KMCT
DENTAL COLLEGE

Recognised Research Centre of Kerala University of Health Sciences
Recognised by Dental Council of India and Govt. of India
KMCT Medical College Campus, Mukkam, Kozhikode-673602
Phone: (0495)2292002, 2292004
E-mail: dental@kmct.edu.in, website: www.kmctdentalcollege.org

TO WHOM SO EVER IT MAY CONCERN

This is to certify that the information in the attached documents is verified by me and is true to the best of my knowledge.

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Pin : 673 602
Mukkam, Calicut Dt.
Kerala, S. India
CALICUT

Principal

Dr. MANOJ KUMAR.K.P
Principal
KMCT Dental College
Manassery, Mukkam

K.M.C.T DENTAL COLLEGE

MANASSERY P.O, MUKKOM, KOZHIKODE
PHONE : 0495 - 2290693

DENTAL MATERIALS RECORD BOOK

Name of the Student : SONA

Roll. No. : 51

Year of study : 2020-2022

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P.O. VALAMBOOR
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LABORATORY CERTIFICATE

This is to certify that Mr./Miss SONA

Reg No. 190020916 has satisfactorily completed the exercises in **DENTAL METERIALS PRACTICALS** prescribed by the University of the BDS Course during the year 2021-22

Date :

Dr. RAMESH KUMAR
Professor & Head of the Department
Department of Conservative Dentistry
& Endodontics
KMCT Dental College, Calicut

Lecturer - in-Charge
Conservative Dentistry and Endodontics

Head of the Department of
Conservative Dentistry and
Endodontics

11/1/22

Lecturer - in-Charge
Prosthodontics

11/1/22 Dr. SHEEJITH. M

Head of the Department of Prosthodontics

Record of submission

Name of the Candidate : SONA

University Reg.No. : 190020916

Date of Practical Examination :

Signature of Examiners 1)

2)

GENERAL INSTRUCTIONS

1. Bring this record book to all practical classes and the record must be kept neat and in good condition.
2. Credit will be given to the records kept neat and submitted in time.
3. Students should wear apron with identity cards while working in the laboratories.
4. After completing the practicals, record your observations and results in the book. Write a relevant inference to the experiment.
5. Submit the record book complete with observations, discussion, diagrams and calculations for valuation when you come to the next practical class.
6. Marks will be awarded for the records during practical examinations.
7. Unnecessary wastage of water, gas or any other materials should be avoided
8. Containers of materials/ chemicals must be kept closed in their proper places when not in use.
9. Excess or waste materials must be thrown into the waste bins and should not be thrown into the sink.
10. Students should enter the laboratories with all the required instru ments. Borrowing will not be permitted.
11. Equipments borrowed from the departments should be returnded be fore leaving the laboratory.
12. Students should keep the laboratory neat and tidy and should not cause any damage to the furniture, equipments etc.
13. Student is liable to replace or compensate for the equipment that is lost or damaged.
14. Strict discipline should be maintained while working in the laboratory.

Sl No.
1.
2.
3.
4.
5.

STUDENTS DECLARATION

I have carefully read the above rules and undertake to abide by them.

Signature of the Student

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MARKS OBTAINED

INDEX OF WORK DONE IN DENTAL MATERIALS (PROSTHODONTICS)

Sl. No	Date	WORK DONE	Score		Staff Sign
			Max. Score	Score Obt.	
1	3/12/19	Mixing of dental plaster	10	7	
2	3/12/19	Mixing of dental stone	10	7½	
3	5/03/19	Mixing of alginate	10	7	
4	24/12/20	Mixing of zinc oxide eugenol paste	10	7	
5	29/12/20	Mixing of heat cure acrylic	10	7	
6	12/12/19	Manipulation of impression compound	10	7	
		Total	60	42½	

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Staff in charge

Head of the Department

Date

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HEAT CURE ACRYLIC RESIN

Sl. No	Date	WORK DONE	Score		Staff Sign
			Max. Score	Score Obt.	
1		Investing the wax block	10		
2.		Dewaxing	10		
3.		Applying the separating medium	10		
4.	29.12.20	Proportioning and mixing	10	7	
5.		Packing & Trial closure – Bench curing – Heat curing – Cooling	10		
6		Deflasking	10		
7		Finishing & Polishing	10		
		Total	10	7	

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IMPRESSION MATERIALS

Sl. No	Date	WORK DONE	Score		Staff Sign
			Max. Score	Score Obt.	
1	12/12/18	Manipulation of impression compound	10	7	
2.	5/03/19	Manipulation of irriversible hydrocolloid impression material (alginate)	10	7	
3.	24/12/20	Manipulation of zinc oxide Eugenol impression material	10	7	
4.		Manipulation of Elastomeric impression material	10		
			30	21	

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GYPSUM PRODUCTS

Sl. No	Date	WORK DONE	Score		Staff Sign
			Max. Score	Score Obt.	
1	3/12/19	Mixing of Model Plaste (Type II)	10	7	
2	3/12/19	Mixing of dental stone (Type III)	10	7½	
		Total	20	14½	

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MANIPULATION OF SILVER AMALGAM ALLOY

Sl No.	Date	Work done	Remarks	Staff Signature
1.	13/02/2020	Mixing Technique of Silver alloy and Mercury Temporary Restoration	B+	

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MANIPULATION OF DENTAL CEMENTS

Sl No.	Date	Work done	Remarks	Staff Signature
1.	09/11/19	Mixing Technique of Zinc Oxide Eugenol a) Sealant b) Temporary Restoration	B++	
2.	23/09/19	Mixing Technique of zinc phosphate cement a) Luting b) Base or Temporary Restoration	B++	
3		Mixing Techenique of Calcium Hydroxide paste		
4.	09/01/2020	Mixing Technique of Glass- ionomer cement a) Luting b) Base or Restoration	B	
5.	17/10/19	Mixing Techniques of Poly Carboxylate cement a) Luting b) Base or Temporary Restoration	B	

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Conservative Dentistry

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Date : 06/01/21

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Head of the Department of Prosthodontics

Record of submission

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University Reg No 150020463

Date of Practical Examination 20/01/21

Signature of Examiners 1)

2) Dr. REMY

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DENTAL CERAMICS

Dental ceramics are non-metallic inorganic materials primarily containing one or more metallic or non-metallic oxides, carbides & nitrates as well as complex mixtures of these materials

→ Classification

A) Based on composition
Feldspathic porcelain, Leucite reinforced porcelain, alumina, aluminous porcelain, glass infiltrated alumina

B) Based on fusion temperature
High (1315°C – 1370°C)
Medium (1090°C – 1260°C)
Low (870°C – 1065°C)
Ultra low (<850°C)

C) Based on microstructural phases
Glass based, glass based with fillers, crystalline based with glass fillers, polycrystalline solids

D) Based on substructure
Metal, Alumina, Zirconia

E) Based on layering ceramic
core, body, enamel, glaze

F) Based on indications
For ceramometal crowns & FPDs
All ceramic crowns

E) Based on processing technique
Condensation & sintering, partial sintering, hot pressing, casting & ceramming

→ Clinical applications
- Indirect restorations for inlays & onlays
- Indirect intracoronal restoration material
- Porcelain denture teeth
- Biomaterial in the form of dental implants

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→ Composition

Dental porcelains are called feldspathic porcelain with quartz being the crystalline phase

Base oxides	Additional oxides	Fluxes	Pigments	Opacifiers
SiO_2	Li_2O	B_2O_3	Fe_2O_3	ZrO_2
Al_2O_3	MgO	Na_2O	CaO	SnO_2
	ZnO	CaO	TiO_2	TiO_2
	SrO	K_2O	MnO_2	CeO_2

- Base oxides – Silica – principle glass forming oxide (60%)
  Alumina is hardest & strongest oxide
- Additional oxides – Li_2O, MgO, ZnO – improve strength & translucency
  Li_2O – smallest & most reactive
- Flux – Base oxide is powerful flux added to soften their temperature
  CaO is commonly used
- Opacifiers – Zirconia/Zirconium oxide – commonly used
- Pigments – Iron oxide are most common

→ Methods of strengthening ceramics

1 Develop residual compressive strength within surface of material
2 Interruption of crack propagation through material

I Development of residual stress within surface of material

1 Development of residual compressive strength

When the core material have higher CTE than veneering ceramic during cooling inner core contract more which pull veneering ceramic inward inducing residual compressive stress

2 Reduce number of firing cycle

During firing quantity of crystalline leucite increase which increases thermal expansion coefficient When CTE exceeds that of metal crack formation & propagation occurs

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INVESTMENT MATERIALS

An investment can be described as a ceramic material that is suitable for forming a mold into which a metal or alloy is cast. Materials such as gypsum, phosphate & silicate are used for investing as they can withstand higher temperatures of burnout & casting procedures

→ Classification

A) Based on binder used
1. Gypsum bonded
2. Phosphate bonded
3. Ethyl silicate bonded

B) Based on method of obtaining expansion
1. Type I investment – Thermal expansion
2. Type II investment – Hygroscopic expansion
3. Type III investment -

Gypsum bonded investment

→ Composition

Refractory material – Quartz or cristobalite
Binder – Gypsum (Type III)
Modifiers – C, colloidal Cu, NaCl, boric acid
Liquid – Distilled water

→ Setting reaction

$CaSO_4 \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \longrightarrow CaSO_4 2H_2O + 3900$ cal/g mol heat

→ Expansion

Total expansion = Setting expansion + Hygroscopic expansion + Thermal expansion

→ Uses

For casting of inlays, onlays, crowns & FPDs made of gold alloy, at temperature <1000°C

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Phosphate bonded investment

- Composition
  - Refractory material – Quartz or cristobalite
  - Binder – MgO, Monoammonium phosphate
  - Modifiers – Carbon
  - Liquid – Water or colloidal silica
- Setting reaction

$$NH_4H_2PO_4 + MgO + 5H_2O \xrightarrow{\text{Room temperature}} NH_4MgPO_4 \cdot 6H_2O + MgO + NH_4H_2PO_4 + H_2O$$

On heating, complex reaction occurs due to loss of water, $NH_4MgPO_4 \cdot 6H_2O$ degrades to non-crystalline polymeric form $Mg_2P_2O_7$ which can again react with MgO giving 3D network of $Mg_2(P_2O_4)_2$

- Uses
  - Framework for metal ceramic prostheses & for some base metal alloys

Ethyl silicate bonded

- Composition
  - Refractory material – Quartz or cristobalite, MgO
  - Binder – Sodium silicate & colloidal silica
  - Liquid – Sodium silicate, dilute HCl
- Setting reaction
  - On mixing silicic acid sol with silica in alkaline medium, polysilicic acid or solvent gel of silica is formed
  - Soft silica gel is formed
  - During drying gel is dried at <160°C it loses alcohol & water to form concentrated, hard, solid, non-porous mass of cristobalite
  - This results in volumetric shrinkage called green shrinkage
- Uses
  - Base metal casting alloy

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→ Composition

Powder/Polymer	Component	Liquid/Monomer
Prepolymerised beads of PMMA	Major component	MMA
–	Activator	Tertiary amine
Benzoyl peroxide	Initiator	–
Dyed organic fillers, sulfides	Color pigment	–
–	Inhibitor	Hydroquinone

→ Manipulation
a) Sprinkle on technique
b) Head adapted dough technique

Fluid/pour type resins
They are low viscous, pourable, chemically activated resins for fabrication of denture base

→ Technique
Agar gel or soft stone or silicone mould of waxed up denture is made. After the gel sets, waxed denture is removed & teeth are reinserted into mould. Flask contains three holes through the gel to mold space. Chemically activated pourable resin is poured through one of holes into mould space. Excess material comes out through remaining holes. After the pouring procedure the flask is placed in a pressure vessel containing warm water & air pressure of 0.1 - 0.2 MPa is applied 30-40 minutes of processing is required for polymerisation

light activated resin
This has proven to be a denture base material with a good working time, as setting process needs application of light source

→ Composition
Polyether urethane dimethacrylate - Major constituent
Camphoroquinone - Photoinitiator
Amine - Photoactivator
Inorganic SiO_2 - Fillers
Organic - Acrylic resin beads - Fillers
High molecular weight acrylic resin - Monomer

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→ Technique

a) Fabrication of denture base
Thin layer of filable material is adapted on master cast
This is polymerised & used as base plate

b) Completion of denture
The teeth are attached on base plate, the denture is again filled on light chamber for polymerisation

→ Mechanism
Camphoroquenone & an organic amine generates free radicals when radiated by light of 400-500nm This initiates polymerisation reaction when exposed to optimal time

→ Use - To fabricate special trays & trial denture bases.

Microwave polymerised resin
Microwave energy is also used to polymerise PMMA resin Special non-metallic polycarbonate or fibre reinforced plastic flask are used instead of metallic flask as microwave will reflect from their surface

→ Types Manipulation
Compression moulding technique
Injection moulding technique
Microwave resins are supplied in powder liquid system similar to conventional resins

Approved

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Denture base is that part of denture that rest on the foundation tissue & to which teeth are attached & does not include artificial teeth. Substance that is used to make denture base is called denture base mate

→ Classification

ISO

a) Heat cure polymers
b) Self cure polymers
c) Thermoplastic materials
d) Light cure materials
e) Microwave materials

Heat activated resin

→ Composition

Powder/Polymer	Component	Liquid/Monom
High molecular weight prepolymerized beads of PMMA	Major constituent	MMA
Benzoyl peroxide	Initiator	—
Mercuric sulfide, cadmium sulfide	Color pigments	—
Dibutyl phthalate	Plasticizer	Dibutyl phthalate
Zinc oxide, Titanium oxide	Opacifiers	—
—	Inhibitors	Hydroquinone
—	Cross linking agent	Glycol dimethacrylate

→ Manufulation

Usually used methods – Compression moulding technique
Injection moulding technique

a) Compression moulding technique

- Once gypsum sets, wax is eliminated by placing the flask in hot water bath (flask is invested with dental gypsum)
- The elimination of wax provides mould space & is flushed with hot water & detergent to remove wax (clevaning)
- A tin foil substitute like cold mould seal is applied & the manipulated heat cure resin in dough

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stage is placed in the mould after kneading the mix mixture with adequate monomer & polymer. Then flas is reassembled

b) Injection moulding technique
- Waxed up denture is invested in one half of dental flask & wax sprues are attached & then the other half of the flask is approximated & invest
- The flask is dewaxed to create mould space, both th halves of the flask are clamped tightly. The liquid monomer is added to the powder. It is introduce into assembled flask
- Carrier maintains the pressure on assembly th throughout the polymerisation process. The flask i then placed in water bath for polymerisation

Polymer/monomer ratio - 3-3.5/1 by volume or 2.5/1 by wei
Physical changes - i) Wet/sandy stage
ii) Sticky or stringy stage
iii) Dough / gel stage
iv) Rubbery stage
v) Stiff stage

- Bench curing - Done at room temperature for 30- minutes after packing
- Heat curing - Done by placing packed flask in boili water. Curing cycle are -
a) 74°C for 8 hrs
b) 74°C for 8 hrs followed by 100°C for 1 hr
c) 74°C for 2 hrs followed by 100°C for 1 hr
- Uses - For fabrication of all denture bases

Chemically activated resin
Also known as self curing, cold curing or polym

Uses
- Denture repair or addition
- Construction of custom tray
- Making orthodontic removable appliance

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→ Composition

Base - Polymethyl hydrogen siloxane polymer
Fillers
Catalyst - Vinyl terminated polydimethylsiloxane
Chloroplatinic acid
Fillers

→ Setting reaction

On mixing, addition reaction occurs between terminal vinyl group & cross linked with hydride groups

→ Uses

Medium body addition silicone - making impression for diagnostic purpose as a substrate for alginate

Polyether

→ Composition

Base - Low molecular weight polyether with ethylene imine terminal
Colloidal silica - Filler
Glycol ether - Plasticizer
Catalyst - Aromatic sulfonate ester
Colloidal silica - Filler
Glycol ether - Plasticizer

→ Setting reaction

When base & catalyst are mixed together a cationic polymerisation occurs. Setting is initiated by sulfonate ester to produce cross linking by cationic addition. No byproduct

Applications of elastomers

- For making impressions for FPDs, RPD & for complete dentures
- For border moulding
- For duplicating casts
- For bite registration

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IMPRESSION COMPOUND

→ Composition

Basically made up of thermoplastic resins & waxes
Compound wax
Gum rosin
Shellac, stearic acid, gutta percha – Plasticizer
Talc – Filler
Rogue – Pigment

→ Manipulation

Impression compound is softened by breaking the cake into pieces & placing into bath of hot water. After immersed in water, it is kneaded with fingers for 1-3 minutes. The compound in thus plastic stage is loaded into tray

→ Uses

- Edentulous arch impressions
- In partially dentulous patients having deep palates, it is added to palate area to customize stock tray
- Used in preliminary impressions of partially dentures to support edentulous areas
- In fixed prosthodontics, to check undercuts in tooth preparations
- To stabilize rubber dams during restorative procedures
- As surgical dressing following surgeries of palate to close the sealing of nasal cavity from oral cavity

Abhirami

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~~Na or K salt~~

→ Composition

Na or K salts of alginic acid -	15%	
Fillers - Diatomaceous earth	60%	
ZnO	4%	
$CaSO_4$ dihydrate	16%	Reactor
Trisodium phosphate	2%	Retarder
Potassium titanium fluoride	3%	Accelerator

→ Manipulation

Powder & liquid according to W/P ratio should be taken for proper wetting powder is incorporated into water & with waved spatula in vigorous figure of 8 motion. It is mixed along the walls to obtain smooth creamy mix

→ Setting reaction

$2Na_3PO_4 + 3CaSO_4 \rightarrow Ca_3(PO_4)_2 + 3Na_2SO_4$

$K_{2n}Alg + nCaSO_4 \rightarrow nK_2SO_4 + Ca_nAlg$

(Potassium alginate)

→ Uses

- To obtain study casts & models for orthodontic purposes
- To obtain preliminary study casts for fabrication of prosthesis
- As preliminary impression to construct custom tray
- To take impression for fabrication of temporaries for indirect restorations

Elastomers

Polymers whose glass transition temperature is below the setting temperature They have low stiffness & extremely large elastic strains

→ Classification

A) According to chemical reaction

1. Polysulphide

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2 Polyether
3 Condensation polymerising silicone
4 Addition cure polymerising silicone

B) According to viscosity
1. Light body
2 Medium body
3. Heavy body
4 Very heavy body

c) According to ADA specification
1 Type I
2 Type II
3. Type III

Polysulfide

→ Composition

Base paste – Polysulfide polymer, a suitable filler to provide strength, plasticizer & small quantity of sulphur as accelerator
Catalyst paste – Contains lead dioxide, filler, plasticizer as in the base paste & stearic acid

→ Setting reaction

On mixing it undergoes both polymerization by oxidation of terminal SH group & cross linking of pendant – SH group & oxidising agent lead oxide which lengthen the cross links of chain reaction of terminal & pendent SH group

Condensation silicone

→ Composition

Base paste – α-ω- hydroxyl terminated polydimethylsiloxane
Filler – silica
Catalyst – Tin organic ester suspension
Stannous octoate
Tetraethyl or orthosilicate – Provide Reactive OH groups

→ Setting reaction

Involves cross linking between terminal groups of silicone polymer & the tri & tetra functional alkyl silicate in the presence of stannous octoate forming a 3D network. Alcohol is byproduct

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→ Composition

Tube 1 - Base paste

ZnO	87%	Main ingredient
Fixed vegetable oil	13%	Plasticizer

Tube 2 - Catalyst paste

Oil of cloves	12%	Reduces irritant effect of eugenol
Gum rosin	50%	Provides smooth mix
Canada / Peru balsam	10%	Increases flow
Filler - Talc, diatomaceous earth	20%	Provides proper consistency of mix
Calcium chloride, Zinc acetate	5%	Accelerator
Colorants	5%	Coloring agent

→ Manipulation

Mix two pastes on glass slab by squeezing stripe of paste of same length. Mixed by using stainless steel spatula by sweeping motion & mixing is done for approximately 1 minute until uniform mix is obtained. Mix is then added to custom tray & impression is made. Proper quantity is depend

→ Setting reaction

$$ZnO + H_2O \rightleftharpoons Zn(OH)_2$$

$$Zn(OH)_2 + 2HE \rightleftharpoons ZnE_2 + H_2O$$

Base Acid eugenol Zinc eugenolate

→ Uses

1. For making 2° / definitive impression of completely edentulous arch
2. As denture relining material
3. For interarchual bite registration
4. As surgical pack paste for periodontal wound healing

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Agar-Agar

Agar is a polysaccharide extracted from certain types Sea weeds

→ Composition

Agar	12%-12%	~~Strengthen set gel~~
Borate	0.2-0.5%	Strengthen set gel
K_2SO_4	1-2%	Accelerator
Fillers - Silica, diatomaceous earth	0.5-1%	Strengthen the mater
Alkyl benzoate	0.1%	Preservative
Glycerin		Plasticizer
Water	80%	

→ Manipulation

1. Liquefy agar & store in sol state (100°C)
2. Tray is loaded with liquefied agar material
3. Immediately before making impression loaded tray is cooled to lower the temperature tolerable by the oral cavity by process called tempering
4. The impression is sealed against the oral tissue enable sol to converted gel, circulating water around the impression tray while it chills the tray & hardens the material

→ Uses

- For making impression for fixed & partial dentures
- In dental laboratory as duplicating material
- Used in double tray technique for bite registration





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→ Modification of gypsum

1 a) Impregnation of gypsum by polymer like polyester, polystyrene
b) Incorporation of wetting agents such as lignosulfonates
c) Incorporation of disinfectant
2 Balanced stone - Contains equal amount of accelerator & retarders
3 Chromatic stone - Changes color
4 Die stone - Investment combination - Can be used only with low fusing gold alloys

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IMPRESSION MATERIALS

Any substance or combination of substances used for making an impression or negative reproduction

Classification

A) Based on setting mechanism
1. Reversible – Agar, Impression compound
2. Irreversible – Alginate, Impression plaster
3. Thermoset – Elastomers, Impression plaster
4. Thermoplastic – Impression compound, impression wax

B) Based on flexibility
1. Inelastic – Impression plaster, Zinc oxide eugenol
2. Elastic – Alginate, agar

C) Based on amount of tissue displacement
1. Muscostatic impression materials – Zinc oxide eugenol, impression plaster
2. Muscocompressive – Impression compound, impression wax

D) Based on type of tray
1. Perforated metal tray – Alginate
2. Water-cooled metal tray – Agar
3. Custom tray – Zinc oxide eugenol, impression plaster

Ideal requirements of impression material

- They should be fluid enough to adapt to oral tissues
- Should have pleasant odour, taste & smell
- Impression must be dimensionally stable until cast is poured to be able to pour more than one cast
- Material must be biocompatible
- Materials processing equipment & processing time should be cost effective
- Material should have adequate shelf life
- There should be no release of gas as byproduct during setting of impression

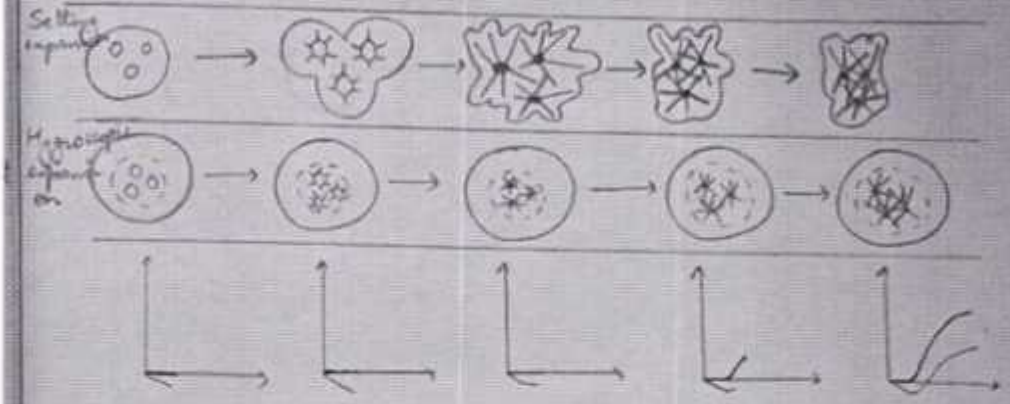
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- Setting time - Time elapses from beginning of mixing until the material hardens Measured by penetration test
- Mixing interval - Time elapsed from addition of powder to water till full mixing is completed
- Setting interval - Time interval between initial set & final set
- Initial setting time - Initial test for set is loss of flow test, initial Gilmore test during initial setting, if material is immersed in water, setting expansion is increased. This is called hygroscopic expansion
- Final setting time - Complete conversion of hemihydrate to dihydrate Final Gillmore test & Vicat test is used
- Controlling setting time - Controlled by manufacturer or operator
- Manufacturer - By controlling fineness of gypsum or by adding accelerator or retarder Controlling nuclei of crystallisation / rate of crystal growth
Accelerators - Decreases setting time Eg - Set gypsum particles, potassium sulphate, 2% NaCl, 3-4% Na_2SO_4, 2% K_2SO_4, Lime, Gum arabic
Retarder - Increases setting time Borax, ~~Potassium~~ K_2SO_4, NaCl (above 2%)
Operator - By varying W/P ratio, spatulation, temperature
- Setting expansion - When hemihydrate is converted to dihydrate, there is no change in properties An expansion of material is detected during setting process of hemihydrate to dihydrate 0.06% - 0.05% setting expansion can be controlled by altering mixing time, W/P ratio & using accelerators & retarders
- Hygroscopic expansion - When gypsum is allowed to set under water, surface tension forces are significantly reduced, which allows the dihydrate to expand to much greater degree

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→ Properties
1 Gypsum strength - Wet & dry strength
2 Tensile strength
3. Compressive strength
4 Dimensional stability

→ Gypsum storage - Stored in airtight closed containers

→ Disinfection - To prevent cross infection, disinfecting the impression is necessary. It should be disposed properly because they are hazardous & cause respiratory problems

→ Advantages of gypsum products
- Fairly good reproducing ability
- Dimensionally accurate & stable
- Inexpensive & easy to use
- Good color contrast

→ Disadvantages of gypsum products
- Poor mechanical properties cause fracture of teeth from stone cast
- Poor abrasive resistance
- Poor compatibility with hydrocolloid impression material
- Poor wetting of rubber impression to materials

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Classification: The ANSI/ADA specification no 125& ISO classification

Type	Name	Molecule	Color	Use
I	Impression plaster	β-$CaSO_4$ hemihydrate	White or pink	Final wash impression for edentulous arches
II	Model Plaster, Plaster of Paris	β-$CaSO_4$ hemihydrate	White	Study models, articulation, flasking
III	Dental stone, (Hydrocal, VS hydrocal corrosy)	α $CaSO_4$ hemihydrate	Green	Working cast for soft tissue prostheses such as complete dentures, flasking
IV	Die stone, dental stone high strength low expansion	α-Modified $CaSO_4$ hemihydrate	Yellow	Die material for fabrication of wax pattern for dental cast metal restoration including intracoronal & radicular
V	Dental stone- high strength & high expansion Crystacal	α-Modified $CaSO_4$ hemihydrate	Yellow	Die material for fabrication of wax pattern for dental cast metal restorations where high expansion needed to compensate for alloy shrinkage such as base metal alloy

→ Manipulation

Required amount of water is measured by volume & gypsum product by weight. Powder is sifted in measured water in clean flexible rigid rubber bowl. Powder is allowed to be soaked for about 3 seconds. Unidirectional mixing is carried out with a stiff stainless steel spatula. The mix should be smooth & creamy.

