C is 100 % (can get distorted while removing from the mouth)

Corrective Impression Waxes

- These waxes are designed to flow at mouth temperature
- Four types of waxes can be used for this technique

1) IOWA Wax , white , by Dr. Smith
2) Korecta Wax No.4 , Orange , by Dr, O.C. Apllegate
3) H-L physiologic paste , yellow-white , by Dr.C.S.Harkins
4) Adaptol , green , by Dr. N.G.Kaye

Corrective Impression Waxes

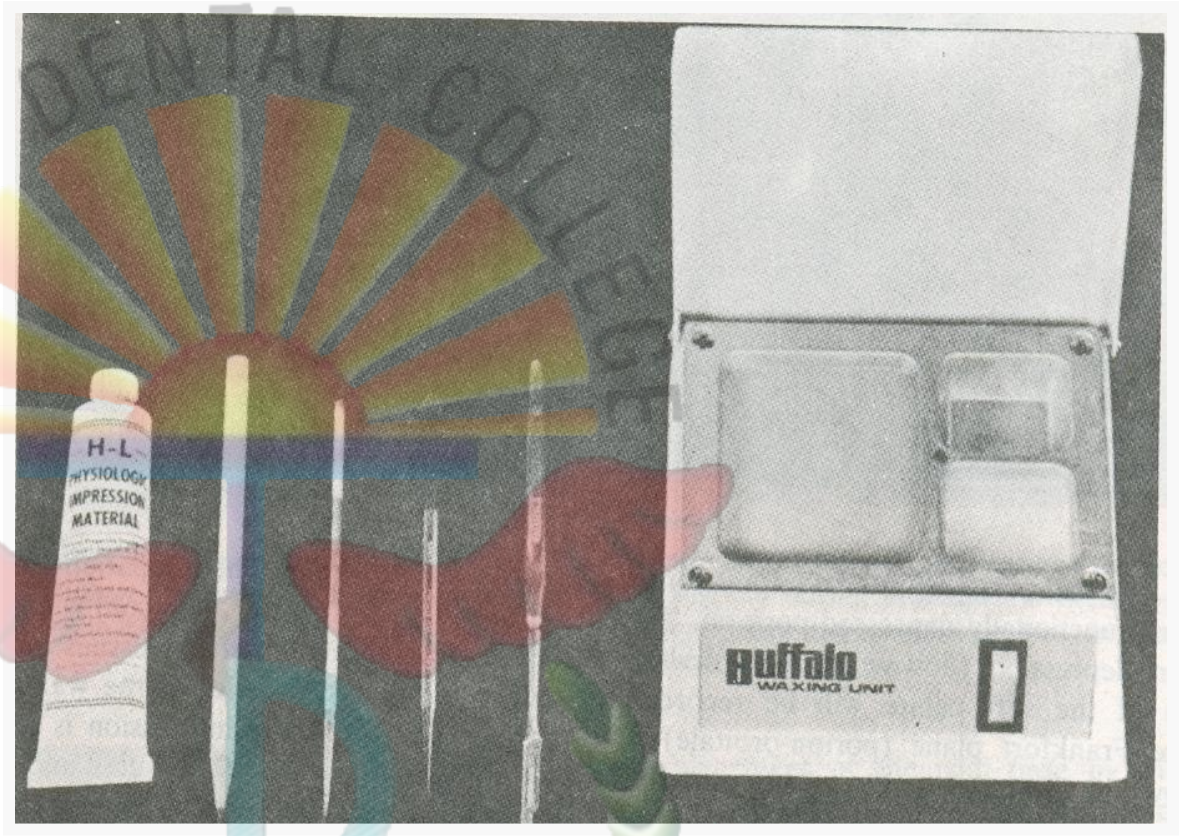
- Advantages –

1) It is a physiologic method displacing the tissues within their physiologically acceptable limits
2) Overcompression is avoided
3) They can be used as corrective material for imperfections in other impressions, particularly those of Zinc oxide – Eugenol paste
4) They flow enough to prevent overdisplacement