→ Setting process

$$CaSO_4 \cdot \tfrac{1}{2}H_2O + 1\tfrac{1}{2}H_2O \longrightarrow CaSO_4 \cdot 2H_2O + 3900 \text{ cal/g mol heat}$$

→ Theories of setting reaction

1 Colloidal theory

Hemihydrate $\xrightarrow{\text{water}}$ Hemihydrate sol $\xrightarrow{\text{water}}$ Dihydrate sol $\xrightarrow{\text{water}}$ Dihydrate gel

2 Hydration theory

Hemihydrate $\xrightarrow{\text{water}}$ Hemihydrate $\xrightarrow{\text{water}}$ Sulphate group → Set dihydrate
Sol

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3. Dissolution precipitation theory

Dihydrate crystal (precipitate) $\xrightarrow{H_2O}$ Hemihydrate dissolves → Suspension of hemihydrate → Saturated solution of hemihydrate → Formation of dihydrate → Supersaturated solution of dihydrate → Dihydrate crystal (precipitate)

The precipitation of dihydrate leading to crystallisation of dihydrate, hence the name "crystalline theory". The crystal of dihydrate are called spherulites due to their needle like appearance



Spherulite crystal growth

→ Water requirements

Theoretically 100 g of $CaSO_4 \cdot \frac{1}{2}H_2O$ requires 18.6 g of reaction water. The excess unreacted water is distributed as free water in the set mass even at completion of chemical reaction & termed wet strength. The presence of water makes gypsum weak. It takes about 24 hrs for gypsum to be fully set; this strength is dry strength.

Setting stages
1. Fluid stage
2. Plastic stage
3. Friable stage
4. Carvable stage

→ Clinical application / Laboratory steps

1. Pour the cast
2. Separation of models from the cast
3. Finishing the cast
4. Clean up

Stage 1 - loss of gloss
Stage 2 - feels warm to touch
Stage 3 - reaches room temperature

- Mixing time - Time from addition of powder to water until mixing completed
- Working time - Time from start of mix to time it no available as workable mix

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freely but can only vibrate

- Liquids
When a solid is heated above its melting point, it becomes liquid Intermolecular attraction still exist, however the molecules have enough energy to move relative to each other

- Gas
Gas is that state in which the molecules are comparatively separated & intermolecular attraction have little effect on movement of molecules

- Plasma
More recently, a fourth state of matter has been taken of & is termed plasma, it is highly ionised gas that occur at high temperature

→ Energy related to atoms
The atoms & molecules of an object have latent energy stored in their electrons. This energy may be ordered & disordered energy
Energy due to motion → kinetic energy → ordered energy
Thermal energy → Disordered energy

→ Non classical states
In mineralogy & crystallography, crystalline solids consist of atoms or molecules closely packed together in a partial repeating symmetry, this symmetry is known as a single unit cell. This unit cell is periodically repeated in three dimension in a lattice
Crystalline solid
The arrangement of atoms in the lattice is orderly & follows a particular pattern, they have

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definite melting & boiling point.

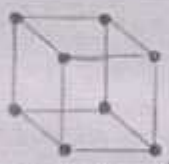
→ Space lattice

Any arrangement of atom in space which every atom is situated similarly to every other atom It can be a result of primary & secondary bonds

14 possible lattice types are present
- Simple cubic space lattice
- Body centred cube
- Face centred cube
- Edge centred cube

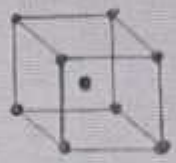
- Factors affecting space lattice
  a) length of each of 3 unit edge cell (axes)
  b) Angle between the edges

- Simple cube
  Atoms are arranged on all eight corners forming a perfect cube (primitive cell)



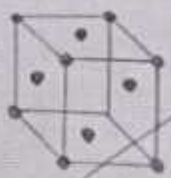
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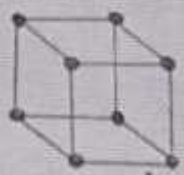
Body centred

To this primitive cell, if one atom is added to centre of cube, it form of body centred cube



Face centred

If atoms are added to centre of each face of primitive cell



Edge centred

Atoms as placed in centre of edge in a primitive cell

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STRUCTURE OF MATTER

The structure of any material, including materials used in usually reflect the individual component & their arrangements within the material

States of Matter

States of matter are distinct forms that different phases of matter take on.

Dislocation between states have been based on differences in molecular interrelationship & resulting properties

Classical states

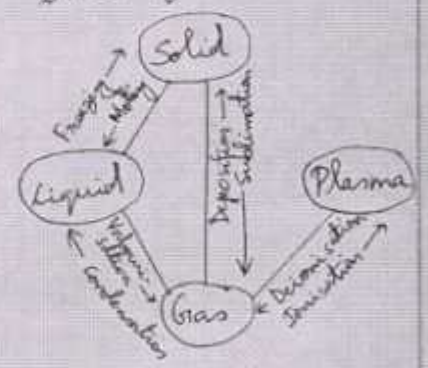
- Solid
- Liquid
- Gas
- Plasma

Non-classical states

- Crystalline solids
- Non crystalline / glassy solids / amorphous solids / supercooled solids liquids

→ Interatomic bonding

Properties of most materials depend upon interatomic bonding between different atoms present in their molecules apart from various other factors.



- Primary valence forces (chemical)
  - Ionic
  - Covalent
  - Metallic
- Secondary valence forces (physical)
  - Vanderwaal forces
  - Hydrogen bonds

→ Classical states

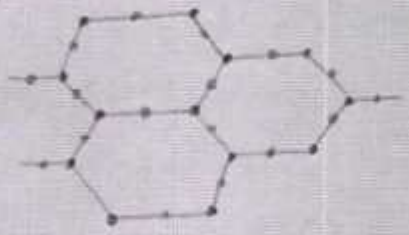
- Solids

The particles in a solid (ions, atoms, molecules) are closely packed together. The forces between particles are strong enough so that the particles cannot move

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Crystalline structure



Most metal show crystalline structure

Eg - Iron - BCC
Copper - FCC
Ti, Zn, Zr - Hcp

Non crystalline / Supercooled liquid

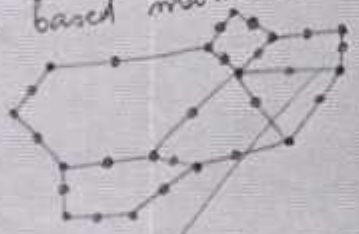
The arrangement of atom is disorderly in the lattice & distributed at random. No regular space-lattice, structural arrangement does not result in low internal energy

- No definite melting & boiling point

Glass transition temperature

Temperature at which there is abrupt increase in thermal expansion coefficient. Here they show increased mobility

Eg - Polymer based materials



Approved

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GYPSUM PRODUCTS

Most commonly used materials to produce frontive replication of the oral structure are gypsum products Gypsum products are derived from

$CaSO_4 \cdot 2H_2O$

$CaSO_4 \cdot 2H_2O \xrightarrow[\text{Dehydration}]{\rightarrow H_2O} CaSO_4 \cdot \frac{1}{2}H_2O$ (gypsum product)

→ Applications in dentistry

Study models for oral & maxillofacial structure, cast & die materials, impression materials, investing materials, investment material, mounting stone models into articulators

→ Manufacturing process: The process of dehydration of gypsum is called calcination

$CaSO_4 \cdot 2H_2O \xrightarrow{\Delta} CaSO_4 \cdot H_2O \xrightarrow{\Delta} CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$

- β- hemihydrate (dental plasters) is produced by the dry calcination where gypsum in open containers
- α- hemihydrate (dental stone) is produced by wet calcination where gypsum produced is heated to about 125°c under steam pressure
- α- modified hemidrate (die stone high strength) is produced by boiling gypsum in presence of crystal modifiers
- Synthetic gypsum produced as a byproduct or water product during the manufacturing process of phosphoric acid





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Line angles should be rounded & provide adequate thickness on occlusal surface

4 Ion exchange
Sodium containing glass is immersed in potassium salt, $K^+ - Na^+$ exchange takes place As K^+ ions are larger they squeeze into place of Na^+ ions creating residual compressive stress Also called chemical tempering

5 Thermal tempering
Rapid cooling of surface form rigid surface with still molten inner core When molten core starts to solidify it pulls outer surface inwards resulting in residual compressive stress

II Interruption of Crack Propagation

1 Dispersion strengthening
Ceramic is reinforced with dispersed phase which interfere with crack propagation

2 Transformation toughening
This brings about change in crystal structure As the controlled transformation from metastable tetragonal phase to stable monoclinic phase occurs, it results in crack shielding & toughening

→ Ceramics based on microstructural phase

1 Glass based systems –
- Made by material with mainly silica & varying them
- Used to make porcelain teeth
- Used as veneering material

2 Glass based system with second crystalline phase
It has wide range using the different ratio of glass phase to crystalline phase

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3 Interpenetrating phase ceramics
Consist of atleast 2 phases interwined & extend continuously from internal to external surface

4 Polycrystalline solids
Solid core ceramic framework material over which veneering porcelain is then layered

→ Fabrication of metal ceramic prosthesis

Conventional powder liquid system

It involves 3 major steps –

1. Compation – Process of adapting & packing the ceramic particles together & removing the binder.

2. Firing – Ceramic buildup is then placed in furnace for firing under vacuum to prevent gas entrapment
Process of conversion of mass of particles held loosely by a binder into fused coherent solid is known as sintering
Stages – Drying / green stage → Low bisque stage
↓
High bisque stage ← Medium bisque stage
↓
Cooling stage

3 Glazing – Once ceramic prosthesis is fired & cooled, it is trimmed & contoured & finished & polished.
Glazing gives smooth, shiny, impervious surface.
It can be achieved by –
Overglazing
Autoglazing

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→ Pressable/Cast ceramic restoration

- Initially a wax pattern prepared to the full anatomical form of the staining technique is used.
- Wax pattern is then invested similar to lost wax technique
- The ring is placed in furnace for 90 minutes at 850°C to burn out wax & create a mould

→ Zirconia core/ceramic buildup

- Most common method to fabricate zirconia core/substructure is to mill a solid block of either fully or partially sintered zirconia by CAD-CAM
- The differena between fully & partially sintered zirconia is in the size of the framework.
- Minimum thickness of 0.3mm for anterior teeth & 0.5mm for posterior teeth

Aftnoon

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FINISHING AND POLISHING

→ Objectives
- Remove marginal irregularities
- Define anatomical contour
- Smoothens surface roughness
- Achieving margination which involve removal of excess restorative material at junction of tooth & the material
- Final polishing - remove minute scratching, obtain smooth enamel like surface

→ Terminologies
- Abrasion - Process of wearing away of surface by fabrication by abrading instruments & the outermost surface material is abrasive
- Material which is finished is substrate Eg - Tooth
- Substrate can be composite resin, modified resin etc
- Abrasive can be natural or man-made
- Abrasive can be 2 body wear & 3 body wear
  - Two body wear - abrasive is bound to instrument & used to polish the specimen surface
  - Three body wear - Abrasive is free

→ Hardness & durability
- Related to hardness & abrasive - durability
- Hardness is surface movement of material to plastically deformed by indenting or scratching another material Measured by Knoops

→ Factors determining finishing & polishing
- Substrate properties Eg - Mechanical properties
- Abrasive properties Eg - Shape, size etc
- Difference in hardness between abrasive & substrate

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- Speed & pressure at which abrasive is applied
- Lubricant used during application of abrasive
  Eg - Water, water soluble polymers

→ Steps in finishing & polishing
Step 1 - bulk reduction & contouring
Step 2 - finishing
Step 3 - polishing

→ Instrument & their design

1 Abrasive instrument design -
Requirements - have the right particle size
Do not gauge substrate

Abrasive motion - Rotary, planar & reciprocal motion
Rotary - Bur in high speed hand piece rotate clockwise
Planar - Used in disks, remove material along a plane
Reciprocal motion - Different motions at same time

Bonded abrasives
Method used - sintering, vitreous bonding, resin bonded abrasives, rubber bonded abrasives

Carbide compounds
- Silicon, boron carbide, tungsten carbide
- Commonly used - tungsten carbide
- For composite resin - silicon & boron carbide

Diamond finishing points
- Diamonds have metal shank
- Titanium nitrate coating also used as additional layer to extend life of points

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Dental stones

Available in different color & are made of abrasive particles sintered together or bonded with an organic resin

Abrasive impregnated brushes & felt devices

Made of polymer bristles with various abrasive polishing particles

Non-bonded abrasives

- They are not bonded to substrate
- Three body wear - particle dispersed in gel

2 Polishing

- Extension of finishing - provides smoothness & luster to restoration
- Very fine abrasives are used
- Systems used -
  - Rubber abrasive points
  - Fine particle disks & strips
  - Fine particle polishing plaster
  - Electrolyte polishing

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Staff in Charge

Head of the Department

Date 06/01/21

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RESTORATIVE MATERIALS

Classify dental materials

a) Preventive
b) Auxillary
c) Restorative

a) Preventive dental materials - This includes pit & fissure sealants & liners, bases, cements & restorative materials as they release fluoride to prevent dental caries

b) Auxillary dental materials - Substances used in the process of fabricating dental prosthesis & appliances but that do not become part of these devices. These include acid-etching solutions, impression materials, casting investments, dental waxes, acrylic resins etc

c) Restorative dental materials - Consist of synthetic components that can be used to repair or replace tooth structure, including fillers, bonding agents, liners, cement bases, amalgams

1. Classify restorative dental materials Give examples
   a) Temporary, intermediate & permanent
   b) Direct & indirect retainers
   c) Aesthetics & non-aesthetics

a) Temporary, intermediate & permanent

- Temporary restorations are often required before the placement of permanent restoration to protect inflamed pulp

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- Type I & Type II ZOE cements are used for temporary restorations
- Materials used for temporary restorations are expected to last for only a short period of time, few days or few weeks almost
- Intermediate restorations last for 3-6 months, when diseased pulp status is under follow up or when another ongoing treatment like orthodontic/periodontal treatment is being done in same tooth
- Reinforced ZOE cement is commonly used
- Permanent restorations serves to donate any material that is expected to last much longer than temporary & intermediate restorations
Eg- Direct filling gold, amalgum, composites, GIC

b) Direct & Indirect

- Direct restorative material used to build & restore the tooth structure directly in mouth. They are usually placed in increments & are soft plastic when placed
- Amalgum, direct filling gold are converted into metallic restoration
- Indirect restoration materials are formed indirectly in lab on other replicas of teeth & other tissues
- Eg - Porcelain, composite, caste metal alloy

c) Aesthetics & Non-aesthetics

- Aesthetic - Any material that is capable of producing like & natural tooth
Eg - Composite, glass ionomer, porcelain

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Non-aesthetic - Any material that is not tooth coloured Eg- Amalgam, direct filling gold, & cast metal inlay & onlay

5 Explain ADA acceptance programme

- The American Dental Association (ADA) seal of acceptance programme began in 1930
- ADA standards have been accredited by American Nationals Standard Institute (ANSI) and thus they are designated as ADA/ANSI standard
- This organisation standardises the properties of materials, ideal requirements of materials used for a particular application & also develops newer materials, equipments & test methods
- The ADA council on scientific affairs is responsible for the evaluation of dental agents, tooth cleaning agents, tooth whitening agents, therapeutic agents used in dentistry & dentistry

4 Ideal requirements of restorative material

- Biocompatible
- Bonds permanently to structures
- Restores the natural appearance of both structure & other visible tissues
- Exhibit properties similar to those of tooth structure & other tissues
- Be capable of correcting tissue repair or regeneration of missing or damaged tissues

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Elastic modulus - 4-6 GPa

3 Biocompatibility - Cement is acidic though less irritating to pulp
a) Polyacrylic acid are weaker than phosphoric acid
b) There is rapid rise in neutrality of acids
c) The higher molecular size of acid molecules prevent acid penetration into dentinal tubules
d) Chemical binding to dentin prevents any further penetration into dentin
e) The fluoride release may be responsible for some antibacterial properties

4 Solubility - Greater than zinc phosphate & GIC

5 Adhesion - Carboxylate groups in polymer molecule chelate with Ca in tooth structure

Bond strength
Enamel - 3.4 - 13 MPa
Dentin - 2.1 MPa

Advantages
1 Chemical bond to enamel & dentin
2 Mild pulp response
3 Anticariogenic

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DENTAL CEMENTS

1. What are ideal requirements of dental cements
- Adequate strength, rigidity & roughness
- Insoluble in oral fluids
- Adhesive to tooth structure
- Prevent any microleakage & secondary caries
- No irritation to pulp & periosteum
- Clinical compatibility with restorations
- Good handling characteristics
- Low film thickness of cement
- Easy removable of excess cement

2. Classify dental cements

i) Grag's classification

A) Water based cements (ADA No. - 96)
They rely on acid-base setting reaction
1. GIC
2. Resin - modified glass ionomer
3. Zinc phosphate
4. Zinc polycarboxylate

B) Oil based cements (ADA No-30)
They depend on presence or absence of eugenol
1. ZOE
2. Non-eugenol cement

C) Resin based cements
Their chemistry of reaction is based on composite resin

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ii) O'Brien's classification

A) By matrix type
1. Phosphate
   a) Zinc phosphate
   b) Zinc silicophosphate
2. Phenolate
   a) ZOE
      i) Polymer
      ii) Ethoxybenzoic acid
      iii) Alumina
   b) Gluum hydroxide salicylate
3. Polycarboxylate
   a) Zinc polycarboxylates
   b) GIC
4. Resin
   a) Polymethylmethacrylate
   b) Dimethylacrylate

iii) Donovan's classification

A) Conventional cements
1. Zinc phosphate
2. ZOE
3. Zinc polycarboxylate
4. Glass ionomers

B) Contemporary cements
1. Resin modified GIC
2. Resin cements

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Disadvantages

1. During setting, the cement is rubbery in consistency
2. Short working time & long setting time
3. Cement is opaque, hence cannot be used for restorative purpose
4. Compressive strength is poor

Clinical Applications

1. Luting cements for base alloy restoration
2. Thermal insulating bases under direct metallic restorations
3. Cementation of orthodontic bands
4. Cementation of pediatric stainless steel crown

III Zinc Oxide Eugenol

Composition

- Powder
  - ZnO - 69%
  - Rosin - 21% (to reduce brittleness)
  - Zn acetate - 0.7% (accelerator)
  - Zn stearate - 1% (plasticizer)
- Liquid
  - Mainly eugenol with some olive oil as a plasticizer
  - Olive oil is weak acid & relieves pain

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Powder

- ZnO with 10% MgO & traces of alumina
- Small amount of fluoride is also present which is released to surrounding tooth structure contributing to anticariogenicity of cement
- Stannous fluoride is added in small amounts to increase strength, regulate setting time & improve viscosity

Liquid

- Polyacrylic acid - 32% - 42%
  It is usually copolymer of polyacrylic acid along with other unsaturated carboxylic acids such as itaconic & maleic acid

Itaconic & tartaric acid - Stabilize liquid & prevent gelling on extended storage.

Available Systems

Powder & liquid
Powder (with acid component freeze dried) mixed with distilled water
Encapsulated

Manipulation

P/L ratio - 1.5:1
Shake the powder bottle gently & dispense the powder with a scoop onto a disposable paper pad or glass slab which is cooled to

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longer working time
Dispose the liquid from the dropper bottle in uniform drops, just before the start of mix, to prevent evaporation of water & subsequent thickening
- Most of powder should be incorporated into the liquid in one large increment
- Mix over small area with stiff spatula. Add the remaining powder, if required to adjust the consistency
- The cement should be used immediately as working time is short
- The cement is no longer usable when it loses its lustre & starts to "crumb"

Setting reaction
- Involves chelation reaction between outer portion of powder particles & polyacrylic acid that result in two phase mass
- The interrupted phase is composed of unreacted portions of the powder particles & the continuous phase is matrix gel composed of hydrated polyacrylate macromolecules which are cross linked by zinc ions
- Mixing time - 30-40 sec
  Setting time - 7-9 min

Properties
Viscosity - Pseudoplastic
Strength
Compressive strength - 80 MPa
Tensile strength - 8-12 MPa

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5 Write on the physical & chemical properties of dental materials

Physical properties

i) Modulus of elasticity
It is the measure of relative stiffness or rigidity of a material
Stiffness is the ability to resist deformation & it reflects the strength of interatomic or intermolecular bonds

ii) Ultimate tensile strength - It is the greatest stress that a material can withstand without undergoing fracture or rupture

iii) Resilience - It is the resistance of a material to permanent deformation under sudden impact

iv) Ductility - Ability of material to undergo permanent deformation with fracture or rupture under a tensile force Increases as temperature increases

v) Malleability - Ability of material to undergo permanent compressive deformation without fracture or rupture. Increase with temperature

vi) Hardness - Resistance to permanent indentation Surface hardness tests are Brinell, Knoop Vickers

vii) Dimensional change - Dental materials are subjected to various change in the oral environment due to chemical, thermal & mechanical insults, apart from being in a moist condition

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Chemical Properties

i) Solubility - The maximum amount of solute that can be dissolved in a solvent at a given temperature

ii) Chemical erosion - Erosion describes solubility in acids. Chemical application of chemical erosion is in acid etching, where the tooth structure is etched with phosphoric acid to achieve adhesion to resin

iii) Leaching - Process of release of substances from a solid material into the surrounding soluble media

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3 Write composition, classification, setting reaction, manipulation, advantages, disadvantages of following cements

I Zinc Phosphate

Composition

- Powder
  - ZnO - 90.2%
  - MgO - 8.2%
    - Reduce temperature & calcination process during manufacture
    - Imparts white color to cement
    - Improves the strength
  - Other oxides - 1.6%
    - Bismuth trioxide
      - Imparts smoothness to freshly mixed cement mass
      - Prolongs setting time
    - Silicon dioxide
      - Acts as inactive filler
      - Aids in calcination process during manufacture

- Liquid
  - Aqueous solution of phosphoric acid - 50-60%
    a) Free acid - 35.2%
    b) Combined with Zn & Al - 16.2%
  - Al & Zn - Upto 10%
    Acts as buffer & partially neutralize phosphoric acid thus limiting reactivity of liquid

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- Water - 33%

Classification

Type I - Fine grained. Film thickness less than 25µm
- luting permanent metallic restorations
- cementation of orthodontic bands

Type II - Medium grained. Film thickness of 40µm
- High strength thermal insulating base

Setting reaction

Powder mixed with liquid
↓
Phosphoric acid attacks surface of powder particles
↓
Release Zn ions into liquid
↓
Al from liquid react with Zn ions
↓
Forms zinc aluminophosphate gel, which covers surface of unreacted powder particles
↓
Exothermic reaction

Set material is amorphous matrix network of zinc aluminophosphate that surrounds incompletely dissolved particles of ZnO
Unbound water forms globules within material, which makes it permeable resulting in porous structure

$3ZnO + 2H_3PO_4 + H_2O \longrightarrow Zn_3(PO_4)_2 \cdot 4H_2O$

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Adhesion - No adhesion to
Solubility - Highly soluble in water for
first 24 hrs after setting & after loss
of material the solubility is negligible
Biocompatibility - Pulp irritant hence varnish is
used in deep cavities
Insulation - Excellent thermal insulator & poor
electrical insulator
Optical properties - Opaque

Advantages
- High compressive strength, used as base
- Good thermal insulator
- Low solubility compared to GIC & ZOE

Disadvantages
- Brittle in nature
- Lacks chemical adhesion
- Pulpal irritant
- Lack of antibacterial action
- Cannot be used to lute ceramic restoration since lack of flexibility

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Manipulation

P/L ratio
For base - putty like consistency - 3.5:1
For luting - more fluid mix with lower P/L ratio

Mixing procedure
- Powder & liquid is dispensed onto glass slab
- Powder is divided into 4-6 increments
- Cooled thick glass slab is used A temperature of 18°C - 24°C would be ideal cooling range
- The powder quantity being minimal, the heat generated is less. Thus helps to achieve slow neutralisation of liquid & better control of the setting reaction
- If a large increment is used, the temperature rise is high & leads to rapid approach of initial set resulting in cement mix of poor properties
- Mixing procedure starts & ends within - minute seconds
- Mixing time - 60-90 sec
- Setting time - 2.5 - 5 min

Properties

1. Strength
Compressive strength - 104 MPa
Tensile strength - 5.5 MPa
Elastic modulus - 13 GPa

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longer working time
Dispose the liquid from the dropper bottle in uniform drops, just before the start of mix, to prevent evaporation of water & subsequent thickening
- Most of powder should be incorporated into the liquid in one large increment
- Mix over small area with stiff spatula
- Add the remaining powder, if required to adjust the consistency
- The cement should be used immediately as working time is short
- The cement is no longer usable when it loses its lustre & starts to "cobweb"

Setting reaction
- Involves chelation reaction between outer portion of powder particles & polyacrylic acid that result in two phase mass
- The interrupted phase is composed of unreacted portions of the powder particles & the continuous phase is matrix gel composed of hydrated polyacrylate macromolecules which are cross linked by zinc ions
- Mixing time - 30-40 sec
  Setting time - 7-9 min

Properties
1. Viscosity - Pseudoplastic
2. Strength
   Compressive strength - 80 MPa
   Tensile strength - 8-12 MPa

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II Zinc Polycarboxylate Cement

Composition

Powder

- ZnO with 10% MgO & traces of alumina
- Small amount of fluoride is also present. Fluoride is released to surrounding tooth structure contributing to anticariogenicity of cement
- Stannous fluoride is added in small amounts to increase strength, regulate setting time & improve viscosity

Liquid

- Polyacrylic acid - 32% - 42%
  It is usually copolymer of polyacrylic acids along with other unsaturated carboxylic acids such as itaconic & maleic acids
- Itaconic & tartaric acid - Stabilize liquid & prevent gelling on extended storage.

Available Systems

1. Powder & liquid
2. Powder (with acid component freeze dried) mixed with distilled water
3. Encapsulated

Manipulation

P/L ratio - 1.5:1

- Shake the powder bottle gently & dispense the powder with a scoop onto a disposable paper pad or glass slab which is cooled to permit

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Elastic modulus - 4-6 GPa

3 Biocompatibility - Cement is acidic though less irritating to pulp
a) Polyacrylic acid are weaker than phosphoric acid
b) There is rapid rise in neutrality of acids
c) The higher molecular size of acid molecules prevent acid penetration into dentinal tubules
d) Chemical binding to dentin prevents any further penetration into dentin
e) The fluoride release may be responsible for some antibacterial properties

4 Solubility - Greater than zinc phosphate & GIC

5 Adhesion - Carboxylate groups on polymer molecule chelate with Ca in tooth structure

Bond strength
Enamel - 3.4 - 13 MPa
Dentin - 2.4 MPa

Advantages
1 Chemical bond to enamel & dentin
2 Mild pulp response
3 Anticariogenic

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Disadvantages

1. During setting, the cement is rubbery in consistency
2. Short working time & long setting time
3. Cement is opaque, hence cannot be used for restorative purpose
4. Compressive strength is poor

Clinical Applications

1. Luting cements for base alloy restorations
2. Thermal insulating bases under direct metallic restorations
3. Cementation of orthodontic bands
4. Cementation of pediatric stainless steel crown

II Zinc Oxide Eugenol

Composition

- Powder
  - ZnO - 69%
  - Rosin - 21% (to reduce brittleness)
  - Zn acetate - 0.7% (accelerator)
  - Zn stearate - 1%. (plasticizer)

Liquid

- Mainly eugenol with some olive oil as a plasticizer
- Olive oil is weak acid & relieves pain

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Available systems
- Powder & liquid
- Two paste system

Types
Type I - For temporary cementation
Class 1 - Powder - liquid
Class 2a - Paste - paste (eugenol)
Class 2b - Paste - paste (non-eugenol)
Class 3 - Paste - paste (non-setting)

Type II - For long term & permanent cementation
Class 1 - Powder - liquid, eg - Super EBA, intermediate restorative material

Type III - Temporary filling materials & bases
Class 1 - Powder - liquid
Class 2 - Paste - paste

Type IV - Cavity liners (thick liners)
Class 1 - Powder - liquid
Class 2 - Paste - paste

Manipulation
Powder-liquid Type
P/L ratio - 4:1 to 6:1
Mill powder is incorporated into liquid & spatulated thoroughly in circular motion with stiff bladed stainless steel spatula

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- Then smaller increments are added until desired consistency is obtained
- Film thickness for ZOE temporary cements should be no more than 40 μm & for permanent cementation it should be less than 25 μm
- Temporary restoration consistency – Mixing is done with high P/L ratio until the mix attains consistency of a dough that can be rolled into rope

Paste form

- Dispense equal amounts of both pastes (accelerator & base) on glass slab
- The paste is mixed till a uniform color is obtained

Manipulation of surgical pack

- A thin consistency is mixed with few cotton fibres to increase strength & durability
- Tannic acid is added to act as hemostatic agent & chlorhexidine to provide antibacterial action
- This pack is then placed on surgical site postoperatively

Setting reaction

Setting time - 4-10 min

- Reaction between zinc oxide & eugenol is a chelation reaction

$$ZnO + H_2O \rightarrow Zn(OH)_2$$

$$Zn(OH)_2 + 2HE \rightarrow ZnE_2 + 2H_2O$$

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Advantages

1. least irritating to pulp due to obtudent effect of eugenol & the neutral pH of the initial mix. It also has soothing effect on inflamed pulp
2. It provides excellent thermal insulation when used as a base
3. Easy to remove & clean when used for temporary cementation of provisional crowns

Disadvantages

1. It does not adhere well to enamel & dentin, hence it causes microleakage & cannot be used for interim & long term restorations
2. Due to its low strength & high solubility it cannot be used for permanent cementation
3. Its solubility is highest among all cements

Clinical Applications

1. As long-term & short term luting agents
2. As temporary & intermediate restorations
3. As root canal sealers Eg- Grossman's or Rickert's sealers
4. Surgical packs
5. Impression pastes

Modifications of ZOE cement

1. Polymer - reinforced ZOE

- The powder is modified with addition of resins hydrogenated rosin & liquid has polystyrene or methylmethacrylate added to it

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- On hydrolysis, ZnO forms $Zn(OH)_2$. This will react with the acid eugenol to form eugenolate, with water being released
- Here water is required for initiation of the reaction & so also a byproduct of reaction, hence known as autocatalytic reaction

Properties

1. Solubility = Eugenol can leach out from material leading to hydrolysis & disintegration of cement. Hence, these cements are mainly for temporary usage
2. Thermal - Good thermal insulator
3. Strength
   - Compressive strength - 5-55 MPa
   - Tensile strength - 0.32-5.3 MPa
   - Modulus of elasticity - 0.22-5.9 GPa
4. Biocompatibility
   - ZOE acts as obtundent due to presence of eugenol, with sedative effect on pulp
   - Neutral pH
   - Should not be used in higher concentrations eugenol can be toxic
5. Optical property - Opaque & white in color
6. Adhesion
   - Does not have chemical adhesion to enamel & dentin
   - Provides an excellent restorative interface with the tooth

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- Compressive strength is increased, which is sufficient for it to be used as an intermediate restoration for 3-6 months
- It is also less soluble in oral fluids
- Examples used for temporary restorative materials & luting agents are intermediate restorative material & Kalzunol

2 Ethoxybenzoic acid (EBA) Modified ZOE (Super EBA)

Composition

Powder

ZnO - 60-70%
Alumina - 20-35%
Hydrogenated rosin - 6%

Liquid

Eugenol - 32%
EBA - 63%

The EBA encourages the formation of a crystalline structure & thereby improves strength considerably. This modified version is widely used as retrograde filling material

Non-Eugenol Cements

- As eugenol inhibits free radical polymerisation, non-eugenol cements were developed to be used for luting purposes in clinical cases which are to receive resinous restorations.

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- Instead of eugenol, carboxylic acid are used to react with ZnO
- They are not brittle & excess is difficult to remove

Uses

Luting temporary crowns, when resin cement has to be used to lute final restoration
- Used for patients who are allergic to eugenol
- Eg- Temp Bond NE, Pre VISION

IV Glass Ionomer Cement

Composition

Powder Ingredients	Percentage	Functions
Silica	35.7 - 41.9	· Glass matrix · Increases translucency
Alumina	20.1 - 28.6	· Basic fillers · Increases reactivity of liquid · Increases opacity
AlF_3	1.6 - 2.4	· Acts as flux
CaF_2	15.2 - 20.1	· Acts as flux
NaF	3.6 - 9.3	· Acts as flux
$AlPO_4$	3.6 - 12	· Glass modifier · Improves properties

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b) Type II - Restorative cements
c) Type III - Liners & Bases

2. Metal - modified glass ionomer
a) Miracle mix
b) Cermet

3 Light cure GIC

4 Hybrid or resin modified GIC

Setting reaction

1. Dissolution

When powder & liquid are mixed together, the a
attacks the glass particles resulting in relea
of Ca^{2+}, Na^{+} & SiO_4^{4-} & F^{-} ions into aqueou
medium. About 20-30% of glass is decompo
by acid attack

Glass + H^{+}
↓
Ca^{2+} + Na^{+} + F^{-}
↓
Al^{3+} + SiO_4^{4-}

2. Initial setting - Calcium cross linking

- Polyacrylic acid chains are cross linked by Ca
ions during initial setting reaction in
first 4-10 minutes from start of mixi
- Since Ca^{2+} ions are doubly charged & ionic
bonded to glass particles. They are readi
liberated by ion exchange with H^{+} ions
acids & are thus responsible for initial
cross linking

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ZrO_2	Trace amount	Increases final strength
Lanthanum, Strontium, Barium & Zinc oxides	Minute amount	Imparts radiopacity

Liquid

- 40-50% solution of 2:1 polyacrylic acid / itaconic acid copolymer in water
- Polyacrylic acid is copolymerised with itaconic, maleic & tricarboxylic acid to stabilize liquid
- Itaconic / maleic acid reduces viscosity of liquid & inhibits gelation caused by intermolecular H-bonding between polyacid molecules
- Tartaric acid increases working time by preventing the premature formation of calcium polyacrylate chains

Classification

Wilson & McLean Classification Based on Uses

Type I - Luting & Bonding Cements
Type II - Restorative Cements
Type III - Liners & Bases
Type IV - Pit & fissure sealants

Mount & Hume's classification

1. Traditional / conventional glass ionomers
   a) Type I - Luting cements

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Uses
- Core buildup materials
- Restricted to class I cavity in primary teeth

3 Resin - Modified Glass ionomer
- Resins & photoinitiators are added to conventional GIC
- Also called hybrid ionomer or resin ionomer

Composition
Powder
Ion leachable fluoroaluminosilicate glass particles
Photoinitiators / Chemical initiators

Liquid
Aqeous solution of polyacrylic acid copolymer that contains pendent methacrylate groups together with approx 10% 2-hydroxyethyl methacrylate

Setting reaction
2 types of reaction — Acid-base reaction
— Polymerization reaction
- When powder & liquid are mixed together; initial setting reaction is by polymerisation of methacrylate group.
- Since it is possible to light cure & initiate setting reaction of resin immediately, this set resin provides an umbrella effect & protects ongoing acid-base reaction within cement.
- This reduces early moisture sensitivity & gives high early strength to mix
- The slower acid-base reaction will be completed after the setting reaction

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- The initial set material is variable

$$Ca^{2+} + PA^{-} \longrightarrow Ca(PA)_2$$

3 Final setting - Aluminium Cross linking

- Gelation occurs during next 24 hrs when the less mobile trivalent Al ions react or crosslink with polyacid chains
- As hydrolysis continues, there is release of more Al^{3+} & SiO_4^{4-} ions
- Silicate forms silica gel whereas Al ions chelate with carboxylic groups displacing even Ca ions because of their higher charge & stronger bonding
- Na & F ions do not participate in cross linking of cement Some of the Na ions may replace the H ions of carboxylic groups, whereas remaining ions along with the F ions are dispersed uniformly within the set cement

$$SiO_4^{4-} + 4H^{+} \longrightarrow SiO_2/2H_2O$$

$$Al^{3+} + 2PA^{-} \rightarrow Al(PA)_2^{+}$$

$$Ca(PA)_2 + Al^{3+} \rightarrow Al(PA)_2^{+} + Ca^{2+}$$

4 Maturation & Structure of Set Cement

- The Ca & Al polyacrylate cross-linked chains become hydrated over time with water being present in liquid. This process is called maturation
- The Al ions, initially surrounded by four H_2O atoms in the gel are then surrounded by six atoms in set cement matrix

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- The unreacted glass particles are sheathed by silicous hydrogel that is found to increase the resistance of glass particles to acid attack since the reactivity of glass surface controls nature of set cement
- The microstructure of set cement consist of agglomeration of unreacted glass particles surrounded by silica gel embedded in an amorphous matrix of hydrated Ca & Al polyalts

Advantages

1. Chemical adhesion to tooth structure
2. Anticariogenic potential
3. Biocompatibility
4. Tooth-coloured restorative material

Disadvantages

1. Inferior mechanical properties
2. Poor wear resistance
3. Highly moisture sensitive
4. Poor esthetics

Modifications

1. High viscous glass ionomers
   - GIC has to be pressed into cavity
   - High strength & better physical properties

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2 Metal modified glass ionomer

Metal filler particles such as silver alloy were incorporated in conventional GIC
This was achieved in two ways —

a) By adding spherical silver alloy particles in 6:1 ratio i.e 6 parts cement & 1 part alloy by volume mixed to suitable consistency with polyacrylic acid at ratio 3:2 by weight
This material incorporating only silver alloy powder without mercury was introduced as 'miracle mix'

b) By fusing glass powder to silver alloy particles through high temperature sintering. Microfine silver particles 40% weight & less than 3.5 μm diameter are mixed with glass powder & then sintered at 800°C. Upto 5% TiO_2 added to modify color.
Pellet formed is ground into fine particles
This is referred to as Cermet.

Properties

- Significant improvement in wear resistance, more for Cermet
- Compressive strength & fracture toughness improved
- Adhesion to tooth structure slightly reduced due to silver
- Radiopacity similar to amalgam
- Less fluoride is released with cermet

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final strength of cement

- Set mix consists of HEMA polymer & pdyacid linked by H-bonding
- This mechanism is known as "dual cure"

Properties

1. Bonding to tooth structure is less due to reduction in carboxylic acid in liquid
   Bond strength is higher
2. Biocompatibility
   Less pulp irritant
3. Compressive strength
   - Slightly lower than conventional GIC
   - Lower modulus of elasticity
   - Tensile strength & fracture toughness are improved
4. Fluoride release is comparable to GIC
5. 1% shrinkage occurs due to polymerization
6. Translucency is better

Advantages

1. Shorter setting time
2. Better initial color stability
3. Improved physical property
4. More esthetic

4 Copomers

- Combination of resin & glass ionomer
- Tensile & flexural strength & wear resistance supeior to GIC but inferior to resin composite

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V Calcium Hydroxide Cement

Composition

Base paste
- Calcium tungstate
- Calcium phosphate
- Zinc oxide in glycol salicylate
- Pigment, radiopacifier
- Inert filler

Catalyst paste
- Zinc oxide
- Zinc stearate in toluene sulfonamide

Setting reaction

Calcium ion from cement causes mineralization of dentin bridge

Hydroxyl ion - neutralize acid by-product & create optimum pH for precipitate setting

Manipulation

Both pastes are dispensed in equal amounts & mixed to a uniform color

Set cement - amorphous calcium salicylate

Advantages

- High alkalinity - antibacterial & protein hydrolytic
- induce reparative dentin formation

Disadvantages

- High solubility - not used in cavosurface when used as liner
- No thermal & dentinal insulation

Classification

1. Based on setting time
   A) Fast setting
   B) Controlled setting

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c) Slow setting
D) Non-setting

II Based on form of availability
A) Powder to be mixed with different vehicle
B) Single paste
C) Two paste system

VI Resin Cement

Composition

Resin matrix - Bis GMA or urethane dimethacrylate
Filler - Quartz, colloidal silica
Coupling agent - Organo silanes
Curing system - Chemical or light curing chemical
Inhibitors - Butylated hydroxytoluene
Opacifiers - Titanium & Aluminium oxides
Color pigments

Classification

Class I - Self cure
Class II - Light cure
Class III - Dual cure

Setting reaction

Resin cement sets by polymerization reaction
1) Chemically activated resins
Base paste - benzoyl peroxide initiator
Catalyst paste - tertiary amine activator

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When the two pastes are spatulated, amine reacts with benzoyl peroxide to form free radicals which start polymerization

2) Light activated resin
When exposed to light of correct wavelength the photoinitiator (camphoroquinone) is activated & reacts with the amine to form free radicals which start polymerization

3) Dual cure resins
- Supplied as two pastes
- When mixed together a slow setting reaction is initiated
- After initial light cure, the remainder of resin cure over a period of time by chemical process

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a) Solution liners (varnish; 2-5 μm)
b) Suspension liners (ZnO (type IV) / $Ca(OH)_2$; 20-25 μm)
2. Thick liners (500-1000 μm)
a) GIC (type III)
b) Zinc oxide eugenol

Purpose
- To serve as physical barrier to the ingress of bacteria bacterial products
- To provide therapeutic effect
- To protect the pulp from residual reactants

Cavity Varnishes
- Cavity varnish is a solution of natural (copal) or synthetic (nitrated cellulose) resins dissolved in an organic solvent such as alcohol, acetone & benzene
- Some varnishes also contain medicinal agents such as eugenol, thymol & fluorides

Functions
- Varnish seals the margins of newly placed amalgam restorations thereby reducing postoperative sensitivity
- It also prevents the penetration of corrosion products into the dentinal tubules from amalgam restorations

Disadvantages
- Varnish should not be used under composite resins as it interferes with polymerization

Factors Affecting The Selection of Pulp Protecting Agents
1. Shallow preparations (≥2 mm of RDT)
In a shallow tooth excavation (which include 1.5-2 mm of RDT), pulpal protection other than in terms of chemical isolation is not necessary

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Bases

Ideal requirements

- Base should be 0.5-0.25mm thick. Very thick bases compromise the bulk of restoration & increase the potential for fracture of the restoration.
- It is not recommended to remove sound tooth structure in order to provide space for a base. Conserving sound tooth structure will enhance restorative support & provide pulpal protection.
- Bases are applied only on internal walls of cavity preparation to prevent dissolution by saliva.

Types

1. Low strength bases
   a) ZOE, $Ca(OH)_2$
   b) Generally used under temporary / interim restoration
   c) $Ca(OH)_2$ used as pulp base
2. High strength bases
   a) GIC, reinforced ZOE, zinc phosphate, zinc polycarboxylate
   b) Used under direct & indirect metallic restorations
   c) Only some bases are indicated under composite resin, eg- GIC

Cavity liners

Cavity liners are cement coatings of minimal thickness applied to the prepared cavity when RDT is adequate
i.e RDT > 2mm

Classification

There types liners

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2 For an amalgum restoration, the preparation is treated with a bonding system & then restored For a composite restoration, the preparation is treated with a bonding system & then restored

3 Moderately deep preparation (0.5- 2mm of RDT)
In a moderately deep tooth excavation for amalgum that includes some extension of the preparation towards the pulp, so that a region include less than ideal dentin protection. It may be judicious to apply base

4 Very deep preparations
If excessive dentin is lost because of caries & tooth excavation extends close to pulp, a liner would be indicated. The ability of hard setting $Ca(OH)_2$ to stimulate the formation of reparative dentin makes it a material of choice to the employed as a liner

Q What is Amalgum?
Amalgum is an alloy of two or more metals of which one of the constituent is mercury Dental amalgum is an alloy made by mixing mercury with silver - tin alloy to which varying amounts of copper & small amounts of Zn are also

Classification of Dental Amalgum

1 According to content
a) Copper amalgum
b) Silver amalgum
c) Prealgamated alloys
d) Amalgum with noble metals

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2 According to number of alloy metals
a) Binary alloys
b) Ternary alloys
c) Quaternary alloys

3 According to whether powder consists of unmixed or admixed alloys
a) Admixed / dispersion or blended alloys
b) Single compositional / Unicompositional alloys

4 According to shape of powdered particles
a) Spherical shape
b) Lathe cut
c) Combination of spherical & lathe cut

5. According to powder particle size
a) Microcut
b) Fine cut
c) Coarse cut

6 According to Cu content
a) High copper amalgams
b) Low copper amalgams

7. According to addition of noble metals
a) Palladium
b) Platinum
c) Gold

8 According to presence of zinc
a) Zinc containing ($\geq 0.01\%$)
b) Non-zinc containing ($< 0.01\%$)

Q. Composition of low Copper & high copper alloys & functions of each component

Low copper alloy: Composition
- Silver - 63-70%
- Tin - 26-28%
- Copper - 2-6%
- Zinc - 0-2%

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Causes delayed expansion

2. Define Amalgamation & write amalgamation reaction of low copper alloy with suitable illustration

Amalgamation is the process of reaction & setting when mercury is mixed & amalgamated with any alloy, in this case, it is silver alloy

Low copper conventional amalgam alloy

Amalgamation occurs when the silver alloy particles are triturated with mercury

- During trituration, mercury diffuses into the γ phase of alloy particles reacting mainly with Ag & Sn. Hg has limited solubility for Ag as compared to Sn
- So Sn remains in solution longer than Ag when solubility exceeds that of Ag, Ag starts precipitating first & γ_1 phase (Ag_2Hg_3) & then γ_2 phase (Sn_7Hg)
- The remaining Hg dissolves the alloy particles γ_1 & γ_2 crystals grow & the amalgam begins to harden
- There is insufficient Hg to consume all the alloy particles. Unconsumed particles are present in set amalgam

$$Ag_3Sn + Hg \longrightarrow \underset{(\gamma_1)}{Ag_2Hg_3} + \underset{(\gamma_2)}{Sn_{7-8}Hg} + \underset{(\chi)}{Ag_3Sn}$$
(γ)

- Microstructure of set amalgam reveals the unreacted γ alloy particles surrounded by a mixture of γ_1 & γ_2 phases



Phases

- γ phase (Ag_3Sn) - This is the original phase

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been completely dissolved in Hg. This is the strongest phase which occupies the maximum available space in the volume of restoration

- γ_1 phase (Ag_3Hg_4) - Noblest phase & most resistant to corrosion & tarnish
- γ_2 phase ($Sn_{7-8}Hg$) - Weakest phase & more prone to corrosion & creep
- Matrix phase - A very small amount of unreacted Hg will be present within the amalgam mass. Since it is a weakest phase, a drastic drop in the strength of amalgam occurs, if this phase exceeds a certain critical limit
- Interphase - Interphase between $\gamma-\gamma_1$, $\gamma-\gamma_2$ and $\gamma_2-\gamma$

Delayed Expansion

Most amalgam when completely triturated properly exhibit minimal dimensional changes after the initial few hours. However some low Cu or high Cu amalgam when improperly triturated & manipulated by excessive trituration which destroy the particles of alloy & result in delayed expansion. This expansion occurs 3-5 days after insertion of the restoration. This type of expansion is known as marginal expansion (or) edge expansion. This is always greater than the initial expansion in contact with water by moisture contamination during trituration & condensation. This is thought to be due to the formation of $Zn(OH)_2$ & $Ca(OH)_2$ when the amalgam alloy containing Zn is exposed to moisture from saliva during trituration & condensation. These hydroxides react with the tin-mercury phase to form calcium stannate & zinc oxide which are expansive in nature.

$$Zn + H_2O \longrightarrow ZnO + H_2$$

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- Complications
a) Protrusion of entire restoration out of cavity
b) Increased microleakage space
c) Restoration perforation
d) Increased creep & flow

Mercury alloy ratio
1 High mercury technique
2 Minimal Mercury technique

1 High mercury technique
- Initial amalgam contain little more mercury (52-56%), producing a plastic mass
- It is necessary to squeeze out the Hg from increments being introduced during build up restoration. Moreover each increment is larger than precursor
- It is not used nowadays

2 Minimal mercury technique
- This method reduces Hg content upto 43% for high Cu Single composition alloy compared to 55% for lathe cut low Cu alloy
- The recommended Hg Alloy ratio is 1:1

Q Enumerate the steps in manipulation of dental amalgam
- Selection of alloy
- Mode of supply
1 Alloy powder & mercury
2 Disposable compule capsule with proportional alloy & mercury
3 Pre weighed alloy in tube form & mercury in sachets

- Proportioning
The Hg: alloy ratio refers to the amount of alloy & Hg that is required for trituration

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High copper alloy

1. Admixed alloy powder
2. Single compositional alloy powder

Admixed alloy powder : Composition

- Silver - 69%
- Sn - 17%
- Cu - 13%
- Zn - 1%

Single compositional alloy powder Composition

- Ternary alloy in spherical form - Silver - 60%
  Tin - 26%
  Copper - 13%
- Ternary alloy in spheroidal form - Composition same as for ternary alloy in spherical form
- Quaternary alloy in spheroidal form - Silver - 60%
  Copper - 13%
  Tin - 24%
  Indium - 3%

Silver

- Major component - 2/3rd of conventional amalgam alloy
- Contributes strength of the finished amalgam restoration
- Decreases flow & creep & increases expansion

Tin

- Helps to control rate of reaction
- Decreases strength
- Reduces resistance to tarnish & corrosion

Copper

- Contributes hardness & strength
- Decreases flow & increases setting expansion

Zinc

- Reducing / deoxidizing agent
- Ads to manufacture
- Acts as plasticizer

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COMPOSITE RESINS

Q1 Define composite & classify composite.

Composite is the combination of two or more materials which are insoluble in each other & when combined give properties equal or superior to those of individual components. If composite include polymer phases, they are called composite resin

→ Classification

1 Based on resin matrix
- A. Bis GMA based
- B UDMA based
- C. Silorane based

2 Based on type of cure
- A Chemical cure
- B. UV light cured
- C Visible light cured
- D. Dual cure
- E Tri cure
- F. Heat & pressure cured

3 Based on mode of curing
- A Instant cure
- B. Soft cure - Ramped cure, Stepped cure, Delayed cure

4 Based on filler particle size
- A Conventional
- B Microfilled
- C Small particle
- D. Hybrid

5. Based on filler particle size (recent classification)
- A Megafill
- B Macrofill
- C. Midifill
- D. Minifill
- E Microfill
- F. Nanofill

6 Based on morphological & mechanical characteristics
- A. Densified composites
- B Microfine composites
- C. Miscellaneous composites
- D. Traditional composites
- E. Fibre - reinforced composites

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Q Dispensing of alloy & mercury
- The volumetric dispension of alloy powder is accurate compared to dispensing by weight

Trituration
- To mix the amalgam alloy intimately with Hg so as to wet the surface of particles to allow reaction between liquid Hg & silver alloy

1 Mulling
2 Condensation
3 Pre-carved burnishing
4 Carving
5 Post-carved burnishing
6 Finishing & polishing

Q Define trituration. Mention function & method of trituration
- The process of trituration is to mix the amalgam alloy intimately with Hg so as to wet the surface of powder particles to allow the reaction between liquid Hg & Ag alloy

- Objectives
- To remove oxide layer
- To pulverize pellet into particles
- To decrease particle size, since it increases surface area of alloys
- To keep amount of γ_1 & γ_2 matrix optimal as uniform as possible
- To provide proper amalgamation

Methods
1. Manual trituration
- Mortar & pestle

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BONDING AGENTS

Q 1 Classify bonding agents

Decade	Bonding Agent Introduced	Features
1960s 1970s	First & second generations	• Dentin etching was contraindicated • Adhesion was primarily to smear layer • Weak bond strength
1980s	Third generation	• Etching both dentin & enamel • Priming a separate step • Improved bond strength
Early 1990s	Fourth generation	• Total etch concept • Wet bonding & hybrid layer concepts introduced • Increased bond strength • Multiple technique sensitive steps
Mid 1990s	Fifth generation	• Application protocol reduced to two steps, etching & bonding, since primer & adhesive were combined in one bottle. • Maintained high bond strengths
Late 1990s	Sixth generation	• Self etching primers introduced • Post operative sensitivity was reduced • Bond strength was lower
Early 2000s	Seventh generation	• All in-one concept introduced • Etching, priming & bonding in single step • Bond strength lower

Based on adhesion

Type	Step involved
Etch & rinse adhesive	3 step – fourth generation 2 step – fifth generation
Self etch adhesive	2 step – sixth generation 1 step – seventh generation

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III Based on treatment of the smear layer
a) Smear layer modifying
b) Smear layer removal
c) Smear layer dissolving

Q.2 What is total etch technique?
- The acid etch technique was initially developed to improve retension to enamel initial agents not appear to bond with dentin
- All the time it was believed that
  - Dentin could not be etched as well as enamel
  - Acid etching of dentin can cause pulp injury
- In early adhesive resin dentin low bond strength was due to hydrophobic nature
- Disrupt dentin without pulp injury along with introducing hydrophilic adhesive lead to improved bond & marginal seal between resin & tooth structure.

Q 3 What is the significance of wet bonding & write a note on hybrid layer?
- Excess water on the substrate result in an over wet substrate
- In such cases, an acetone based primer is used, this is wet bonding
- Excess water → collagen swelling → less penetration of resin material & also disturb primer, which will not be displaced completely from tooth
- Cause hydrophobic & hydrophilic interphase at dentin
- Composite interface which result in formation of water globules or blisters which on load, force dentinal fluid into pulp causing operative sensitivity
- If water free acetone based adhesive used, within 36 sec complete interfibrillar penetration of resin occur resulting in hybridised zone formation

→ Hybrid Layer
- Structure formed in dental hard tissues by demineralisation of surface & subsurface followed by infiltration

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- Inner surface of mortar is roughened to minimize the friction between amalgam

2 Mechanical trituration
- It is done by using mechanical trituration
- Advantages
  - Uniform & reproducible mix
  - Minimal trituration time
  - Atmospheric Hg contamination is reduced

Q Write the effects of mercury toxicity
- Like all other materials Hg have the potential for hazardous if not used properly
- Minimata disease occurs when severe Hg poisoning It is neurological disturbance with ataxia, numbness of hand & feet, muscle weakness & damage to hearing & speech
- Also has the potential to damage the fetus in womb
- Hg from dental amalgam restoration is usually released in form of vapours & ions
- Hg vapours is dangerous - rapidly absorbed into the blood stream via alveoli of lungs

Q What are the measures taken to ensure mercury hygiene?
- Dental & non dental staffs should be well trained in management & hygiene protocols
- The operatory field should be well ventilated
- Operatory should be easy to clean after spillage
- Everyone should be aware of potential source of Hg contamination
- Avoid skin contact

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12

- High powder vacuum evacuator should be used during finishing & polishing of amalgam
- All scrap amalgam & excess Hg should be salvaged & stored in an air tight container containing radiographic fixed solution
- Professional clothing should be removed before leaving the workplace

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of monomer & subsequent polymerization

→ Zones of hybrid layer

- Top layer - Amorphous phase denatured or more loosely arranged collagen directed towards adhesive resin
- Middle - Collagen fibres seperated by electrolucent space
- Base - Partially demineralised dentin infiltrated by resin

→ Advantage

- Seperate application of conditioner, primer & adhesive - so better control
- Less technique sensitive
- High bond strength

→ Disadvantage

- Risk of overetching dentin
- Overwet or overdry dentin
- Time consuming

OV

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Q.2 What are the different types of curing lamps?