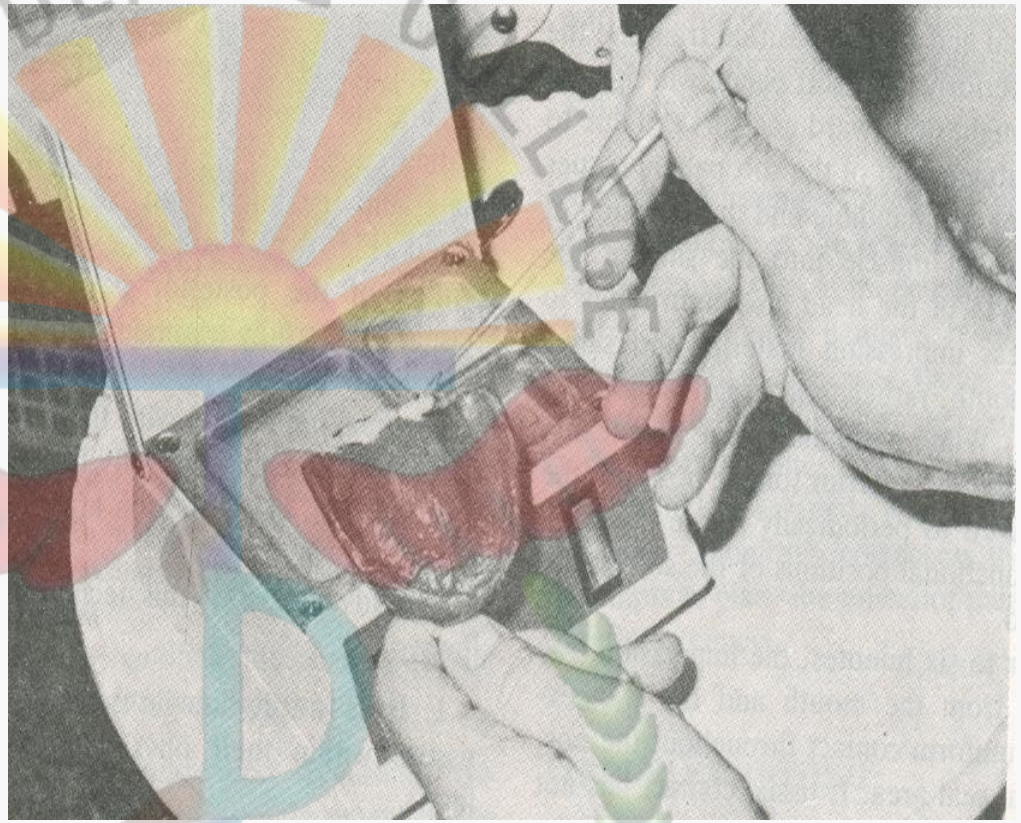
Corrective Impression Waxes

- Disadvantages –

1) More time is necessary during the impression appointment
2) Difficulty in handling the materials
3) Added care has to be taken during boxing
4) Material not easily available
5) Special Armamenterium required for using the material



Armamentarium for the fluid wax technique



Fluid Wax Technique

Uses

- Functional impression of distal extension partial dentures
- To record posterior palatal seal
- Functional impression for obturators

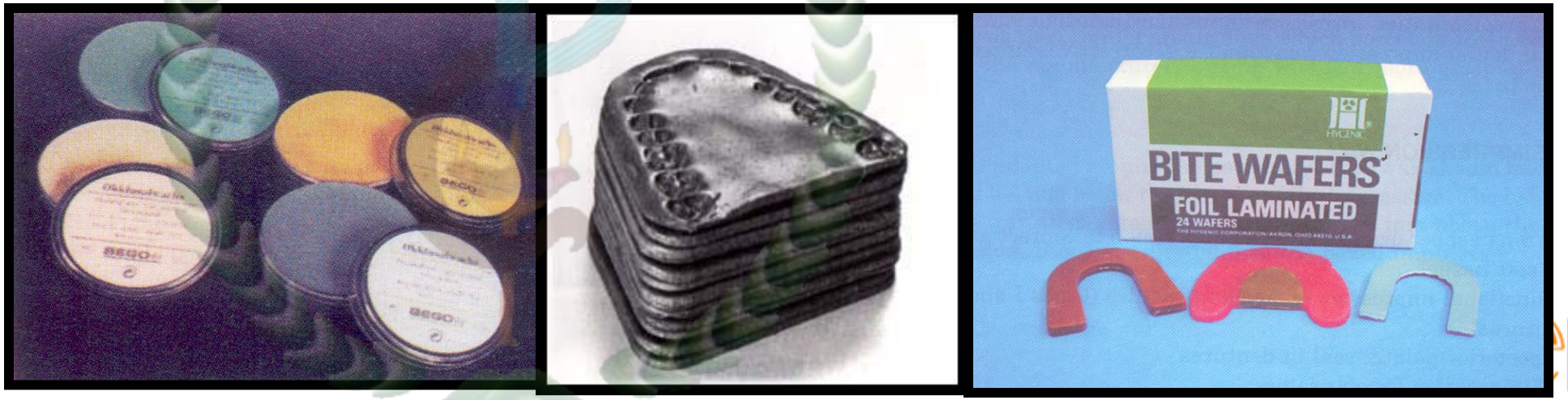
Bite Registration Wax

- Used to record the occlusal relationship of opposing quadrants
- Consists of beeswax, paraffin wax & ceresin wax
- Flow at 37°C ranges from 2.5 % to 22 %
- Mode of supply : U-shaped thin sheets, which are sometimes matallised or foil laminated

  eg. Aluwax

Bite Registration Wax

- Bite Registration Wax is interposed between the teeth & patient is asked to bite in the position of jaw relation recording
- The indentations thus formed on the wax are used to place the cast in position & then transfer it to the articulator.



Conclusion

- Waxes find great utility in dentistry from blocking undercuts, making rims, impressions, wax patterns to casting
- Wide variety available for different uses
- Handling of wax is an art
- Its not only removing of unwanted but also building-up of what is wanted

Success of this art lies in the type of wax work & the skill of the wax worker

Take away message

- Primarily used in dentistry to form patterns of appliances prior to casting.
- They are essentially soft substances with poor mechanical properties.

PROBABLE SAQS AND LAQS

Laq

1.Classify dental waxes .discuss ideal properties of inlay wax.

2.Composition ,properties and manipulation of inlay casting wax .

Saq

1.Dental application of waxes .

2.Inlay casting waxes .

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- THANKYOU