1 QTH curing light
- Commonly used - Quartz bulb with tungsten filament in halogen environment
- Wavelength of light 440 to 500nm

2. LED curing light
- Use a solid state electronic process to produce a light wavelength in blue spectrum (440-480 nm)
- Requires less power & do not generate heat

3 PAC curing light
- Plasma arc curing uses xenon gas that is ionized to produce plasma arc
- High intensity white light is again filtered to remove heat & wavelengths except blue light

4. Argon laser curing light
- Have highest intensity
- Can emit single wavelength of 480nm

Q 3 Write a note on polymerization shrinkage & add method to reduce it
- Composite material shrink during polymerization. This cannot be eliminated & pull material away with wall. It causes postoperative sensitivity & microleakage
- Shrinkage vary based on filler ratio, so shrinkage ratio is in between 0.6 - 1.4 %
- Composites with higher filler loading such as hybrids & fine particle composites shrink less
- Chemically activated composites cure at much slower rate hence shrinkage is less

→ Clinical Techniques to reduce shrinkage
- Ramped cure - Polymerize in layer
- Soft start - Initial slow polymerization
- Delayed cure - Restoration partially cured with low intensity light followed by final high intensity exposure

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- Fabricating & restoring composite extraorally & then cementing into tooth.

Q 4 What is disadvantage of UV light on composite?

- The plasma arc & laser curing light present a narrow band of light emission that may not correspond to the absorption band of photoinitiators present in composite resin, resulting in incompletely cured resin.
- They allow a reduction in polymerization time. This results in a decrease in pre-gel time, which in turn causes an increase in shrinkage stress.

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DENTAL BURS

Q1 Explain concentricity & runout.

→ Concentricity

- Concentricity is the direct measurement of the symmetry of bur head itself
- It measures how closely a single axis can be passed through tips of all blades
- It is an important indication of whether one blade is longer or shorter than other

→ Runout

- Dynamic test measuring the accuracy with which all the blade tip pass through a single point when the instrument is rotated.
- It measures not only the concentricity of the head but also the accuracy with which the centre of rotation passes through the centre of head
- Even a perfectly concentric head exhibits substantial runout if the head is off centre on the axis of bur
- The bur neck is bend, but not held straight, handpiece unit or shank is eccentric relative to handpiece bearing

Q2 Define dental burs

- Dental burs are rotating instrument having bladed cutting head that are used in a dental hand piece
- Commonly made from -
  a) Steel - Single piece tempered tungsten vanadium alloy steel & blades are machined out of steel blank
  b) Tungsten carbide

Q3 Classification of burs

I Depending upon their mode of attachment to handpiece
- Latch tip, friction grip

II Depending upon handpiece used
- Slow speed contrangle bur
- Straight handpiece bur

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- Aerotor bur

III Depending upon shape
- Round
- Inverted cone
- Straight fissure
- Tapered fissure
- Pear shaped

Q 4 Factors affecting cutting efficacy
- Rake angle
- Clearance angle
- No. of blades & its distribution
- Speed
- Influence of load
- Depth of engagement
- Bur diameter
- Heat treatment
- Runout
- Concentricity

Q 5 Difference between dental bur & diamond points
- Diamond coated abrasive points are other forms of rotary cutting instruments
- It consist of an inner blank area with industrially crushed diamond of different grit are either electroplated with meshed or sintered with metal mixture.
- They can be -
  - Coarse grit - 125 - 150 µm
  - Medium grit - 88 - 125 µm
  - fine grit - 60 - 74 µm
  - very fine grit - 26 - 44 µm

Q 6 Write a note on rake angle & clearance angle
→ Rake angle
- Most important design characteristic of bur design

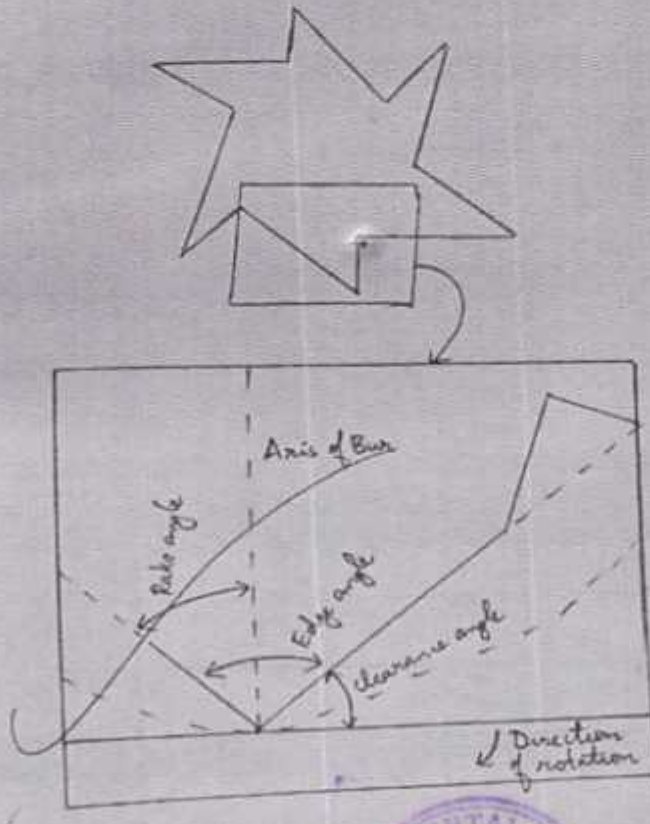
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- A rake angle is said to be negative when rake face is ahead of radius.
- For cutting hard & brittle material a negative rake angle minimise fractures of cutting edge, increasing the tooth life.

→ Clearance angle

- The clearance angle eliminates rubbing friction of the clearance face, provides a step to prevent the bur edge from digging into tooth structure excessively & provide adequate clearance space for the chips formed ahead of the following blades.
- An increase in clearance angle causes a decrease in edge angle



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1. Bring this record book to all practical classes and the record must be kept neat and in good condition.
2. Credit will be given to the records kept neat and submitted in time.
3. Students should wear apron with identity cards while working in the laboratories.
4. After doing the practicals, record your observations and results in the book. Write a relevant inference to the experiment.
5. Submitt the record book complete with observations, discussion, diagrams and calcu lations for valuation when you come to the next practical examinations.
6. Marks will be awarded for the records during practical examinations.
7. Unnecessary wastage of water, gas or any other materials should be avoided
8. Containers of materials/ chemicals must be kept closed in their proper places when not in use.
9. Excess or waste materials must be thrown into the waste bins and should not be thrown into the sink.
10. Students should enter the laboratories with all the required instruments. Borrowing will not be permitted.
11. Equipments borrowed from the departments should be returnded before leaving the laboratory.
12. Students should keep the laboratory neat and tidy and should not cause any damage to the furniture, equipments etc.
13. Student is liable to replace or compensate for the equipment that is lost or damaged.
14. Strict discipline should be maintained while working in the laboratory.

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RULES FOR THE CLINIC

Clinics periods are from 9 a.m to 4 p.m. Sunday will be holiday

No students will be allowed in the clinic unless attired in the regular uniform prescribed and his general appearance is neat and clean.

Students expected to be prompt in their attendance in the clinic.

The throwing of the waste materials such as paper, guaze, dressing cotton, napkinsetc. into the Fountain spitons or on the floor other than the receptacles furnished will be result in disciplinary action against and the students found guilty.

All damages to chairs or other equipments will be charged on the account of the students concerned.

Students will not be allowed to take patients other than those who are regularly assigned by the staff in charge.

Students desiring to treat their own patients or personal friends must obtain the prior approval of the staff in charge and all such patients must apply and pass through the regular, routine of admission. They must pay the prescibed charges for the treatment.

Material and supplies necessary for clinic work will be provided as per instructions from the staff in charge.

Students must keep an appointment book beside the clinic record sheet of individual patients with them. They should make entry of the patient's name, number and type of work done in the appointment book as well as on the record sheet.

0 Students must possess their own instruments for clinical work as required by the individual clinical department.

1 Loaning of instruments will not be allowed.

2 Students are forbidden to sit on the Dental chairs.

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STUDENTS DECLARATION

I have carefully read the above rules and undertake to abide by them

Signature of the student

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CERTIFICATE

This is to certify that Mr. /Miss. ASHIKA V P

Reg. No. 18002043O *has satisfactorly completed the PreClinical excercise prescribed by the University for the BDS Course during the year* 2021 - 22

Date : 31/8/21

Lecturer-in-charge

Head of the Department

DEPARTMENT OF ORTHODONTICS

Record of submission :

Name of the candidate. ASHIKA V P

University Reg.No 18002043O

Date of Practical Examination : 9/9/21

Signature of Examiners 1)

2)

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DEPARTMENT OF ORTHODONTICS

INSTRUCTIONS TO STUDENTS

On posting to the department students should be possess the following instruments and materials. Without these, students are not allowed to attend the clinics or the laboratory.

1. Young's loop forming pliers
2. Adam's pilers (Clasp adjusting pilier)
3. Cutting pliers
4. Glass marking Pencil.
5. Glass slab 9" *41/2"* 1/2"
6. Rubber sheet 3" * 2 1/2"
7. Ruler and divider
8. Carver
9. Instruments tray
10. Spirit lamp
11. Plaster spatula
12. Rubber bowl
13. Towel
14. Copying pencil
15. Orthodontic impression Trays, High FLANGE
    U-O,1,2,3,4
    L-O,1,2,3,4,
16. Graph sheets-15
17. Metalic Scale

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PPLIANCE FABRICATION

1. HAWLEY'S APPLIANCE
2. HAWLEY'S APPLIANCE WITH ANTERIOR BITE PLANE
3. HAWLEY'S APPLIANCE WITH POSTRIOR BITE PLANE AND ' Z ' SPRING
4. TONGUE GUARD APPLIANCE
5. ORAL SCREEN
6. EXPANSION APPLIANCE
7. CATALAN'S APPLIANCE

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STAINLESS STEEL

Steels are the iron based alloys that contain less than 1.2 % Carbon. When 12-25 % of chromium is added to the steel the alloy is called stainless steel.

Due to its resistance to corrosion and staining, good luster, non flaking and non peeling properties care of sterilisation and low maintanance, it is popularly used in many industries such as building and architecture, automobiles, medicines and cookwares

History

1912 - Harry Brearly of sheffield, UK, discovered it while seeking for a corrosion resistant alloy for gun barriers.

1919 - It was introduced to dentistry by F. Hauptmeyer of Germany who called it 'Wipla' meaning "like Platinum"

1929 - It was used for manufacturing orthodontics wires.

1930 - Angle used stainless steel as a ligature wire.

1937 - It was proved to be an efficient orthodontic material by the studies done by P. Simon, S. Friel, De Coster, R. Schwarz, A. Kirkhaus, A. Bruse, and J. Wunderly

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Types

Based on different crystalloid configuration of the structure, stainless steel is of 3 types:

1. Ferritic
2. Martensitic
3. Austenitic

1. Ferritic stainless steel (AISI 405)

→ Pure iron at room temperature has BCC structure and refered to as ferrite.

→ Stable at 912°C

Advantages:

→ Good resistance to corrosion

→ Low cost

Disadvantage

→ low strength

→ Cannot be heat hardened.

2. Martensitic Stainless steel (AISI 410)

→ Martensitic steel is made by transforming austenitic steel into martensitic form.

FCC of austenitic steel $\xrightarrow[\text{Quenching}]{\text{Hardening}}$ BCT structure of martensite

Advantages:

→ Can be heat treated

→ Because of its high strength and hardness it can be used for surgical and cutting instruments like burs, shanks and orthodontic pliers.

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7. Microimplants
8. wires used in removable appliances and retainers
9. Orthodontic instruments and plier.

Properties:

→ It can withstand occlusal forces due to its high stiffness.
→ It is highly ductile and malleable, it can be drawn into wires or hardened into stainless steel sheet for bands.
→ It is corrosion resistant so it is stable in oral environment.
→ It is strong enough to prevent distortion, so orthodontic parameters such as compared to non metal brackets, making orthodontic treatment tip and torque can be expressed freely in brackets.
→ Because of their stainless steel brackets produce less friction as compared to non metal brackets, making orthodontic treatment faster and more comfortable for patient.

Passivating Effect

Resistance to tarnish and corrosion of the stainless steel because of passivating effect of chromium. The cr in the stainless steel form a thin adherent transparent but tough and impervious oxide layer on the

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surface of alloy when it is subjected to an extraoxidising atmosphere or mild as clean air. The protective layer prevent further tarnish and corrosion by blocking the diffusion of oxygen to the underlying bulk alloy. This is called passivating effect.

Sensitization:

Heating stainless steel at 400 - 900°C

↓

Reaction of Cr and C at grain boundaries

↓

formation of Cr free chromium Carbide at grain boundaries

↓

Loss of Cr from matrix of stainless steel (less than 12%)

↓

Loss of passivating effect

↓

Reduction in corrosion resistance

↓

Weakening of metal

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Methods to reduce sensitization

1) Reduce the carbon content such that Cr carbide is not formed.

2) Stabilisation : Most successful method employed to eliminate Cr carbide precipitation is introduction of some other element which react with Carbon.

eg: Ti - stainless steel that have been modified in their masses is said to be stabilized.

Formability

→ High formability provides the ability to bend the wire into desired configuration without fracturing the wire.

Biocompatibility

→ It induces resistance to corrosion and tissue tolerant to element of wire.

Cold working

→ strain hardening / work hardening

→ In a poly acrystalline material.

→ Metal become stronger and harder.

Annealing

→ Effect associated with cold working can be reduced by simple heating the metal.

→ Severe cold working more readily does annealing decreases.

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→ In general comprises of 3 stage :
recovery, Recrystallisation and grain growth

→ High melting point of metal, higher temperature needed

Soldering and Welding

→ compatibility to be welded or soldered to auxillaries and alllatchments.

→ Soldering is a procedure where two or more metals are joined together by melting and flowing a filler metal into joint.

→ Welding is the procer by which 2 pieces of similar metals are joined together without addition of another metal.

Cold welding : Done by hammering or pressure
eg : cold welding of gold foil filling

Hot welding : Use heat of sufficient intensity to melt metals being joined the heat source is usually an oxyacetylene flame or high electricity.

Components of Solder Joint

a) Parent metal to be joint (substrate metal)
b) Flux and antiflux
c) Filler metal
d) Heat source

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Flux: It is a compound applied to metal surfaces to be joined to prevent formation of oxides that may reduce the strength of solded area.

Antiflux: The material used to restrict the flow of solder into unwanted areas are known as antiflux. It is applied before applying flux.

eg: Graphite, whiting ($CaCO_3$ in alcohol, water suspension)

Types of Soldering:

1) Soft Soldering - Joining of 2 metals by the use of a filler metal having a very low melting temperature, usually below 350°C

- Soft Soldering uses a lead - tin alloy as filler.

2) Hard Soldering - Joining of 2 metals by the uses of a filler metal having a melting temperature of less than 450°C.

3) Brazing - Joining procedure in which 2 metals are joined together by the fusion of a filler metal between them having a melting temperature of more than 450°C

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Clinical Application of Soldering

a) Soldering of hooks and springs to each wire.

b) Soldering of wire to wire.

c) Attaching a buccal tubes to bands.

d) Joining inner and outer pairs of bands.

Clinical Application of Welding

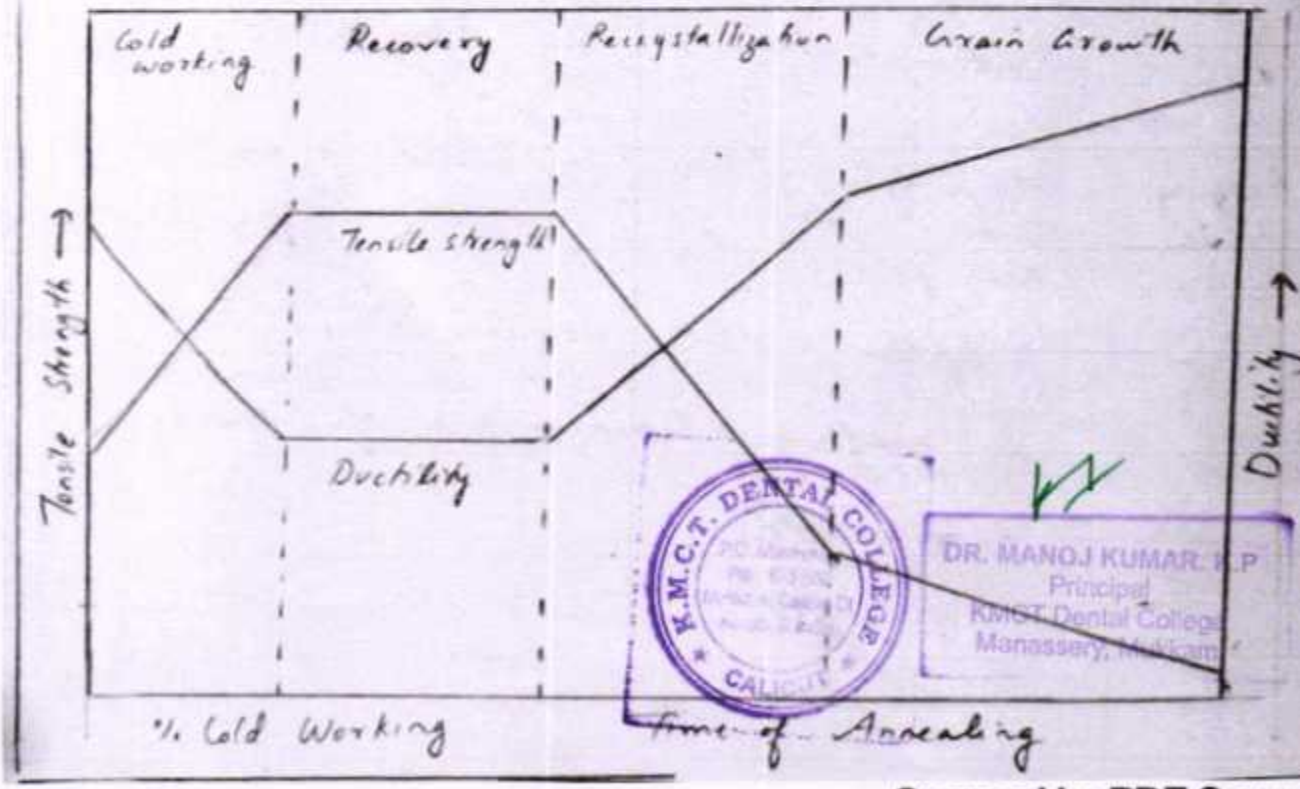
a) To weld ss strips to make blanks for an band

b) To weld buccal tubes on posterior bands.

c) To weld brackets on anterior bands

- Tensile strength and ductility of a metal as function of cold work and annealing curve.

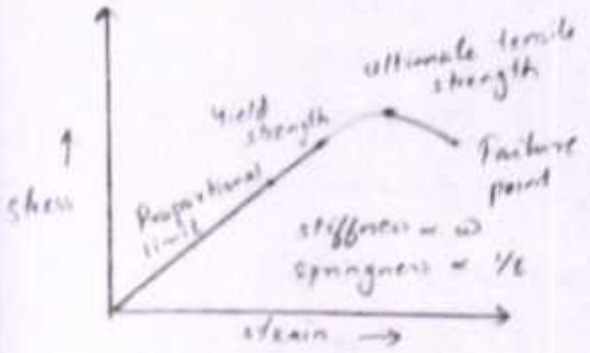
Graph of Annealing



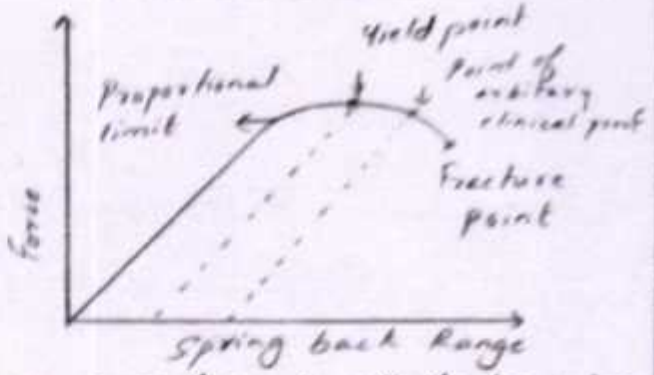
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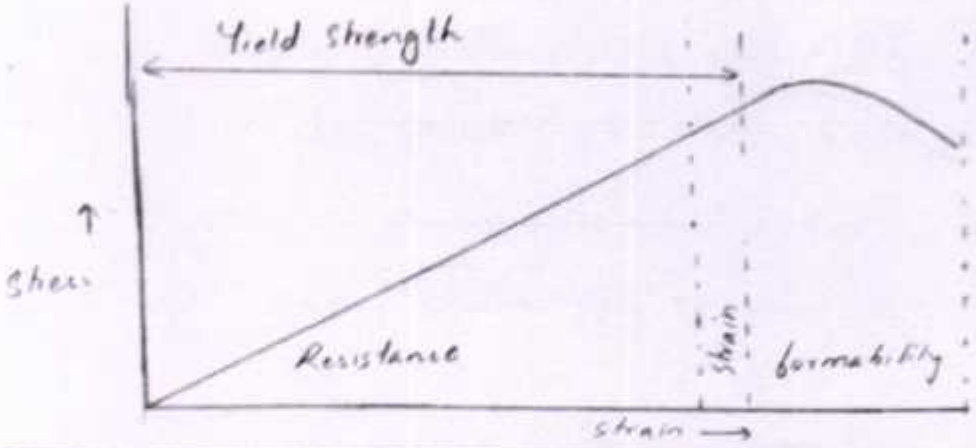
Stress strain Curve



Modesate Spring back



Diagrammatic Representation showing properties of orthodontic wire



Exercise	Date of commencement	Date of completion	Grade	Signature of Instructor
Straightening of wire 4" length -19 gauge		10/2/20	B+	
Straightening of wire 6" length -19 gauge	10/2/20	13/2/20	B	
Equilateral 1" Triangle of length 1" -19 gauge	13/2/20	9/3/20	B	
Square of 1" length - 19 gauge	9/3/20	7/1/21	B	
Recangle of 2"*1" length -19 gauge	7/1/21	9/1/21	B	
'U' Loop - 19 gauge		14/1/21	B	
'V' Loop - 19 gauge		20/	B	
'UV' Loop - 19 gauge		2 /1/21		
Circle of $2\frac{1}{2}$" diameter - 19 gauge	9/1/21	11/1/21	B	

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AISI Classification of Stainless steel

→ 100 series - Type 102 - austenite general purpose steel

→ 200 series - austenitic chromium - Ni - Mn Alloy
Type 201 and 202 (austenite general purpose)

→ 300 series - Type 301 (highly ductile). Type 302, 303, 304, 304L, 304LN, 308 (used as filler metal when welding), 309, 310, 310S, 316, 316L, 316Ti, 321

→ 400 series - ferritic and martensitic Cr Alloy. Type 405 (for welding application), 404, 409, 410, 416, 420, 439, 440.

→ 500 series - Heat resisting Cr alloy

→ 600 series - Originally created for proprietary alloys.

→ 900 series - Austenitic Cr - Mo alloy

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CLASPS USED FOR RETENTION

REMOVABLE APPLIANCE

→ Devices that can be inserted into and removed from the oral cavity by the patient at will.

→ Used to treat a no. of minor malocclusions

→ Used in conjugation with fixed appliances and for retention after treatment with fixed appliances.

Advantages:

→ Ability to maintain oral hygiene

→ Less chair side

Disadvantages

→ Need for patient cooperation

→ Failure to adhere to prescribed removable appliance wear schedules will result in either slow treatment response or no response at all.

Action of Removable Appliance

→ Removable appliances work by applying a single force onto the crown of the tooth.

→ Thus removable appliances act by tipping the tooth around its centre of resistance.

→ Tipping can be brought about in the mesio-distal or bucco-lingual direction.

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→ The key point to be considered is the position of the root apex before the beginning of treatment, teeth that have their apex at the correct position are ideally suited for the with removable appliances.

→ In such patients, the irregularity is usually due to the crowns being tipped from its correct position and through therefore respond well to tipping tooth movements possible using a removable orthodontic appliance.

Components of Removal Appliance

→ Made up of three basic components

(a) Retentive components

(b) Active components

(c) Base plate

(a) Retentive components

→ They are components that help in keeping the appliances in place and resist displacement of appliance.

→ Adequate retention of a removal appliance is achieved by incorporating certain wire components that engage undercuts on the teeth.

→ These wires components that aid in retention of removable appliance are called clasps.

(b) Active Components

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→ They are components of the appliance that exert forces to bring about the necessary tooth movement.

→ Active components include:

(1) Bows (2) Springs (3) Sources (4) Elastics

(3) Base plate

→ The bulk of the removable appliances is made of acrylic base plate.

→ The prime function of the base plate is to incorporate all the components together into a single functional unit.

→ The base plate also helps in retention of appliance and for anchorage.

Uses of base plates in Removable Appliances:

(a) The base plate unites all the components of the appliances into one unit.

(b) Helps in achoring the appliance inplace.

(c) It provides support for the wire components

(d) Helps in distributing the forces over a large area.

(e) Bite planes can be incorporated into the plate to treat specific orthodontic problems

CLASPS

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Clasp

- Clasps are retentive components of removable orthodontic appliance
- Adequate retention of a removable appliance is achieved by incorporating certain wire components that engage undercuts on the teeth.
- Retension of appliance implies resistance to displacement of appliance.

Importance

- Good retention is essential for proper delivery and direction of force by active components.
- If retention is inadequate, it leads to difficulty in appliance wear and poor patient co-operation.
- Active components will not work effectively if there is poor retention.
- chances of appliance breakage are more if retention is less.

Requirements of an Ideal Clasp

1. It should offer adequate retention
2. It should permit usage of both fully erupted as well as partially erupted teeth.

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(3) It should offer adequate retention even in the presence of shallow undercuts.

(4) They should not by themselves apply any active force that would bring about undesirable tooth movements of the anchorage teeth.

(5) It should be easy to fabricate.

(6) It should not impinge on the soft tissues.

(7) It should not interfere with normal occlusion.

Mode of action of clasp

→ clasp act by engaging certain constricted areas of teeth that are called undercuts

→ When clasps are fabricated, the wire is made to engage these undercuts so that their displacement is prevented.

Circumferential Clasp

→ Also known by the terms three quarter clasp or 'c' clasp

→ They are designed to engage the bucco-cervical undercut.

→ Wire is engaged from the proximal undercut along the cervical margin then carried over the occlusal embrasure to end as a

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Adams clasp

→ First discovered by Professor Philip Adams

→ Also known as liverpool clasp, Universal clasp and modified arrowhead clasp

→ when properly constructed this clasp offers max. retention.

→ The adams clasp is made of following parts:

(a) Two arrowheads

(b) Bridge

(c) Two retentive arms

→ The two arrowheads engage the mesial and distal proximal undercuts.

→ The arrowheads are connected to each other by a bridge that is at 45° to the long axis of the tooth.

Advantages:

(1) It is rigid and offers excellent retention

(2) It can be fabricated on deciduous as well as permanent.

(3) They can be used on partially or fully erupted teeth.

(4) It can be used on molars, premolars and on incisors.

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(5) No specialised instrument is need to fabricate the clasp. Young's Universal pliers that are used routinely for most wire bending can be used.

(6) It is small and occupies minimum spaces.

(7) The clasp can be modified in a number of ways.

Modification of Adams clasp

→ **Adams with single arrowhead**: Adams clasps can be modified to have a single arrowhead. This type of clasp is indicated in a partially erupted tooth, which usually is the last erupted tooth molar. The single arrowhead is made to engage the mesio-proximal undercuts of the last erupted molar. The bridge is modified to encircle the tooth distally and ends on the palatal aspect in a retentive arm.

→ **Adams with T hook**: A T hook can be soldered onto the bridge of the adams clasp. These hooks are useful in engaging elastics.

→ **Adams with incorporated helix**: A helix can be incorporated into the bridge of Adams clasp. This also helps in engaging elastics.

→ **Adams with addition Arrow head**: Adams clasp can be constructed with an additional arrowhead. The additional arrowhead engages the proximal undercut of the adjacent and is soldered on to the bridge of Adams. This type of clasp offers additional retention.

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→ Adams with soldered buccal tube: A buccal tube can be soldered onto the bridge of the Adams clasp. This modification permits use of extra-oral anchorage using face bow headgear assembly.

→ Adams with distal Extension: The adams clasp can be modified so that the distal arrowhead has a small extension incorporated distally. This distal extension is engaging elastics.

→ Adams on Incisors and premolars: Adams clasp can be fabricated on the incisors and premolars when retention in these areas is required. They can be constructed to span a single tooth or two teeth.

Construction of Adams clasp

→ straightened piece of wire
→ First make a bend in the wire slightly more than a right angle.
→ Mark with a pencil to show second bend point.
→ Hold in the pliers just below one of the bends.
→ Right angled bend on the other side to match.
→ Turn the pliers around, then the wire is pulled back on itself forming the 'U' type of loop at the bottom of the arrowhead.
→ The second arrowhead held or in the pliers back prior to bend.
→ Both arrowheads are bend into 45° from the bridge.
→ Checking that the arrowheads fit into marked undercuts of teeth.

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→ The leg is sufficiently off the plate to allow acrylic to flow underneath.

→ Bridge halfway up crown.

→ Final clasp position.

Southend clasp

→ Used when retention is required in the anterior region.

→ The wire is adapted along the cervical margin of the tooth the central incisors.

→ The distal part ends are carried over the occlusal embrasure to end as retentive arms on the palatal side.

Triangular clasp

→ They are small triangular shaped clasps that are used between two adjacent posterior teeth.

→ They engage the proximal undercuts of two adjacent teeth.

→ These clasps are indicated when additional retention is needed.

Advantages:

→ Provides adequate retention, no irritation to the gingival tissue.

→ Easily fabricated

→ Preformed clasps are available

→ They can be made in advance and adjusted according to tooth and can be used to engage elastics.

Disadvantages:

→ It is not a versatile clasp like Adams clasp and is mainly used for additional retention.

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Ball end clasp

→ This clasp is fabricated using stainless steel wires having a knob or a ball like structure on one end.

→ The ball can be made at the end of the wire using a silver solder. Preformed wires having a ball at one end are also available.

→ The ball end clasp is indicated when additional retention is required.

Schwarz clasp

→ The schwarz clasp or the arrowhead clasp can be said to be the predecision of the Adams clasp

→ The clasp is designed in such a way that a no. of arrow head engage the interproximal Undercuts between molar and between premolars and molars

Drawbacks

① Needs special arrowhead forming pliers to fabricate
② Occupies a large amount of space in the buccal vestibule
③ The arrowheads can injure the interdental soft tissue.
④ It is difficult and time consuming to fabricate

Crozat Clasp

→ This clasp resembles a full clasp but has an additional piece of wire soldered which engages into the mesial and distal proximal undercuts.

→ Thus it offers better retention than the full clasp

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Types of clasp based on using the undercuts

1. Clasp using mesial / distal Undercuts
   - Adam's clasp
   - Triangular clasp
   - Ball end clasp
   - Arrowhead / schwartz clasp
   - crozat clasp

2. Using buccal / Lingual Undercuts
   - Jackson's clasp
   - Southend clasp
   - Dig Ging's clasp

Various clasps used in Removal orthodontic appliances

1. Free end clasps come end of clasp embedded in acrylic
   - → C clasp
   - → Ball end clasp
   - → Crozat clasp
   - → Wrought Roach clasp
   - → Lingual extension clasp
   - → Triangular clasp
   - → Duggings clasp
   - → Arrow pin clasp
   - → Ulsicks' clasp

2. Continuous clasp (both ends embedded in acrylic)
   - → Jacksons clasp
   - → Eyelit clasp
   - → Delta clasp

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3) The patient clasp should be examined for adequate retention if not they should be engage the undercut, so as to increase retention

4) They active component should rest at a desired location they should not impringe on the gingiva, sulcus, or the frenum.

5) The patient should be educated on how to insert and remove the appliances, it is a good idea to show the appliance to patient & demonstrate to them the action of various components of the appliance, they should be instructed not to destort the various active components of appliance.

6) The active components can be activated after a few days once the patients get used to the appliances.

Instructions to the patient:

→ The patient is given before he leave the dental office on the use and care of appliance.

→ ① The patient should be instructed on the hours of wear. Most appliances are to be worn both day and night ie 24hrs is recommended that they be worn during breathing as well.

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2) The appliance and the teeth should be cleaned after every meal. They should be cleaned before retiring to sleep.

3) The patient is asked to clean the appliance using detergent solution and brush. While cleaning the appliance, care should be taken not to bend or distorge any of the components of appliance.

4) In case of removable appliance that incorporate screws, the patient and parents should be given clear instructions on how to activate the appliance.

5) The patients are instructed to report immediately to the clinical case of appliance damage or any other problem while wearing them.

6) The patient should be instructed not to leave the appliance out of mouth for a long period of time as it increases the risk of loss and damage.

Problems encountered in Removal appliance Therapy

- Oral hygiene maintainence: Patient who fail to clean the appliance and teeth pose the risk of gingival inflammation and hyperplasia.

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→ Soft tissue irritation: Removal plate that are not trimmed and polished properly can lead to tissue irritation and ulceration care should be taken to avoid sharp nodules and irregularities in the appliance. In addition wire components that extend deep into the vestibule offers risk of vestibular irritation and injury.

→ Caries: Improper oral hygiene can result in caries. The appliance should be designed in such a way that areas of food stagnation do not occur.

→ Pain: Excessive forces applied by the active components can cause tenderness or even pain of teeth being moved.

→ Tooth mobility: Presence of traumatic occlusion or use of excessive force during therapy can cause abnormal mobility of teeth.

30/1/24

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SPRINGS

They are active components of removable orthodontic appliances that are used to effect various tooth movements.

classification

Based on presence or absence of helix

a) Simple - without helix

b) Compound - with helix

Based on nature of stability of spring

a) Self supported springs - usually made of thicker gauge wire. They can support themselves.

b) Supported Springs - made of thinner gauge wire and thus lack adequate stability. Hence a section of spring is encased in a metal tubing to give it adequate support.

Ideal Requirement of spring

a) Spring should be simple to fabricate

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b) It should be easily adjustable.

c) It should fit into available space with out discomfort to patient.

d) It should be easy to clean.

e) It should be robust

f) It should apply force of required magnitude & direction.

g) It should not slip or dislodge when placed over a sloping tooth surface.

h) It should remain active over a long period of time.

Factors to be considered in designing a spring

Diameter of Wire :- by decreasing diameter, force applied on it is lesser and therefore force spring remain more flexible and active over a long period of time.

Length of Wire :

Force can be decreased by increasing length of wire.

Force to be applied - calculated based on number of teeth to be moved, root surface area and patient comfort.

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Patient comfort

Patient should be able to insert appliance with spring in proper position so as to bring about desired tooth movements

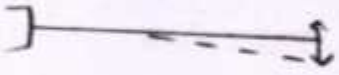
Diameter of wire

The flexibility of a spring to a spring large extend depends upon diameter of wire used.

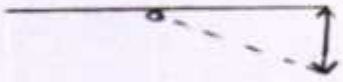
$$F = \frac{D^4}{L^3}$$

$$D \propto \frac{PL^3}{T^4}$$

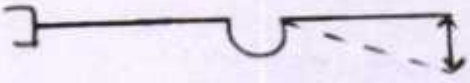
D → diameter of wire
L → Length of wire
F → Force
D → Deflection



simple spring



spring with helix incorporated



spring with U loop incorporated

Finger spring / single cantilever spring

→ Also called single cantilever spring one end is fixed in acrylic and other end is free

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→ Finger spring is used for mesio-distal movement of teeth.

→ It can be used only on those teeth that are located correctly in bucco-lingual direction, ie teeth should be within line of arch.

→ Finger spring consist of an active arm of 12-16 mm length, which is towards tissue, a helix of 3mm internal diameter and a retentive arm of 4-5mm length that is kept away from tissue and ends in a small retentive tag.

→ Finger spring is activated by moving active arm towards teeth intented to be moved.

Construction:

→ Spring is constructed such that helix is positioned opposite to direction of intended

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to inflammation of given tissue.

Indication

- It is used for mesio-distal movement of teeth
  eg: closure of anterior diastemas

Activation:

Activated by opening coil or moving active area towards tooth to be moved. About 3mm of activation is considered optimum.

Z Spring / Double Cantilever

→ Also called double cantilever spring
→ Used for labial movement of incisors.
→ Used for bringing about minor rotation of incisors
→ Spring can be made for movement of a single incisor or two incisors
→ Spring should be perpendicular to palatal surface of tooth.

Activation:

Activated by opening both helices by 2mm at a time.

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Z spring Construction

→ It is made up of 0.5mm hard round ss wire
→ It consists of 2 helices of internal diameter and can be made for 1, 2 or more incisors
→ Spring positioned perpendicular to 2 parallel surface of tooth with long retentive arms 12 mm

Coffin Spring

→ Introduced by Walter Coffin
→ This is an omega shaped spring which helps to bring about arch expression.
→ It is indicated in patients with a narrow maxillary arch as it brings about slow dentoalveolar arch expression.

Construction:

→ It is made up of 1.25mm hard round 5.5 mm wire.
- It has an omega shaped / U shaped loop which is in center which stands away from palate with retentive arm embedded in acrylic base plate

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Activation of Coffin spring

→ Activated manually by holding both ends at region of clasps and pulling sides gently.

T Spring

→ It is made of 0.25 mm hard round SS wire used for buccal movement of premolar and canines.

→ Spring has a T-shaped arm, ends of which are embedded in base plate.

→ Loops incorporated in arms of T- loops can be opened up to remain in contact with tooth as it moves buccally.

Activation

- It is done by pulling free end of T towards intended direction of tooth movement.

Boxing of Springs

→ To prevent damage, the spring placed on the palatal aspect can be boxed.

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Exercise		Date of commencement	Date of completion	Grade	Signature of Instructor
Finger spring (2Nos) 23 gauge	a		16/3/2021	B	
	b		28/3/2021	B+	
Double cantilever (Z) Spring (2Nos) 23 gauge	a		30/3/2021	B	
	b		30/3/2021	B	
'T' Spring	a		13/4/2021	B	
	b		13/4/2021	B+	
Coffin Spring	a		20/4/21	A	
	b		9/5/2021	B	

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CANINE RETRACTORS

They are springs that are used to move canine in a distal direction

→ It is classified into three

1) Based on their location
   a) Buccal - Buccally placed
   b) Palatal - Palatally placed

2) Based on presence of helix or loop
   a) Canine retractor with helix
   b) Canine retractor with loop

3) Based on their mode of action
   a) Push type
   b) Pull type

V- loop canine retractor

Wire used - 0.7mm or 21 gauge wire

Indications

1. Indicated when only distal movement of canine is required
2. Minimal distal movement of canine is achieved with this retractor.

Spring design

Parts of the spring are
1) Active arm
2) V loop
3) Retentive arm

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The active arm engages mesial surface of canine at cervical level and proceeds posteriorly to form U loop. It is made in a similar fashion like labial bow.

→ The mesial end of U loop starts at the premolar bend at right angle, the width of loop depends on width of premolar.

→ It extends 2 or 3mm below cervical margin.

→ Finally, curved around the interdental area between premolars.

Advantage:

Very easy to fabricate
Simple in design
Not bulky

Disadvantage

Least efficient of all canine retractors

Activation

Activated by closing loops by 1mm

Helical Canine Retractor

Synonym - Reverse loop canine retractor

Wire used - 0.7 mm or 21 gauge stainless steel.

Indications:

- In patients with shallow sulcus depth for retractor of canine.
- Mostly used in mandibular arch.

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Spring design

Parts of spring:

1. Helix / coil
2. Active arm
3. Retentive arm

→ The active arm starts from mesial cervical aspect of canine.

→ It can be made into encircle mesiolingual aspect of canine.

→ The active arm proceeds backward upto distal of second premolar.

→ From there, a helix is made with maximum diameter of 2.5 mm.

→ The retentive part of spring crosses active arm in mesial aspect of second premolar

→ The height of coil is made according to depth of sulcus.

Drawbacks

→ It is stiff in horizontal plane

→ Unstable vertically

Activation

→ There are two methods. In both, it should not be activated more than 1mm.

→ Method 1 - Consist of cutting off 1mm of wire from free end and reshaping it to engage mesial surface of canine

→ Method 2 - By opening coil by 1mm

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Buccal Canine Retractor

Wire used: 0.7mm or 21 gauge SS wire

Indications

Buccal canine retractor is used where a buccally placed canine has to be moved both palatally and distally.

Spring design

- It is one of the few springs where coil is closed for activation.
- The end of spring is bent at right angle to canine to be moved.
- Then it is shaped to the tooth.
- Coil is placed as high as possible without interfering with soft tissues.
- Tag should cross over mesial contact point of second premolar.
- Coil should be placed in between present and future position of canine.
- If thinner wire is used (0.6mm), then they are sleeved to prevent distortion.

Activation:

Coil should be activated by only 1mm
Activated by closing coil using hollow chop pliers like mathews or Andresens
- Activated by bending anterior arm using three pliers.

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Uses

① Distalization of palatally placed canine
② Distal movement of premolars

Design

→ Palatal canine retractor consists of three parts

① Active arm
② Coil
③ Retentive arm

i) Active arm contracts tooth surface at right angles to desired tooth movement.

ii) Coil should be placed as far away possible to have a good range of action. It is centered on the line through midpoint of tooth and perpendicular to its intended path. Coil size should be 2.5 to 3 mm.

→ For maximum efficiency, coil should be placed on opposite side of tooth movement. For distal movement, coil is placed on mesial aspect of tooth. For mesial movement coil is placed on distal

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aspect of tooth.

- Active arm, coil and retentive tag lie in the same line.
- Retentive tag gets embedded in acrylic plate.

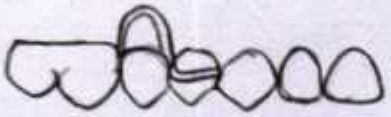
Activation

Method 1 - spring is activated by opening coil by 2.5mm

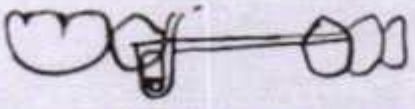
pull free arm of spring slightly away from point of emergence from coil.

Method - 2

Tension can be given to spring by squeezing coil with tip of plier.



U loop canine retractor



Reverse loop canine retractor

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Buccal canine retractor



Palatal canine retractor

20/9/19

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LABIAL BOWS

They are active components that are usually used for incisor retraction

Parts of Labial bow

① Horizontal bow portion
② Vertical loops
③ Retentive arms

Uses

- Used for retraction of anterior teeth
- Used for retention of teeth after active orthodontic treatment is completed.
- → Used for reinforcement.
- → It can be used for attatchment of auxiliary springs
- → It can also be used for carrying soldered attatchments.

Types:

① short labial bow
② Split labial bow
③ Robert's retractor
④ long labial bow
⑤ Reverse labial bow
⑥ Mulls retractor
⑦ Fitted labial bow
⑧ High labial bow apron spring.

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Classification

Based on presence or absence of U loop:

(1) With U loop

(2) Without U loop

Short labial bow

Wire used - 0.77 mm hard round stainless steel.

Component:

A bow, two U loops, retentive arm.

Indications:

- Causes minor over jet reduction and anterior space closure.
- Purpose of retention at termination of FAT.
- When only four incisors are to be retracted
- When there is mild protrusion of teeth.
- Used for retraction of teeth.
- If spacing of anterior between incisors.

Activation

→ By compressing U loops.

→ Should be such that labial bow displaced palatally by 1mm

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Advantages:

- It can be fabricated easily.
- Used for correcting minor discrepancy in overjet
- Used to reinforce anchorage.
- Used for retention
- Easy to adjust
- Used for attatchment of whip spring.
- Hooks can be soldered which are useful for attatchment of esthetics or for engaging J-hooks for extra oral anchorage.
- Offsets can be prepared on horizontal arm for correction of minor irregularities anterior teeth.



Contraindication

- In case of severe proclinations of incisors because horizontal bow portion has a tendency to slip gingivally when activated due to inclined plane effect of teeth.

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Long Labial bow

→ Wire used - 0.7mm hard round stainless steel wire.

→ Components:

A bow, two U loops, retentive arms extend from one first premolar to opposite first premolar

Indications

→ Minor anterior space closure.

→ Minor overjet reduction

→ Closure of space distal to canine.

→ As a retaining device at the end of FAT.

→ Guidance of canine during canine retraction using palatal retention.

→ When there is mild protrusion

Activation

→ By compressing U loops

→ Should be such that labial bow displaced palatally by 1mm.

→ Modified form of long labial bow can be made by soldering distal arm of U loops to bridge of Adam's clasp.

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Advantages

→ Can control canines
→ Used for retention
→ Can be used to close space between canine and premolar.
→

Reverse loop labial bow

Component

→ U loops are placed distal to canine and free ends of U loops are adapted occlusally between first premolar and canine
→ Wire used - 22 gauge wire

Indications

→ Case of minor overjet reduction
→ Anterior space closure.
→ Purpose of retention at termination of FAT
→ Position of canine has to be controlled during retraction of anterior.

Activation

→ U loop is opened → looping of labial bow in incisor region.
→ A compensatory bend is then made at base of U loop to maintain proper level of bow

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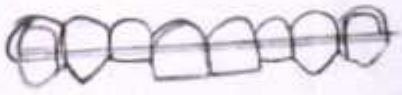
Advantages

→ It can be used to retain anterior teeth after active treatment is completed.

→ controls canine, it prevents buccal drift of canine during retraction of anterior incisors.

Drawbacks

→ If care is not taken to activate it properly it can be distorted easily.



Roberts Retractor

Wire used - 23 gauge wire

Components - 9 coil of 3mm internal diameter mesial to canine.

Indications:

Patients having severe anterior proclination with overjet of 4mm.

- used in adult patient in whom lighter forces are desirable (as bow is highly flexible it generate lighter forces) flexibility is effected by size of 0.5mm thin diameter along with increased wire length also.

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incorporation of coil.

Activation

- It is adjusted in vertical limb below coil by bending it palatally.

Advantages

→ Range of action is longer and more length of wire is incorporated. Lighter force is applied as thinner wire is used for construction of labial bow.

→ can be used for correction of severe protrusion of teeth. The retractor doesn't slip over inclined plane of teeth with severe proclination as movement of retractor is along arc of rotational radius along which teeth moves while correcting the proclination.

Disadvantages

- Uncomfortable to patients.
- Cannot be given for lower anterior as the sulcus is shallow.



Robert's Retractor

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Split Labial bow

Wire used - 22 gauge wire

Components

Labial bow with split in the middle
→ 2 split rale buccal arms having a u loop each

→ This type exhibit increased flexibility.

Indications

→ Anterior Retraction

→ Modified form is used for closure or midline diastema modified form
→ Free end of buccal arm is made to hook onto distal surface of opposite central incisor

Activation

→ Compressing of U loop 1-2 mm at a time

Types

a) Split labial bow used for retraction
b) Used for median diameter closure

a) Used for Retraction

→ One of the main drawbacks of labial bow is rigidity

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→ Flexibility of bow can be increased by dividing bow effective for incisor retraction.

Drawbacks

→ Rotation or minor irregularities are difficult to control with split labial bow

Activation

→ By closure of loop by 1mm

b) Split bow for median diastema - closure

→ Free ends of bow cross over each other

→ wire should be parallel to one another

→ Free end of one bow crosses opposite central incisor and hooked into distal aspect of central incisor

→ In the same way, opposite side bow is fabricated.

Drawbacks

→ This useful only for closure of median diastema

→ Not effective in overjet reduction

Activation

- closure of loop by 1mm.

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No	Exercise		Date of commencement	Date of completion	Grade	Signature of Instructor
23	SHORT LABIAL BOW (19, 21 gauge) 2 No	a		19/2/2021	B+	
		b		9/8/2021	B-	
24	LONG LABIAL BOW (22 gauge) 2 No	a		9/8/2021	B-	
		b		9/8/2021	B+	
25	SPLIT LABIAL BOW (22 gauge)	a				
		b				
26	REVERSE LABIAL BOW (22 gauge)	a				
		b				
27	ROBERTS RETRACTOR (23 gauge)	a				
		b				

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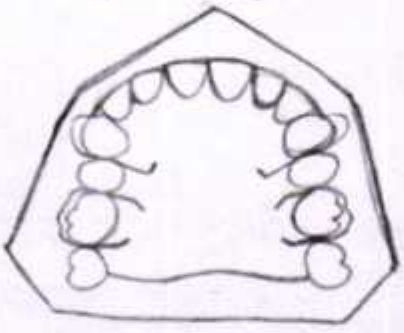
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Hawley's appliance with bite plate is used for deep bite correction

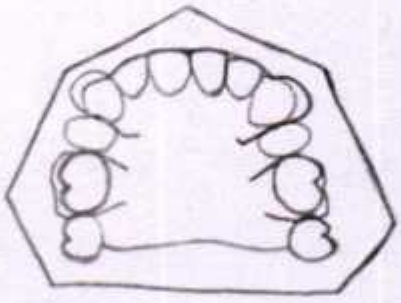
→ It is used in TMJ problem.

→ It is used as habit breaking appliance

→ Hawley's appliance with bite plate removes restraining effect in mandible and allow further growth.



Hawley's retainer with long labial bow



Hawley's retainer

Modifications of basic Hawley's Appliance

1. The simplest modification is to augment the labial wire with hooks for elastics or actually substitute many thin incisors.

→ The elastic are very effective and cut down no of observations visits since patient merely changes elastics to

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newer derived tension of teeth being moved.

- Greater care must be taken to prevent piling up of tissue lingual to maxillary incisors however.

2. The common modification of Hawley's appliance involved modification of labial bow.

3. Hawley's appliance can be modified to produce labial movement, which is used for correction of rotation of incisors, single tooth cross bite.

- In such case modification involves incorporation of cantilever spring, intended to move incisor labially. single or double cantilever spring can be used to correct palatally placed incisor like angle. Tooth anterior cross bite or when two teeth are in cross bite, retroclined incisors in class II division 2 malocclusion.

4. The active components that are added to Hawley's appliance for canine retraction and midline diastema.

5. Hawley's appliance can be modified to produce buccal movement of posterior

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teeth on either side to produce expansion of constricted maxillary arch or springs (T springs) can be incorporated to move single teeth.

6 Posterior teeth may be moved with removable appliance in maxilla and mandible posterior tooth movement usually involves opening spaces rather than closing them. Most frequently as the result of premature loss, teeth have drifted into edentulous spaces must be moved back to original position to allow eruption of permanent teeth.

- Modified clasps or auxillary springs can be incorporated to Hawley's appliance to achieve this result.

7 Movement of maxillary posterior teeth in a constricted maxillary arch can be made possible with an upper removable appliance to achieve this result with incorporated screw in mid-palatal region with base plate split into 2 halves.

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8. Lower removable appliance are more difficult to tolerate by patient and are generally not as satisfactory for any appreciable movement.

Modifications of Hawley's appliance for different tooth movements.

Type of movement	Spring used with basic Hawley appliance.
(A) labial and buccal movement	- single cantilever spring - Double cantilever spring - Coffin spring - T spring - Expansion screws
(B) Lingual movement	→ short labial bow → long labial bow → split labial bow → Reverse labial bow → Robert's retractor → Mill's retractor → High labial bow with apron spring
(C) Mesio distal movement	→ Finger spring → Split labial bow → Canine retractor → screw

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HAWLEYS APPLIANCE WITH ANTERIOR BITE PLANE

Hawley's Appliance anterior bite plane is used for management of deep bite or excessive overbite.

→ Excessive overbite predisposes a patient to periodontal involvement, abnormal function, improper mastication, excessive stress, trauma, functional problem.

→ Constriction of mandibular anterior segment and progressive crowding and irregularity of teeth in this area are inevitable sequence.

→ Although overbite correction remains a continuing problem for even most compliant orthodontist. considerable benefit may be realized from the case of bite plate.

→ Anterior bite plate are fabricated by crossing base plate behind maxillary anterior.

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Indications

1. Deep bite
2. Cuspal interference
3. Pain associated with TMJ disturbance
4. Decreased lower facial height.

Contra Indication:

1. → Increased lower facial height
2. Severe protrusion

Mechanism of action

→ The bite planes disocclude posterior teeth and allow them to erupt further, supereruption of posterior teeth helps in correction of deep bite.

→ when used in case of TMJ, pain dysfunction helps in relieving pain by disocclusing teeth & forward repositioning of mandible.

→ By virtue of opening bite, it helps in eliminating occlusal interferences.

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Uses of flat anterior bite plane

1. Used to reduce overbite
2. Used to correct TMJ problems
3. correction of bruxism
4. correction of occlusal prematurities
5. Used as periodontal splint
6. Eliminate functional retrusion effect
7. Used as dental crutch
8. promotes increase in mandibular intercanine width since restricting influence of maxillary arch is removed.



Upper anterior inclined bite plane

→ It is used in cases where there is severe retroclination of lower anterior teeth.

→ It is a modification of anterior bite plane.

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→ The bite plane is inclined downwards and forwards at an angle of 60° to occlusal plane.

→ When lower incisors are retroclined, a flat anterior bite plane cannot be given as forces will no longer be transmitted along long axis of teeth and therefore an anterior inclined bite plane should be used.

→ The lower incisors engage bite plane when patient closes mouth & mandible is guided to be held in forward position.

Uses of anterior inclined bite plane.

① Guiding mandible forward
② Proclination of retroclined lower anterior.
③ Reduction of overbite
④ It can also be used to reinforce anchorage in lower anterior teeth
⑤ engaging bite plane exerts backward pressure.

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No	Exercise	Date of commencement	Date of completion	Grade	Signature of Instructor
29	Hawley's appliance with Anterior Bite Plane		8/8/21	B	

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HAWLEYS APPLIANCE WITH POSTERIOR BITE PLANE AND 'Z' SPRING

→ This is used for management of cross bite mainly anterior cross bite.

Double cantilever spring 'z' spring

→ One of the most frequently used appliance to correct anterior cross bite.

→ The spring consists of double helix between two parallel arms and inferior arm extend as retentive component in acrylic base plate.

→ The parallel arms can be activated as per requirement to either push entire tooth labially or just mesial or distal aspect of tooth to correct a mesiopalatal / linguo or distal / lingual retention of tooth.

→ It is advisable to use spring along with a posterior bite plane when tooth is in crossbite and show an overbite of more than 2mm or opposing teeth are compromised.

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Posterior bite plane

→ It decreases or at times even eliminate forces exerted on teeth in opposing arch.

→ Posterior bite plate is also called as molar capping.

→ It is used to get occlusal clearance to tooth movement during correction of anterior cross bite.

→ Fine thickness should be just enough to clear the occlusion.

Indications

① To give occlusal clearance for correction of crossbite of either anterior or posterior teeth.

② For diagnosis of occlusal prematurities

③ Cases with TMJ pain dysfunction.

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No.	Exercise	Date of commencement	Date of completion	Grade	Signature of Instructor
20	Hawley's appliance with Posterior Bite Plane and 'Z' Spring		21/8/21		

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TONGUE GUARD APPLIANCE

Tongue guard appliance is the modification of tongue thrusting appliance.

Tongue thrusting

→ It is described as a condition where in during swallowing tongue contacts with teeth in anterior region.

→ Not infrequently, tongue is the only problem.

→ There is associated or preceded by finger habit.

classification of tongue thrusting

- Moyer's classification
  - Simple tongue thrusting
  - Complex tongue thrusting
  - Retained infantile swallow

☆ According to area of tongue thrusting

→ Anterior tongue thrusting

→ Posterior tongue thrusting

☆ According to Bad and ☆

→ Tongue thrusting without deformation

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→ Tongue thrusting without deformation

→ Tongue thrusting causing anterior deformation

→ causing buccal deformation

→ Combined tongue thrusting causing both and posterior open bite.

Appliance therapy

→ A removable or fixed habit breaking appliance can be used to reeducate the tongue.

→ An acrylic palatal retainer with a fence may be fabricated as a reminder to place tongue properly during swallowing.

→ Removable tongue spikes the mandibular and have been tried in class II division I case with tongue thrusting.

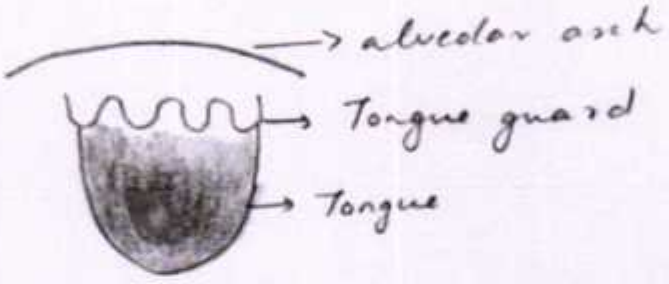
→ Tongue spikes are V-shaped three or five projections and are fabricated with 0.046 inch stainless steel alloy. They extend upto cingulum of lower incisor soldered to molar bands or crowns.

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Modified tongue crib are used for lateral tongue thrusters

optimum age for placement of this type of appliance → 5 - 10 yrs

→ Depending on severity of open bite problems for 9 months may be required for autonomous correction of malocclusion.



Clinical features or effect of tongue thrust on dentofacial structure.

1. Open bite — anterior
   — Posterior
   } Lateral tongue thrust
2. Proclination of upper anterior teeth.
3. Protrusion of centre or segments of both arches with spaces between incisors and canine.

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4. Narrow and constricted maxillary and posterior cross bite.

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ORAL SCREEN

→ Oral screen is a sheet of acrylic resin that is worn inside lips and outside teeth. Oral screen is a functional appliance because it has no active elements designed to produce force.

→ It produces its effects by redirecting pressure of muscles and soft tissue like lips and cheeks.

→ Vestibular screen was introduced by Rowell in 1912.

→ Vestibular screen and oral screen are used as synonyms by many of authors.

→ Krauss differentiate between vestibular screen and oral screen.

Oral screen	Vestibular screen
→ Used to control abnormal habits namely mouth breathing and tongue dysfunction.	→ Extended into vestibule in contact with alveolar process. → No teeth contact → Also called as lip molder.

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Mechanism of action:

→ Oral screen prevents pressure from cheeks from acting on dentition because of tongue is free to exert its force → passive expansion of arch.

- Pressure from lips is directed to incisors → lingual movement of labially inclined teeth → retroclination of maxillary incisors permits.
- Lower jaw is moved forward → in patients bite.
- Hypotonic lips are activated → tonicity of lips is improved.
- Passive expansion of apical base
- Possible intrusion of maxillary incisors and differential eruption of molars

Other actions

→ stimulation of proper nasal breathing.

→ Cessation of habits like finger and thumb sucking, lip biting.

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Uses of oral screen

- Used as both active and passive appliance
- Used for correcting tongue thrusting, lip biting habits.
- Correction of mouth breathing when airway is patent
- Correction of flaccid hypotonic orofacial musculature

Disadvantages

1. It is not a complete mechanotherapy
2. It is the only initial assault in phase I correction of orthodontic problem.

Modifications

Oral screen modifications

- Holtz modification
- Double oral screen
- Rehak modification
- screen with breathing holes
- oral screen and [illegible]

Holtz modification

It involves adaptation of wire loop [illegible] anterior part of screen.

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	Exercise	Date of commencement	Date of completion	Grade	Signature of Instructor
3	Oral Screen		25/8/21		

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Certified that the candidate has completed the requisite Pre-clinical Laboratory Technics.

Date :

Instructor

Head of the Department.

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DEPARTMENT OF CONSERVATIVE DENTISTRY

&

ENDODONTICS

PRE-CLINICAL RECORD BOOK

Name : ANJALI PRAKASHAN

Class : II nd BDS

Register Number: 170020546

Year : 2018-2019

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DR.

KMCT Dental College Manassery, Mukkam

Certificate

This is to certify that Mr./Ms. ANJALI PRAKASHAN

.....

.....

has satisfactorily completed the exercises in ***Conservative Dentistry & Endodontics Pre-Clinical exercises****, and record during the year* .....

University Reg. No: 170020546

Staff in charge

External Examiner

Internal Examiner

Professor & Head
Dept. of Conservative Dentistry
& Endodontics

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Head of the Department
Dept. of Conservative Dentistry
& Endodontics
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GENERAL INSTRUCTIONS

1. Bring the record book to all practical classes and the record must be kept neat and in good condition.
2. Students should wear aprons with identity cards while working in the laboratories.
3. Exercises should be completed in the specified time period and evaluated by the staff in charge in the record book.
4. Submit the record book for valuation when you come for the practical examination.
5. Marks will be awarded for the records depending on neatness and completion, during the practical examination.
6. Unnecessary wastage of water, gas or any other materials should be avoided.
7. Containers of materials / chemicals must be kept closed in their proper places when not in use.
8. Excess or waste materials like paper, cotton & plaster powder must be thrown into the waste bins and should not be thrown into the sink. Excess amalgam must be disposed as per instructions.
9. Students should enter the laboratories on time with all the required instruments. Borrowing will not be permitted.
10. Mouth masks and gloves are mandatory while working.
11. Equipments borrowed from the department should be returned before leaving the laboratory.
12. Students should keep the laboratory neat and tidy and should not cause any damage to the furniture, equipments etc.
13. Student is liable to replace or compensate for the equipment that is lost or damaged.
14. Strict discipline should be maintained while working in the laboratory
15. Students are not allowed to wear hand ornaments & watches while working
16. Students should take care of their belonging from theft or loss.

STUDENTS DECLARATION

I have carefully read the above rules and undertake to abide by them.



Signature of the Student

I BDS EXERCISES

PLASTER TOOTH MODEL EXERCISE

Sl. No	Date	Exercise	Grade	Signature
1.	18.11.2017	36 CLASS I OCCLUSAL CAVITY	B++	
2.	22.11.2017	36 CLASS I BUCCAL PIT CAVITY	B++	
3.	09.12.2017	16 CLASS I MESIAL DISTAL PIT IN MAXILLARY MOLAR	B++	
4.	27.12.2017	14 CLASS V, BUCCAL CAVITY	B+	
5.	03.02.2018	COMPOUND CAVITY 36 CLASS II MESIO OCCLUSAL CAVITY	B++	
6	24.02.2018	COMPOUND CAVITY 14 CLASS II MESIO OCCLUSAL CAVITY WITH REVERSE CURVE	B++	
7	24.03.2018	COMPOUND CAVITY 13 CLASS III MESIO CAVITY (LINGUAL APPROACH)	B+	

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PLASTER TOOTH MODEL EXERCISE

Sl. No	Date	Exercise	Grade	Signature
8	05.05.2018	COMPOUND CAVITY 36 CLASS II MESIO-DISTO OCCLUSAL CAVITY (MOD	B++	
9.	04.09.2018	36 CLASS I INLAY CAVITY	B+	
10	04.09.2018	COMPOUND CAVITY 36 CLASS II MESIO OCCLUSAL INLAY CAVITY	B++	

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SIMPLE CAVITY - 36 CLASS 1 OCCLUSAL CAVITY

OUTLINE FORM

Irregular outline in the groove extensions, half the distance into the groove. Mesial and distal outline run parallel to the proximal contour and 4mm away from the outer contour preserving the marginal ridge

DIMENSIONS

Pulpal depth = 4mm from the marginal ridge
Pulpal width = 4mm at the triangular ridge

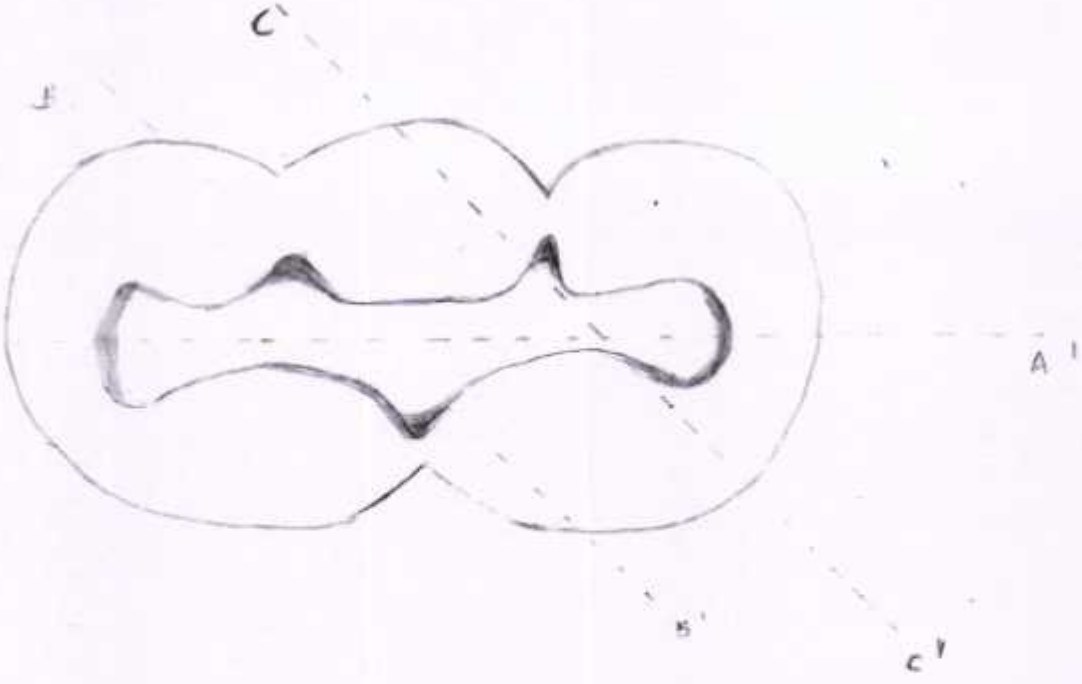
FEATURES

* Outline circumvents the cusp in smooth forming curves
* No sharp junctions
* Mesial and distal walls parallel to outer contour of the tooth and 4mm away
* Pulpal floor flat
* Smooth walls and floor
* Line angles and point angles well defined and rounded
* Taper to mesial and distal walls and walls at groove extensions
* Inverse taper in the buccal and lingual walls at the triangular ridges of the cusp
* Cavosurface angles form a 90 degree butt joint

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SIMPLE CAVITY - CLASS I OCCLUSAL



OCCLUSAL VIEW



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SIMPLE CAVITY 3b CLASS I BUCCAL PIT CAVITY

OUTLINE FORM

Oval

LOCATION

Occlusal $\frac{2}{3}^{rd}$ buccal surface involving the buccal groove

LOCALISATION

centre of cavity lie at the junction of occlusal and middle $\frac{1}{3}^{rd}$ of the buccal surface

DIMENSION

Occluso-gingivally = 4 mm
Mesio-distally = 3 mm
Axial depth = 3 mm

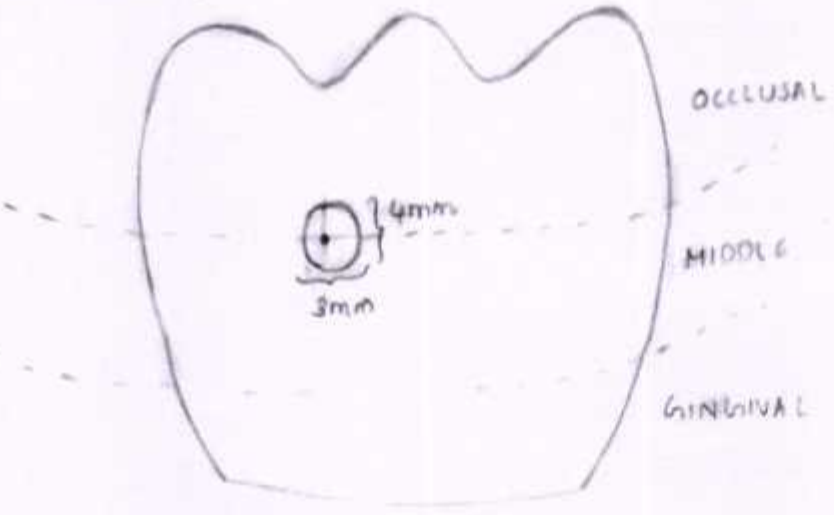
FEATURES

* Axial wall is flat and follows the buccal contour
* Walls are smooth and lie perpendicular to axial wall or follow the enamel rod junction
* Line angle is well defined
* Obtuse cavosurface angle

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BUCCAL VIEW



BUCCOLINGUAL C.S



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CLASS I MESIAL DISTAL PIT IN MAXILLARY MOLAR

OUTLINE FORM

Mesial cavity - kidney shaped
Distal cavity - heart shaped

DIMENSIONS

4mm from the marginal ridge
width - 4mm at the triangular ridge

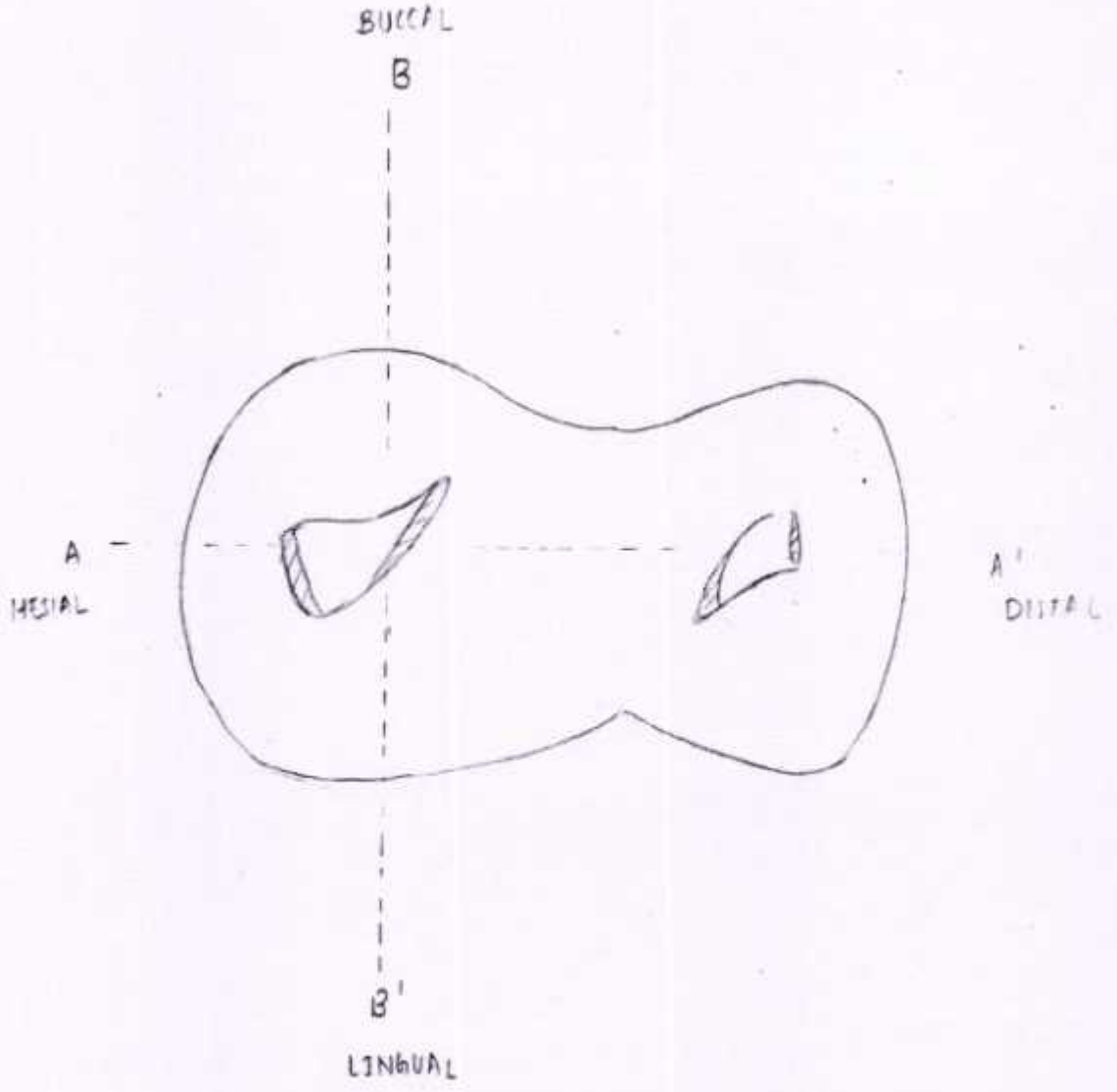
FEATURES

* Mesial and distal walls are parallel to the outer contour of the tooth and 4mm away
* Mesial and distal walls adjacent to the oblique ridge run parallel to the ridge
* Groove extensions upto half the distance into the groove from the central groove
* Taper to mesial and distal walls and the walls parallel to the oblique ridge
* Inverse taper to buccal and lingual walls at triangular ridge
* Walls - Smooth, rounded and well defined

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CLASS I MESIAL DISTAL PIT IN MAXILLARY MOLAR





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SIMPLE CAVITY 14 CLASS V INCISAL CAVITY

OUTLINE FORM

Trapezoidal with rounded corners

LOCATION

Central 1/3rd of buccal surface

LOCALISATION

Occlusal wall lie at the junction of middle and cervical third

DIMENSIONS

* Occlusal wall length = 12 mm
* Cervical wall length = 8 mm
* Occlusal cervical width = 5 mm
* Axial wall depth = 4 mm

FEATURES

Axial wall parallel to the outer contour of the tooth external wall and lie perpendicular to the axial wall and point angle are rounded. Line angles well defined but rounded

RETENTIVE GROOVES :

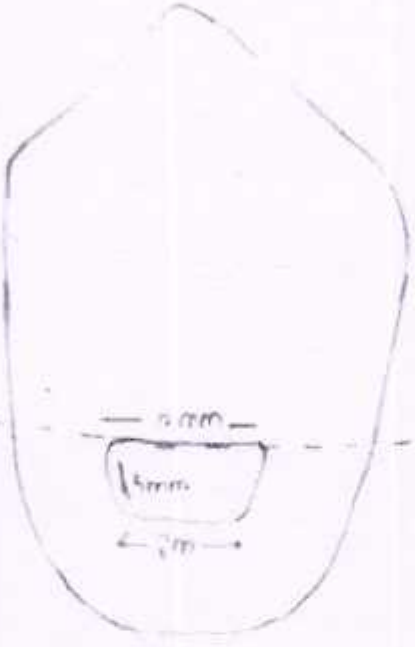
LOCATION - Axio gingival and axio occlusal line angle

DIRECTION - Bisecting the line angles

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BUCCAL VIEW



BUCCOLINGUAL CS



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COMPOUND CAVITY 36 CLASS II MESIO OCCLUSAL CAVITY

PROXIMAL BOX

OUTLINE FORM - Inverted truncated cone shape with base located gingivally and apex towards the marginal ridge

DIMENSIONS

* Gingival seat depth (occluso-gingival depth) = 1.2 mm from the marginal ridge
* Gingival seat axial width = 3 mm
* Gingival seat bucco lingual width = 12 mm

FEATURES

Occlusal cavity should mesially develop a flare such that

a) The proximal contact with the adjount tooth is broken (0.2 mm of buccal and lingual contact; 0.5 mm of gingival contact in natual teth)

b) The occlusal outline should meet at 90 degree to an imaginary tangent drawn on the outer proximal surface forming a "butt joint"

The buccal and lingual walls of the proximal box should be parallel to the middle one third of the buccal and lingual surface

Gingival seat should be flat and perpendicular to long axis of the tooth

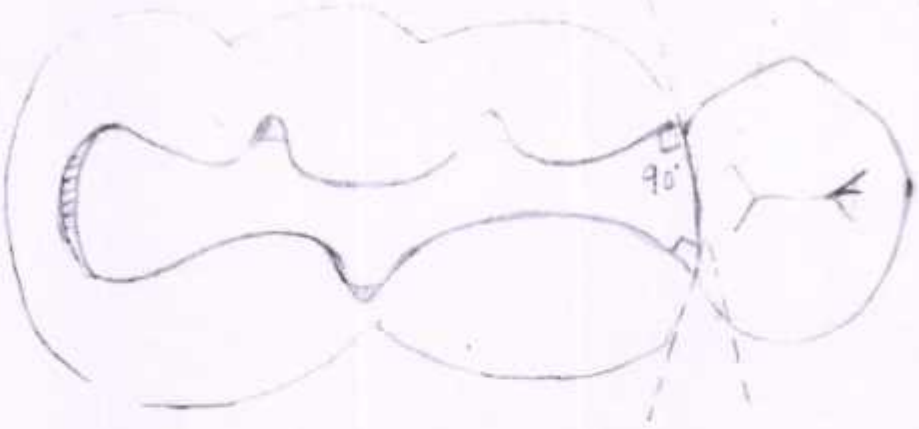
Bucco gingival and linguo-gingival line angles are rounded in the form of an arc

Axial wall should be

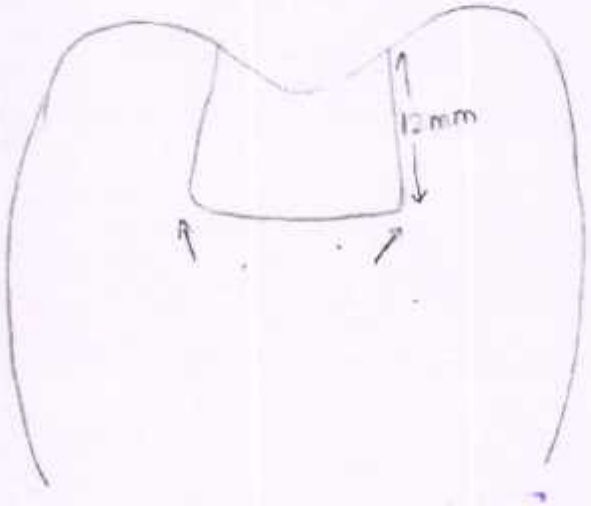
1) Tapered occluso gingivally and parallel to the DE

2) Bucco lingually convex and parallel to the outer outlines

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Mesial flare to break the contact should form a butt joint to an imaginary tangent drawn from the outer proximal surface to ensure resistance form



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3) Axiopulpal line angle is rounded

4) Gingival cavosurface bevel of 20 degrees

RETENTIVE GROOVE

LOCATION : Axiobuccal and axiolingual line angles

EXTENT : Axio buccal pulpal point angle to axiobuccogingival point angle. Similarly on the linguo axial line angle

TRANSLATION : Bisecting the line angle

DEPTH : 2 mm

NOTE

Factors controlling the flare in a class II amalgam preparation

a) The contact with adjacent tooth - contact should be broken

b) obtain a cavo surface bull joint to an imaginary tangent drawn to outer proximal surface

c) The enamel wall must follow the enamel rod direction

Cavosurface bull joint is given for amalgam preparation to improve the resistance form in the tooth and the restoration.

In tooth, it removes unsupported tooth structure and the enamel margin follows the enamel rod direction.

In restoration - the resistance form is got by obtaining adequate bulk to resist masticatory forces. Tensile strength of amalgam is low and so tends to fracture if bulk is less

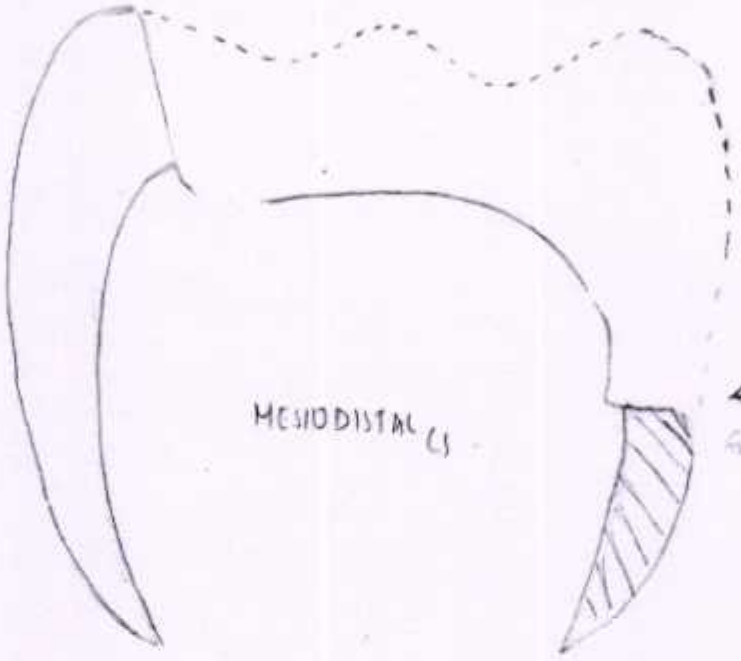
20 degree gingival cavosurface bevel is given to

a) follow the enamel rod direction

b) Remove unsupported enamel

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COMPOUND CAVITY-14 CLASS II MESIO OCCLUSAL CAVITY WITH REVERSE CURVE

OCCLUSAL CAVITY :

Outline form dumb bell shaped with ends somewhat triangular features similar to exercise 1

DIMENSIONS :

Proximal box dimension

* Gingival seat depth from marginal ridge = 12 mm
* Gingival seat width axially form gingival cavosurface = 3 mm

Features same given in exercise 5

REVERSE CURVE

Definition :- It is a deviation or smooth 's' shaped curve extending from the isthmus to proximal contour

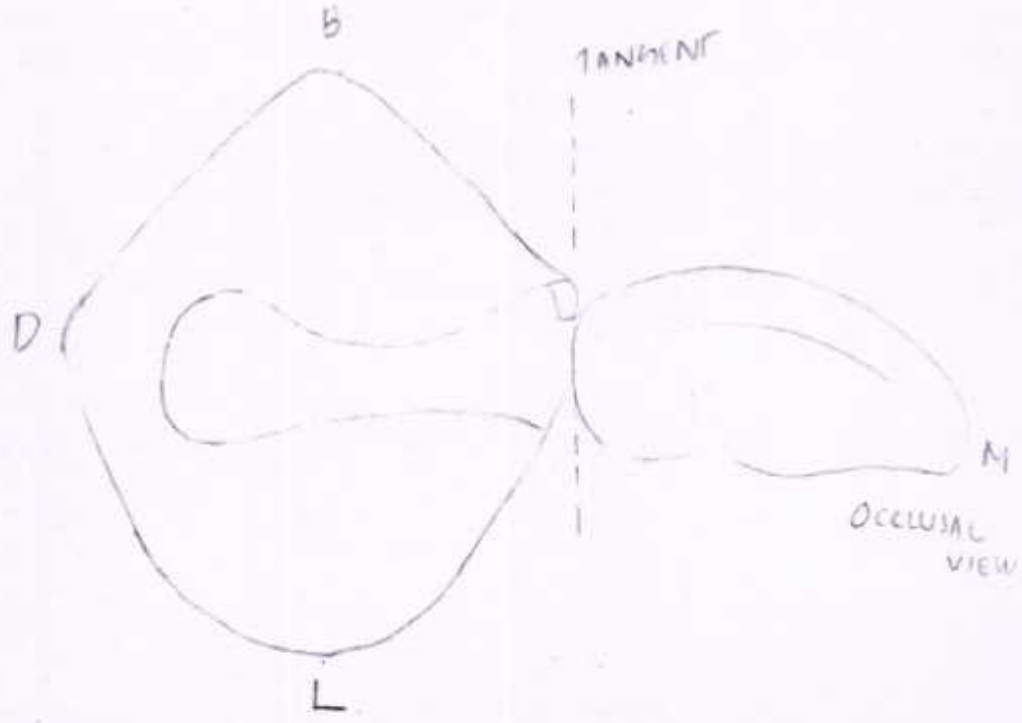
INDICATION :-

* Broad contact
* Extensive caries
* Rotated tooth

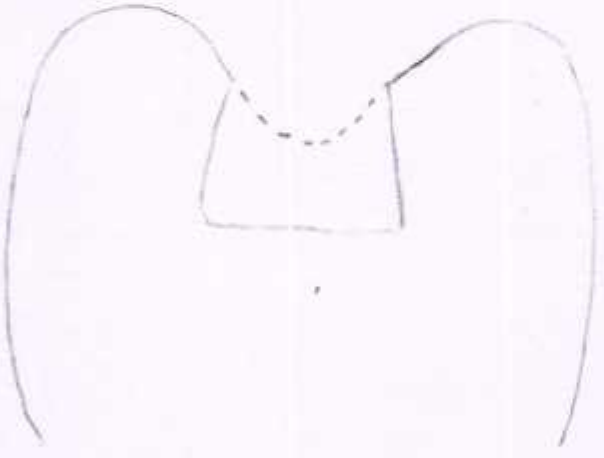
ADVANTAGES

* Obtain a built joint
* Maintain a narrow isthmus
* Preserves the cusp
* Maintain resistance form the tooth

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OCCLUSAL VIEW



MESIAL VIEW



20° GINGIVOCCLUSAL

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[illegible], Kozhikode

COMPOUND CAVITY IN CLASS III

MESIO CAVITY (LINGUAL APPROACH)

LOCATION :

Middle third of the mesial surface cervical to the contact point

DIMENSION :

Labial wall incisa cervical length - 10 mm.
Lingually - 6 mm
Axial depth - 4 mm

FEATURES :

* The labial wall is placed in the labial embrassure
* The labial wall parallel to the incisal $\frac{2}{3}^{rd}$ contour of the labial surface of the tooth.
* Incisal wall lie cervical to the contact point (do not break incisal contact)
* Gingival wall is kept supra gingivally
* Axial wall follow the proximal contour
* labioincisal and labiogingival line angles are rounded

RETENTIVE GROOVE

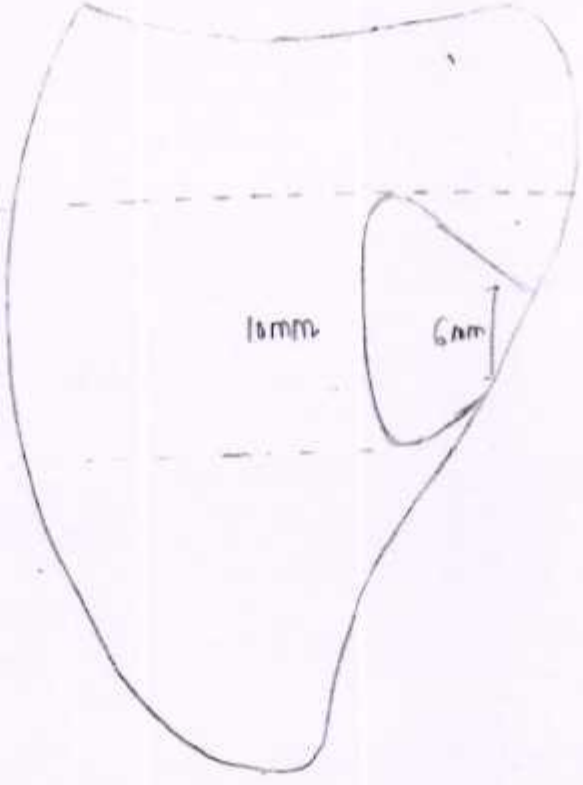
LOCATION : Axiogingival & axioincisal line angles

EXTEND : Within the dentin 5 mm

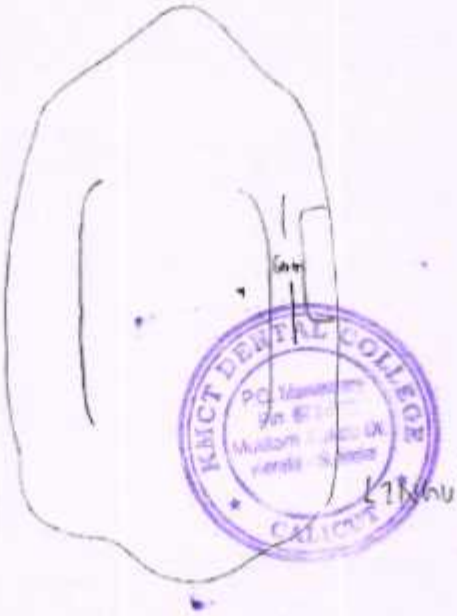
DIRECTION : Paralleling the line angle

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CLASS III MESIAL CAVITY (LINGUAL APPROACH)



MESIAL VIEW



LINGUAL VIEW

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THE MESIAL RIDGE IS BROKEN TO APPROACH THE MESIAL CAVITY

COMPOUND CAVITY 36 CLASS II
MESIO DISTO OCCLUSAL CAVITY (MOD)

OUTLINE FORM

Irregular outline with groove extensions half the distance into the groove, mesial and distal outline run parallel to the proximal contour and 1 mm away from the outer contour, preserving the marginal ridges

PROXIMAL BOX

OUTLINE FORM

Inverted truncated cone shaped with base located gingivally and apex towards the marginal ridge

DIMENSIONS

Gingival seat depth [occlusal gingival depth] = 12mm from the marginal ridge

Gingival seat axial width = 3 mm

Gingival seat buccolingual width = 12 mm

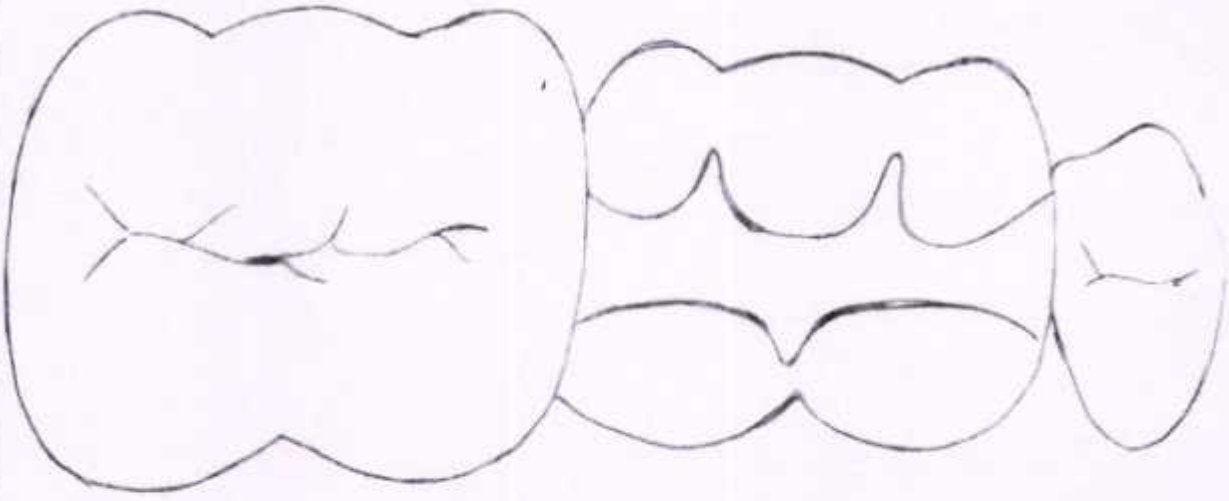
FEATURES

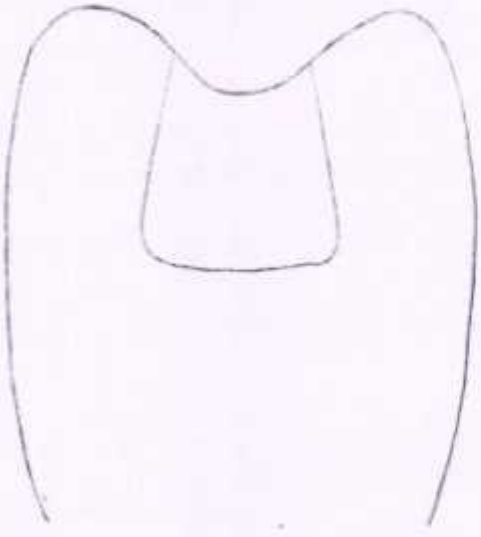
- Occlusal cavity should mesially develop a flare such that

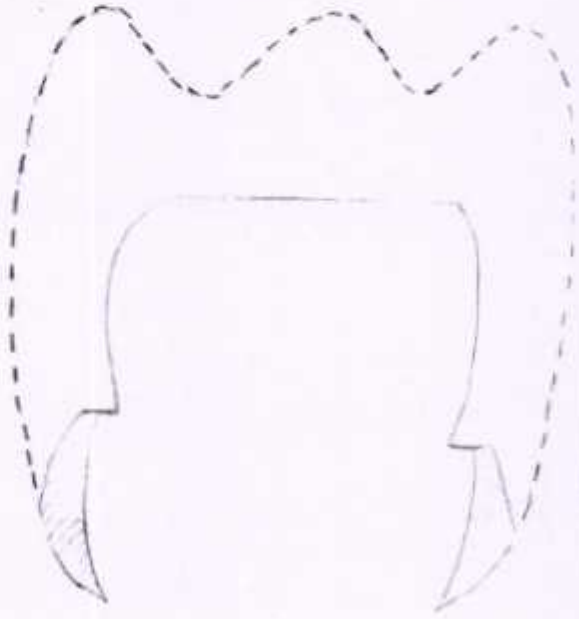
a) The proximal tooth with the adjacent tooth is broken (0.2 mm of buccal and lingual contact; 0.5 mm of gingival contact in ~~molar~~ teeth)

b) Occlusal outline should meet at 90 degree to an imaginary tangent drawn on the outer proximal surface forming a butt joint

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MESIAL AND DISTAL

PROXIMAL OUTLINE S

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- Buccal and lingual walls of the proximal box should be parallel to the middle $\frac{1}{3}^{rd}$ of the buccal and lingual surface
- Gingival seat should be flat and perpendicular to long axis of the tooth
- Buccogingival and linguogingival line angle are rounded in the form of an arc
- Axial wall should be
  a) Tapered occluso gingivally and parallel to the DEJ
  b) Bucco lingually convex and parallel to the outer contour
  c) Axio pulpal line angle is rounded
- Gingival cavo surface bevel of 20°
- Retentive groove
  * location - axio buccal and axio lingual line angles
  * Extent - Axio buccal pulpal point angle to axio buccal gingival point angle Similarly on the linguo axial line angle
  * Transition - bisecting the line angle
  * Depth - 2mm

NOTE :

- Factor controlling the flare in a class II amalgam preparation are
  a) the contact with adjacent tooth contact should be broken
  b) obtain a cavosurface bull point by an imaginary tangent drawn to outer proximal surface
  c) Enamel wall must follow the enamel rod direction

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• Cavosurface butt joint is given for amalgam preparation to improve the resistance form in the tooth and the restoration.

• In tooth it removes unsupported tooth structure and the enamel margin follows the enamel rod and direction

• In restoration - The resistance form is got by obtaining adequate bulk to resist masticatory forces. Tensile strength of amalgam is low and so tends to fracture of bulk is less

• 20 degree gingival cavosurface bevel is given

a) to follow the enamel rod direction

b) Remove unsupported enamel

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36 CLASS I INLAY CAVITY

OUTLINE FORM

External occlusal cavosurface outline
outline form similar to amalgam preparation

DIMENSIONS

- Pulpal floor depth = 5mm from marginal ridge
- Internal bucco lingual width = 5mm at the triangular ridge
- External buccolingual width = 6mm at the triangular ridge

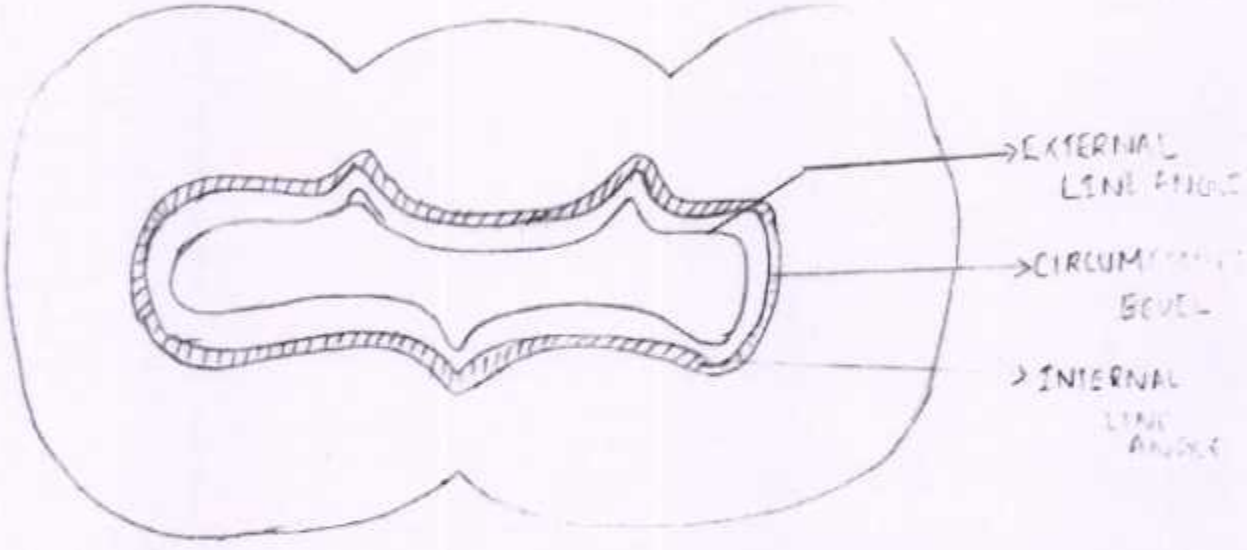
F[illegible]URES

- [illegible] external walls taper away from the long axis of the tooth by [illegible] degrees
- [illegible] circumferential - occlusal bevel to obtain 40° in metal, gingival bevel to obtain 30° in metal

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OCCLUSAL VIEW



→ 1° flare

→ 2° flare

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COMPOUND CAVITY 36 CLASS II

MESIO OCCLUSAL INLAY CAVITY

OUTLINE FORM

Irregular outline with groove extension half of the distance into the groove from the central groove.

Mesial and distal outline run parallel to the proximal contour and 1mm away from the outer contour preserving the marginal ridge.

FEATURES

OCCLUSAL CAVITY

① The cavity walls taper occlusaly.

② Primary flare of 45° to the axial wall is given in buccal and lingual walls followed with a 2° flare towards the cavosurface margin

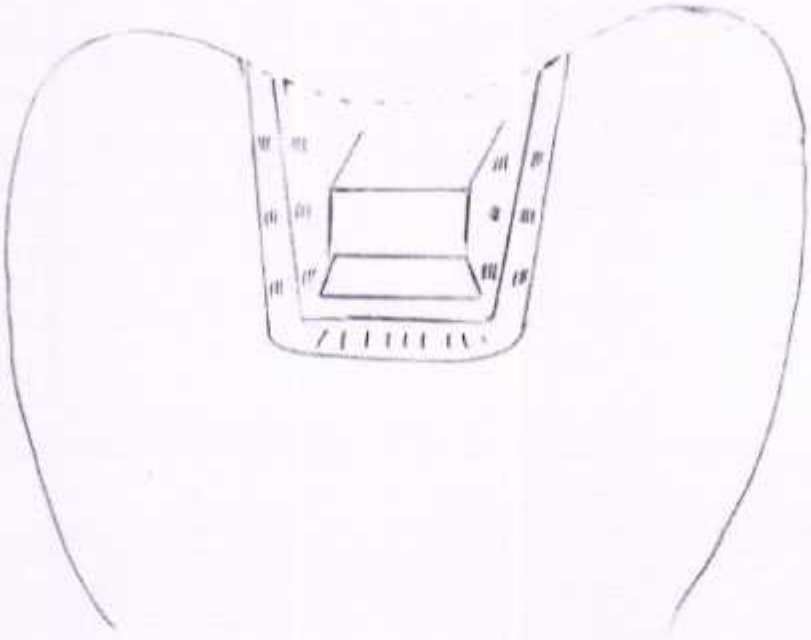
③ Flat gingiva

④ Gingival cavosurface bevel is given.

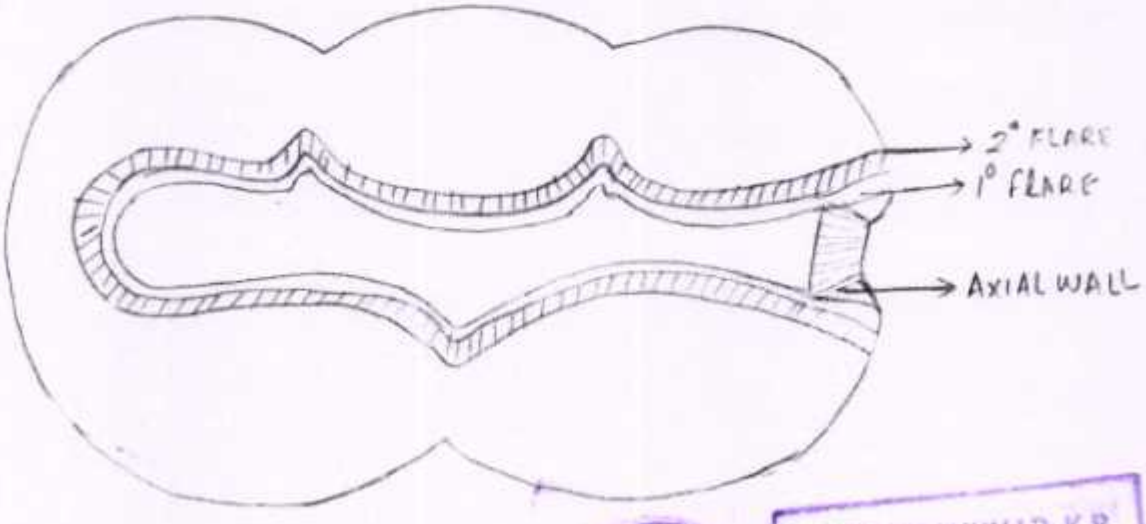
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PROXIMAL VIEW



OCCLUSAL VIEW



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ASSIGNMENT

1) Define Operative Dentistry ?

Operative Dentistry is the art and science of the diagnosis treatment and prognosis of the defects of teeth and that do not require full coverage restoration for correction. Such treatment should result in the restoration of proper tooth form functions aesthetics while maintaining the physiological integrity of tooth in harmonious relations with adjacent hard and soft tissue all of which enhance proper health and welfare of patient

2) Define tooth preparation ?

Tooth preparation is the mechanical alteration of a defective, injured or diseased tooth to receive a restorative material that establishes a healthy state for the tooth including aesthetics, correction where indicated normal forms and functions

3) Define internal wall, external wall line example ?

Internal wall : It is prepared surface that doesn't extend to external tooth surface

Eg: axial wall, Pulpal wall

External wall : It is prepared surface that extend to the external walls.

4) Define axial wall, pulpal wall, isthumus and cavosurface margin

• Axial wall is an internal wall of prepared cavity that lies parallel to the long axis of the tooth

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- Pulpal wall is the internal wall of prepared cavity that is perpendicular to the long axis of the tooth and is occlusal to the pulp
- Isthumus is a narrow space between the occlusal and proximal portion of the cavity (class II)

5) Classify cavities depending on the number of surfaces involved.

1) Simple cavity : Caries occuring only in one surface
2) Compound cavity : Caries involving two surface
3) Complex cavity : Caries involving 3 or more tooth surface

6) Classify the dental caries according to GV Black

CLASS I

- Caries on occlusal surface of premolars and molars
- On occlusal $\frac{1}{3}^{rd}$ of the facial and lingual of molars
- On lingual surface of maxillary incisors

CLASS II

- On the proximal surface of posterior teeth

CLASS III

- Caries on the proximal surface of anterior tooth that do not involve the incisal stage

CLASS IV

- Caries on the proximal surface of the anterior tooth that do involve incisal stage

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CLASS V

• Caries on the gingival third of facial or lingual surface of all teeth

CLASS VI

• Caries on the incisal edge of anterior teeth or occlusal cusp height of posterior teeth.

7) Enumerate the steps in GV Black's cavity preparation

It involves 2 stages:

STAGE I ⟹ Initial tooth preparation steps

Step-I : outline form and initial depth
Step II : Primary resistance form
Step III : Primary retention form
Step IV : Convenience form

STAGE II ⟹ Final tooth preparation steps

Step V : Removal of any remaining infected dentin or restorative material
Step VI : Pulp protection
Step VII : Procedures for finishing external walls
Step VIII : Final procedures - cleaning, inspecting, desensitizing

8) Define outline form and enumerate the factors and rules governing the outline form

Outline form means placing the cavity margins in its position they will occupy in the final tooth preparation

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Enamel walls and margins

Factors :

- Extend of lesion, defect or faulty restoration
- Aesthetics
- occlusal relationships
- Adjacent tooth contour
- Designed cavosurface marginal contouration of proposal restoration

Rules Governing Outline form :-

- Extend the cavity margins into the sound tooth structures involving all caries and friable tooth as old restoration. Margin should be placed in a position to afford good finishing outline should be a smooth and flowing centre
- Avoid margins or extreme eminences like cusp heights and edge grooves
- Extend of outline form should provide convenience form while preserving cuspal and marginal strength.
- Faciolingual extend should be minimized to $\frac{1}{4}^{th}$ of intercuspal distance occlusally.
- Depth of cavity must be 0.2 mm dentin for pit and fissure caries and 0.2-0.8 mm for smooth surface cavity
- In proximal cavities, the margins should clear the contact to the adjacent tooth by 0.5 mm.

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...re primary resistance form and enumerate the methods ...ployed to obtain the same in an amalgam restoration

...tention : It is defined as the shape and form of the ...position walls that best enables the restoration and the tooth to ...stand without fracture, masticatory forces delivered principally along ...e axis of the tooth

...inciples :

1) obtain a box form.
2) Flat floor that uses perpendicular to the forces of mastication
3) Restrict the restoration extension to external walls to prevent undermining of cusps and ridges [can line extension to minimum of 1/4th of intercuspal distance]
4) Rounding or covering of internal line and point angles
5) Cap weakened cusp and envelope or include weakened tooth within the restoration
6) Provide sufficient thickness or bulk to the restorative material
7) Bond the material to the tooth structure when appropriate
8) Reverse's curve 90° convexity, butt joint and 20° gingival convexity base
9) Taper to the mesial and distal axis walls in class I and all the gingival extensions

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10) Define the retention form and enumerate the methods of retention of cavity for silver amalgum

Definition : It is the shape and form of the conventional preparation that resists displacement and removal of the restoration by tapping or lifting forces

Features :

a) Primary Retention form :-

i) occlusal convergence
ii) Irregular outline form
iii) occlusal dove tail
iv) Box form with well defined bud rounded line and point angles
v) Smooth and flat walls and floors

b) Secondary Retention form

i) Retentive grooves or lobes
ii) Retentive pins
iii) slots
iv) Caves
v) Adhesive system for bonded amalgum

11) Define convenience form and mention it's features in an amalgum preparations ?

CONVENIENCE FORM

It will be the shape and form of preparation that form adequate accessibility, visibility and ease of operation in preparing and restoring the tooth

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Features

- Extensive walls to gain adequate access to deeper portions of the cavity
- Clearing the proximal contact with adjacent tooth in a class II cavity provide convenience for matrix placement.

2 Name the line angles and point angles of class I and class II cavity within suitable diagrams.

A line angle is a junction of two plane surfaces of different orientation along a line

A point angle is the junction of plane surfaces of three line angles of different orientation and it's name is from it's involved surfaces or line angles

LINE ANGLES

- Mesio buccal line angle
- Mesio lingual line angle
- Disto buccal line angle
- Disto lingual line angle
- Buccopulpal line angle
- Linguopulpal line angle
- Mesio pulpal line angle
- Distopulpal line angle

POINT ANGLES

- Mesio bucco-pulpal point angle
- Mesio lingual-pulpal point angle
- Disto buccopulpal point angle
- Disto linguo pulpal point angle

Line angle & point angle in class

For class I there are 4 line angles and 4 point angles

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LINE ANGLES

- Distofacial line angle
- Facopalatal line angle
- Axio-faual line angle
- Lingua gingival line angle
- Axiogingival line angle
- Axiopulpal line angle
- Axio lingual line angle
- Disto lingual line angle
- Distopulpal line angle

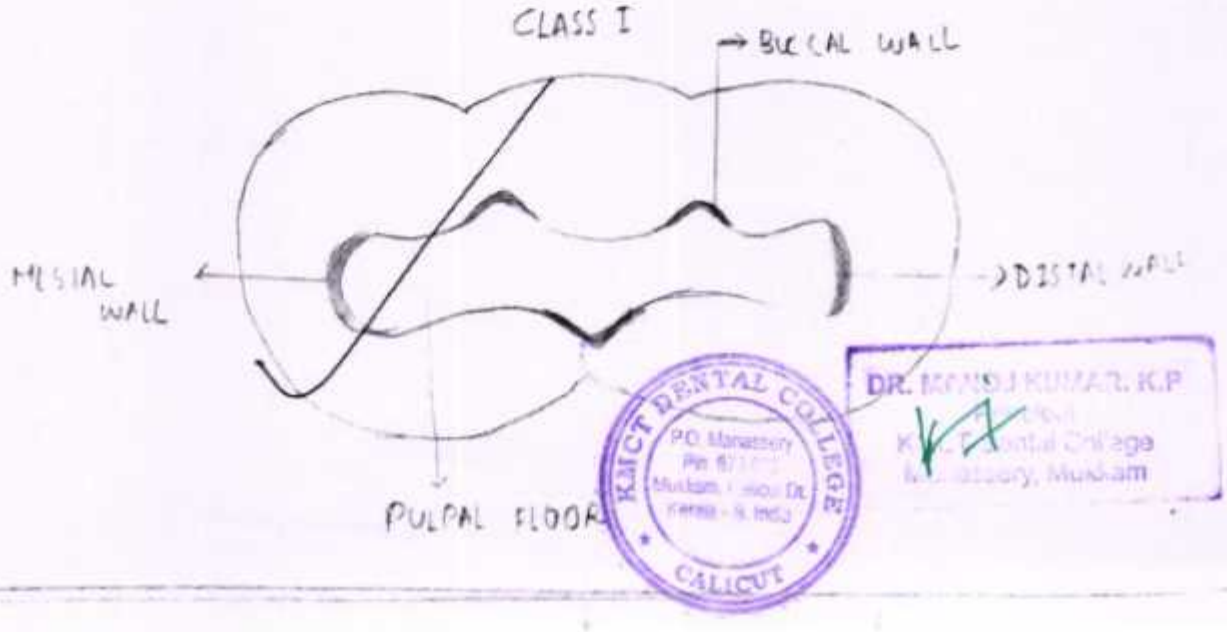
POINT ANGLES

- Distofacio pulpal point angle
- Axiofacio pulpal point angle
- Axio facio gingival point angle
- Axio lingua pulpal point angle
- Axiolingua gingival point angles
- Distolingua pulpal point angle

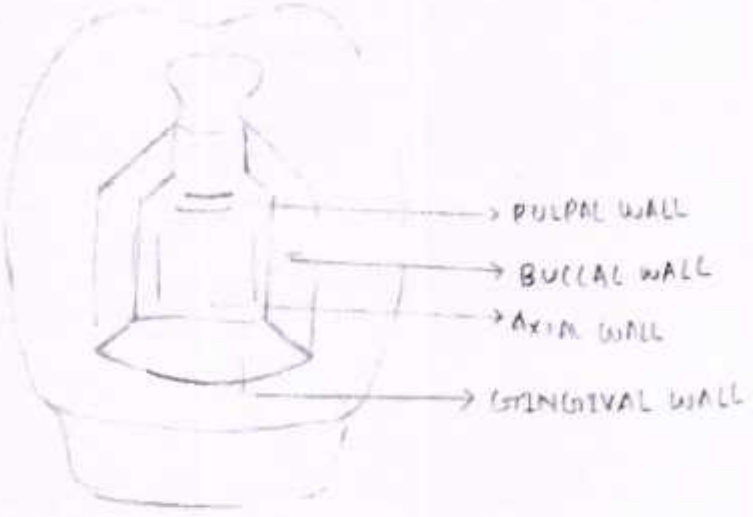
13 What are the features of strongest enamel margin ?

It is formed by the full length enamel rods and is supported on the preparation side by progressive shorter rods on which extend to dentin the cavosurface angle will be greater than 90°

14 Draw a labelled diagram of class I and class II cavity ?



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15) Define the procedure for finishing of preparation walls ?

Finishing of preparation wall is the further development which individual of a specific cavosurface design degree of smoothness or roughness that produce the maximum effectiveness of the restorative material being used.

16) what are the objectives for finishing of external walls ?

- To create a best marginal seal between restoration and the tooth
- To obtain smooth marginal junction
- To provide maximum strength to the tooth and restoration

17) what are the principles to be considered during this steps ?

- The cavity walls should follow the enamel and rod direction
- The cavity walls should be placed in the second dentin
- The wall should be smooth
- The cavosurface margin should be 90° except at the gingival cavosurface of the proximal box of a preparation where a bevel is given

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18) What is circumferential tie ? what is it's significance ?

It is the peripheral anatomy of class preperation. The margin should be prepared to create a favourable relationship between the casting and cutting cement as the weak link in an indirect restoration is the cement line. The features in an intracoronal preparation is in the form of bevel expected away from the preperation.

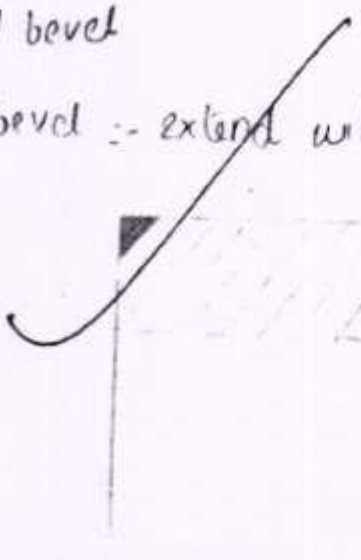
19) what are the principles of tooth preparation for an indirect restoration ?

- Obtaining a single path of insertion and removal (line of draw)
- Concept of taper ($2°$-$5°$)
- Circumferential tie

20) What are the different types of bevel ?

* Depending on location :-
  - Gingival bevel
  - Occlusal bevel

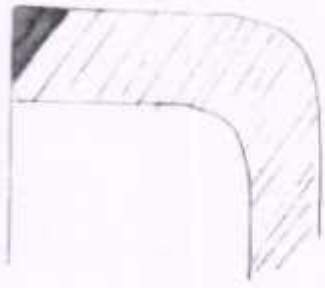
a) Axial bevel :- extend within the enamel only



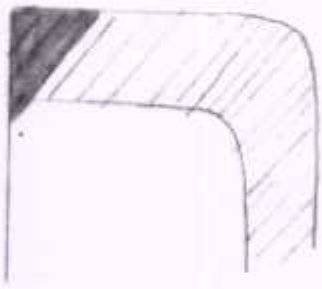
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b) Short bevel : Involve the whole enamel length



c) Long bevel : Involve all of the enamel wall and partly into dentin



d) Full bevel : Includes all of the dentinal and enamel wall or floor

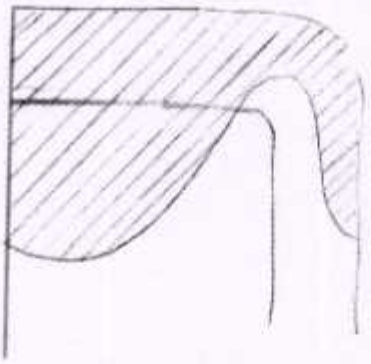


e) Halo ground bevel : when the bevel which usually in the form of a flat plate is prepared in a concave form



f) contour bevel : when a bevel is given opposite to an axial resisting wall on the buccal or lingual surface of the tooth

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21) What are the functions of a bevel ?

- Create a strong marginal configuration
- provide retention
- provide an acute angle in the marginal metal which can be burnished protect the cement line
- May be extended to improve surface defects without removing excess tooth material

22) Write the difference between Silver amalgam preparation and cast preparation

SILVER AMALGAM PREPARATION	CAST RESTORATION
• outline form is narrow as there is no involvement and the walls converge occlusally	• outline form is wide as there is more surface involvement and the cavity walls diverge occlusally
• The cavity which is kept at $\frac{1}{6}^{th}$ of intercuspal distance	• The width of the cavity may be increased upto $\frac{1}{3}^{rd}$ of the intercuspal distance
• The occlusal cavosurface angle is 90° to establish a butt joint with amalgam	• The occlusal cavosurface angle is 135° to 145° to achieve a lap sliding fit with the inlay

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• Burs used are No 245 and No : 330	• Burs used are No: 271 and No 169
• Gingival bevel is in the range of 15° to 20°	• Gingival bevel is steeper and is in the range of 20° to 35° This help to minimise the cement line
• Undercuts is in the preparation improve retention of the restoration	• No undercuts should be present in the preparation
• Proximally, minimum clearance is provided not more than 0.5mm from the adjacent tooth	• Proximally more clearance may be accepted
• Ideally gingival seal should be located supragingivally	• Subgingival extension of the gingival seal is acceptable
• Secondary retention is provided by grooves, slots, pins and amalgam pins	• Secondary retention is provided by grooves, slots, internal bevel, skirts, collars and reverse bevel
• Proximal walls are only provided with a primary flare	• The proximal margins show primary and secondary flare
• Internal line angles are rounded	• Internal line angles are well defined
• Reverse curve may be present on proximal outline	• Reverse curve is not provided in the proximal outline
• Beveling is done by only on the gingival cavosurface margin to remove unsupported enamel	• Bevels are placed on the occlusal and gingival cavosurface margin to [illegible]

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II BDS EXERCISES

EXERCISES ON TYPHODONT TEETH
AMALGAM AND GLASS IONOMER RESTORATIONS

Sl. No.	Date	Tooth No.	Preparation	Grade Sign	Base, matrix wedge placement	Grade Sign	Restoration	Grade Sign
1	24/11/18	36	CLASS I OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
2.	26/11/18	47	CLASS I OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
3.	03/12/18	35	CLASS I OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
4	04/12/18	46	CLASS I BUCCAL PIT		ZINC PHOSPHATE CEMENT		AMALGAM	
5	17/12/18	16	CLASS I MESIAL ~~OCCLUSAL~~ DISTAL PIT ~~CAVITY~~		ZINC PHOSPHATE		AMALGAM	
6	01/01/19	44	CLASS I OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
7.	14/01/19	27	CLASS I MESIAL DISTAL PIT		ZINC PHOSPHATE CEMENT		AMALGAM	
8.	04/2/19	27	CLASS I PALATAL EXTENSION		ZINC PHOSPHATE CEMENT		AMAL GAM	

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EXERCISES ON TYPHODONT TEETH
AMALGAM AND GLASS IONOMER RESTORATIONS

Sl. No.	Date	Tooth No.	Preparation	Grade / Sign	Base, matrix wedge placement	Grade / Sign	Restoration	Grade / Sign
9.	21/01/19	47	CLASS I BUCCAL EXTENSION	B+	ZINC PHOSPHATE CEMENT.	B+	AMALGAM	B
10	22/01/19	26	CLASS I MESIAL DISTAL PIT	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
11.	26/02/19	37	CLASS II MESIO-OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
12	19/03/19	46	CLASS II MESIO-OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
13	27/04/19	16	CLASS II MESIO OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
14.	27/04/19	16	CLASS II DISTO OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
15.	30/04/19	26.	CLASS II MESIO-OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+
16	30/04/19	26	CLASS II DISTO OCCLUSAL CAVITY	B+	ZINC PHOSPHATE CEMENT	B+	AMALGAM	B+

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EXERCISES ON TYPHODONT TEETH
AMALGAM AND GLASS IONOMER RESTORATIONS

Sl. No.	Date	Tooth No.	Preparation	Grade Sign	Base, matrix wedge placement	Grade Sign	Restoration	Grade Sign
17	06/05/19	17	CLASS I MESIAL DISTAL PIT		ZINC PHOSPHATE CEMENT		AMALGAM	
17	06/05/19	17	CLASS II ~~MESIA~~ DISTO-OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
18	07/05/19	45	CLASS II DISTO OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
19	11/05/19	14	CLASS II MESIO OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
20	20/05/19	24	CLASS II MESIO OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
21	20/05/19	15	CLASS II MESIO OCCLUSAL CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
22	18/06/19	36	~~DUMBELL~~ MOD CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	
23	18/06/19	46	MOD CAVITY		ZINC PHOSPHATE CEMENT		AMALGAM	

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EXERCISES ON TYPHODONT TEETH
AMALGAM AND GLASS IONOMER RESTORATIONS

Sl. No.	Date	Tooth No.	Preparation	Grade / Sign	Base, matrix wedge placement	Grade / Sign	Restoration	Grade / Sign
24	18/06/19	44	CLASS V BUCCAL CAVITY	BH	ZINC PHOSPHATE CEMENT	BA	AMALGAM	B
25	18/06/19	16	CLASS V BUCCAL CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	B
26	18/06/19	25	CLASS V BUCCAL CAVITY	BH	-	-	GIC	B
27	22/06/19	45	CLASS V BUCCAL CAVITY	BH	-	-	GIC	BH
28	26/06/19	33	CLASS III CAVITY	BH	-	-	GIC	B
29	26/06/19	13	CLASS IV CAVITY	BH	-	-	GIC	B

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EXERCISE ON EXTRACTED TEETH

PREPARATIONS FOR AMALGAM RESTORATION

Sl. No.	Date	Tooth No.	Preparation	Grade / Sign	Base, matrix wedge placement	Grade / Sign	Restoration	Grade / Sign
1.	26/06/19	14	CLASS I CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
2.	26/06/19	24	CLASS I CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
3	26/06/19	15	CLASS I CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
4	26/06/19	25	CLASS I CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
5	28/06/19	36	MESIAL DISTAL PIT	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
6.	28/06/19	24	CLASS II CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
7	28/06/19	15	CLASS II CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH
8	28/06/19	25	CLASS II CAVITY	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	BH

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EXERCISE ON EXTRACTED TEETH

PREPARATIONS FOR AMALGAM RESTORATION

Sl. No.	Date	Tooth No.	Preparation	Grade / Sign	Base, matrix wedge placement	Grade / Sign	Restoration	Grade / Sign
9	28/06/19	36	MESIO OCCLUSO LAVEM	BH	ZINC PHOSPHATE CEMENT	BH	AMALGAM	B

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ASSIGNMENT

1 Name the parts of hand cutting instruments and explain instrument formula with example

Most hand cutting instruments are composed of three parts

1) Handle or shaft
2) Shank
3) Blade

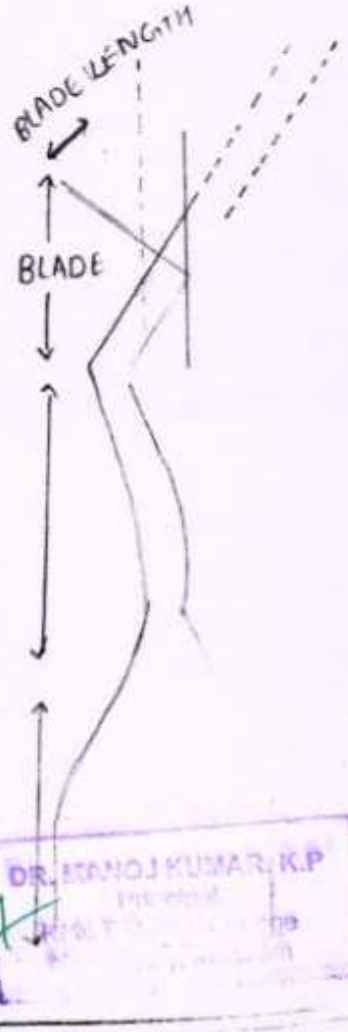
Cutting instruments have formula describing the dimensions and angles of the working end. These are placed on the handle using a code of three or four numbers separated by dashes or spaces

FIRST NUMBER : The first number indicates the width of the blade or primary cutting edges in tenths of a millimeter

SECOND NUMBER : The second number of a four number code indicates the primary cutting edge angles measured from the parallel to the long axis of the instrument. handle in clockwise centigrade

THIRD NUMBER : (second number in three number code) represents the length of the blade or millimeter that is from shank to the cutting edge

FOURTH NUMBER : (third number in three number code) represents the angle which the blade forms with the long axis of the handle or plane of instrument.



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Example :- Instrument with formula 15-95-3-7 represents

15 : Width of the blade in tenths of a millimeter i.e 1.5 mm

95 : Cutting edge angle in centigrades

3 : length of blade i.e 3mm

7 : Blade angle in centigrades

2) Classify the dental cutting tool using flow chart

CLASSIFICATION GIVEN BY GV BLACK

CUTTING INSTRUMENTS	CONDENSING INSTRUMENTS	PLASTIC INSTRUMENTS	FINISHING & POLISHING INSTRUMENTS	ISOLATION INSTRUMENTS	MISCELLANEOUS INSTRUMENTS
A. Hand - chisels - Excavators - Hatchets - Hoes B. Rotary - Burs - stones - Discs	- Pluggers • Hand • Mechanical	- Spatulas - Cement carvers - Carvers - plastic filling instrument - Burnishers	A. Hand - Orange wood sticks - Polishing points - finishing strips B. Rotary - Finishing brushes - Mounted brushes - Mounted stones - Rubber cups	- Rubber dam kit (frame, clamps sheet, forceps and punch) - Saliva ejector - Cotton roll holders - Evacuator tip and equipments	- Mouth mirror - Explorers - probe - pliers - Scissors - Others

CLASSIFICATION GIVEN BY MARZOUK

Based on different restorative procedures performed by different instruments

→ [illegible] INSTRUMENTS

- [illegible] MIRROR
- Explorers

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* Tweezers / cotton pliers
* Periodontal probes

→ INSTRUMENTS FOR TOOTH STRUCTURE REMOVAL

A) HAND CUTTING INSTRUMENTS

* Excavators
  - i) Hatchet
  - ii) Hoe
  - iii) Spoon
  - iv) Discoid
  - v) Gleoid
  - vi) Angle formers
* Chisels
  - i) Straight
  - ii) Monoangle
  - iii) Bin angle
  - iv) Triple angle
* Special forms of chisels
  - i) Enamel hatchet
  - ii) Gingival marginal trimmer
  - iii) Wedelstaedt chisel
  - iv) Offset hatchet
  - v) Triangular chisel
  - vi) Hoe chisel

B) ROTARY INSTRUMENTS

* Burs
* Hand pieces
* Ultrasonic instruments

→ RESTORING INSTRUMENTS

* Mixing instruments : plastic or stainless steel spatula
* Condensing instruments : Rounded, triangular, diamond or [illegible] condensers

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* Burnishing instruments : Ball, egg, conical shaped burnishers
* Carvers : Hollenback, discoid and cleoid, diamond shaped carvers
* Files : Hatchet / parallelogram shaped
* Knives : Bard Parker knife and stevns knife

→ FINISHING AND POLISHING INSTRUMENTS

A) Hand
* Orange wood sticks
* Polishing points
* Finishing strips

B) Rotary
* Finishing Burs
* Mounted brushes
* Mounted stones
* Rubber cups
* Impregnated disc and wheel.

CLASSIFICATION GIVEN BY STURDEVANT

A) CUTTING INSTRUMENTS

i) Excavators
* Ordinary hatchets
* Hoes
* Angle formers
* Spoon

ii) Chisels
* Straight chisel
* Curved chisel
* Binangle chisel
* Enamel hatchet
* Gingival marginal trimmer

iii) Others
* Knives
* Files
* Scalers
* Carvers

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B. NON CUTTING INSTRUMENTS

i) Amalgam condensers
ii) Mirror
iii) Explorers
iv) Probes

3 List the difference between Gingival Marginal Trimmer and Enamel Hatchet

ENAMEL HATCHET	GINGIVAL MARGINAL TRIMMER
* It have a straight blade which makes it a single plane instrument	* The blade curved, which makes it a double plane instruments and enhances lateral scrapping motion
* The cutting edge is in plane parallel to the long axis of the handle	* The cutting edge of the GMT is not at 90° to the axis of the blade
* It is available as right and left type	* Right, Left, mesial and distal blunted types are available
* used for cleaving enamel and planning the distal walls so as to have sharp outline of the preparations	* used for planning of gingival cavosurface margin that is removal of unsupported enamel and to bond axiopulpal line angle in the class II

4. List the difference between monoangle chisel and hoes

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MONOANGLE CHISEL	HOES
* The primary cutting edge is in a plane perpendicular to long axis of shaft * By definition chisel is an instrument where the blade makes upto 125° angle with the planes of the instruments * They are used to push or pull for anterior proximal restorations, smoothening proximal walls	* Dental hoe resembles a garden hoe * By definition it's any instrument where the blade makes more than 12.5° angle with the plane of an instruments * Usually the blades make 45-90° angle to the long axis of handle * It's shank can have one or more angles

9) Write the difference between hoe and ordinary hatchet

HOE	ORDINARY HATCHET
* Resembles miniature garden hoe * Blade makes more than 12.5° angle with the plane of instrument * Hoe blade usually makes 45-90° angle to the long axis of handle * Shank can have one or more angles	* Ordinary hatchet excavator is a bevelled instrument * Blade is disordered in the same plane as that as long axis of the handle * used for preparing and sharpening line angles of anterior tooth

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6 Mention the various devices and materials used for sharpening hand instruments

1. Stationery sharpening stones
2. Mechanical sharpeners
3. Handpiece sharpening stones

STATIONERY SHARPENING STONES

- The most frequently used sharpening equipment consists of a block or ... of abrasive material called a 'stone'
- The stone is supported on a firm surface and the instrument is ... and held by hand while being stroked against the stone surface
- Stationary stones are often called 'oilstones' because of the common practice of applying a coating of oil to them as an aid to the sharpening process
- Sharpening stones are available in a variety of grits, shapes and materials

* Grits	* Shapes	* Materials
i) Coarse	i) Flat	i) Arkansas stone
ii) Medium	ii) Grooved	ii) Silicon carbide
iii) Fine	iii) cylindrical	iii) Aluminium oxide
	iv) Tapered	iv) Diamond

MECHANICAL SHARPENERS

- Ross honing machine

HAND PIECE SHARPENING STONES

- Mounted silicon carbide stones
- Mounted aluminium oxide stones

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Classify rotary instrument according to speed and write their uses :

The rotational speed of an instrument is measured in revolution per minute (rpm) Rotary speeds in dentistry is classified as follows

1) ACCORDING TO STURDEVANT

- Low or slow speeds (< 12,000 rpm)
- Medium or intermediate Speeds (12,000 - 200000 rpm)
- High or ultra high speed (> 200,000 rpm)

2) ACCORDING TO HARZOOK

- Ultra low speed 300 - 3000 rpm
- Low speed 3000 - 6000 rpm
- Medium high speed 20,000 - 45000 rpm
- High speed 45 000 - 100 000 rpm
- Ultra high speed > 100 000 rpm

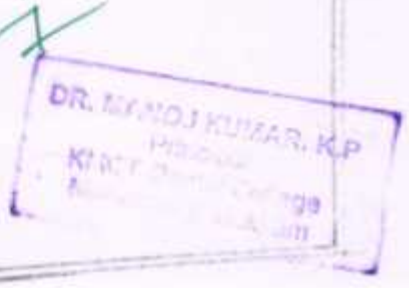
The low speed range is used for :

- cleaning teeth
- occasional caries excavation
- finishing and polishing procedures

The high speed range is used for

- Tooth preparation
- Old restoration removal





8 What are the advantages and disadvantages of high speed

ADVANTAGES	DISADVANTAGES
• Diamond and carbide cutting instruments remove tooth structure faster with less pressure vibration and heat generation • The number of rotary cutting instruments needed is reduced because smaller sizes are more universal in application • The operator has better control and greater ease of operation • Instruments last longer • Patients are generally less apprehensive because annoying vibrations and operating time are decreased • Several teeth in the same arch can and should be treated at the same appointment	• More heat production • Not fit for larger preparation • preparation can cause operator fatigue

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9. Write the disadvantages of slow speed

- Ineffective cutting
- Time consuming
- Operator fatigue
- Produce patient discomfort

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Enumerate the steps of tooth preparation

Tooth preparation is divided into two stages

STAGE I

INITIAL TOOTH PREPARATION STAGES

1) Outline form and initial depth
2) Primary resistance form
3) Primary retention form
4) convenience form

FINAL TOOTH PREPARATION STAGES

5) Removal of any remaining infected dentin and old restorative material
6) Pulp protection
7) Secondary resistance and retention forms
8) Procedures for finishing external walls
9) Final procedures of cleansing, inspecting and sealing

II FUNCTIONS OF BASE

- Bases are used to provide thermal protection for the pulp and to supplement mechanical support for the restoration by distributing local stresses from the restoration onto the underlying dentinal surface
- To withstand the force of condensation of restoration material
3. Shock absorber

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- To substitute dentin in deep cavities

  Eg: zinc phosphate cement under Amalgam restoration

- To serve as an intermediate bonding material between the tooth and composite restoration

  Eg: GIC in sandwich techniques

- To prevent the ingress of bacteria and their noxious products into dentinal tubules through microleakage

12 Enumerate the functions of a liner?

i) To serve as a physical barrier to ingress of bacteria/bacterial products

ii) To produce therapeutic effect such as antibacterial, anticariogenic or pulpal anodyne effect (to relieve pulpal pain)

iii) To provide a barrier for protection of the pulp from residual reactants diffusing out of a restoration

iv) To prevent oral fluids that may penetrate leaky restoration from reaching the pulp through dentin

v) To contribute to some initial identical and thermal insulation when used under metallic restorations

13 What are the actions of calcium hydroxide

- Calcium hydroxide has excellent pulpal compatibility and stimulate reparative dentin formation.

- Reduction in the inflammation due to antibacterial [illegible] of the canal is responsible for the mineralization of dentin bridge.

- Calcium ion responsible for reducing the [illegible]

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serum flow and there by create a conductive atmosphere for mineralisation

- Hydroxyl ions for cement neutralise the acids produced by the osteoblasts and create a optimum pH for pyrophosphatase activity necessary for mineralisation

What are the actions of Zinc Oxide Eugenol ?

- soothing action on pulpal tissues
- Eugenol has topical anaesthetic properties. Therefore termed as obtundent material
- Provides excellent thermal insulation when used as a base
- Good short term sealing
- Good thermal insulators

What are the factors affecting the selection of a pulp protecting agent ?

- It should provide thermal protection against temperature changes
- Electrical protection against galvanic shock
- Mechanical protection during various restorative procedures
- chemical protection from toxic components
- Protection from microleakage interface between tooth and restoration
- It should be biologically and chemically compatible
- It should not discolour either the restoration or the tooth
- It should maintain the dentin thickness between the floor of both pulpal chamber (one of the most important

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16 Classify matrices

I) Depending upon their method of retention

a) Mechanical retained :

Eg: Ivory matrix retainers No:1 and Tofflemire universal dental matrix band retainer.

b) Self retained

Eg: copper or stainless steel bands, auto matrices

II) Depending upon its preparation

a) Mechanical matrix :

Eg: Ivory matrix retainers No·1 and 8

b) Anatomic / custom made matrix

Eg: Compound supported

III) On the basis of transparency

a) Transparent matrices

Eg: celluphate, celluloid.

b) Non transparent matrices

Eg: Stainless steel

IV) Depending upon the tooth preparation for which they are used

TYPE OF PREPARATION	MATRICES AND RETAINERS
- class II tooth preparation	• Ivory number 1 • Nyhomes retainers

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TYPE OF PREPARATION	MATRICES AND RETAINERS
- class II mesio occlusal distal tooth preparation	• Ivory matrix number 8 • Tofflemire matrix • Steels sloved and self adjusting matrix • Anatomical matrix band • Retainerless matrix
- class III tooth preparation	• S shaped matrix band • Cellophane matrix strips • Ugly strips
- class IV tooth preparation	• plastic strips • Aluminium foil • Transparent acetate film • Anatomic matrix

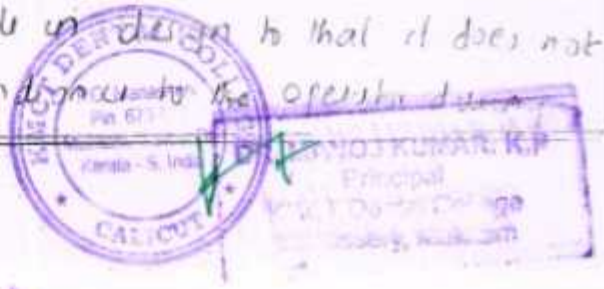
Enumerate the ideal requirements and dimensions of matrix ?

Requirement of a matrix band :

i) RIGIDITY : The matrix band should be rigid enough so as to withstand the pressure of condensation applied during restoration placement and maintain its shape during hardening.

ii) ADAPTABILITY : The matrix band should be able to match to almost any size and shape of tooth

iii) EASY TO USE : The band should be simple in design so that it does not cause any difficulty to the patient or hindrance to the operator during



restoration of the tooth.

4) It should be able to displace the gingiva and rubber dam for ease in working

5) NON REACTIVE : It should be inert to tissues and the restorative material

6) HEIGHT AND CONTOUR :- The matrix band should not extend more than 2mm beyond the occlusogingival height of the crown of tooth as it facilitates vision and speed up working. The matrix band helps in the formation of a physiologic proximal contact relationship

7) APPLICATION :- The matrix band should be such that it can be applied and removed easily

8) STERILISATION :

It should be inexpensive

DIMENSIONS OF A MATRIX BAND

- Material range in width from 5.35mm (1/4") to 9.25 mm (3/8") for permanent teeth and 3.775 mm (1/8") to 7.9375 mm (7/16") for deciduous teeth
- Thickness may range between 0.381 mm (0.0015") to 0.0508 mm (0.002")
- Matrix band should extend 2mm above the marginal ridge height and 1mm below gingival margin of the preparation.

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What are the functions of wedges ?

wedges are used to

i) Prevent gingival overhangs of restorations

ii) Seperate teeth to compensate for the thickness of the matrix band

iii) stabilize the matrix band and retainer

iv) Retract the rubber dam from gingival margins to control bleeding and moisture

v) Helps in depressing rubber dam in interproximal area

vi) Helps in retracting and depressing the interproximal gingival area thus helping in minimising trauma to soft tissue.

vii) Provides close adaptability in cervical portion of proximal restoration thereby achieving correct contour and shape of cervical areas.

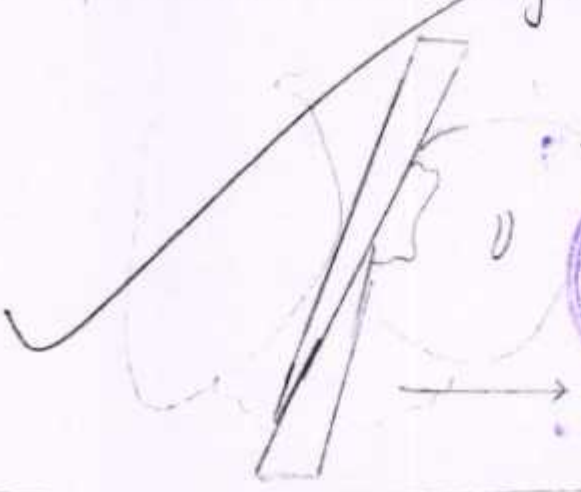
19) Write the methods of wedging with diagrams ?

1. Double wedging

- Two wedges are used in one is inserted from buccal embrasure and another is inserted from lingual embrasure

- This technique is indicated in following cases.

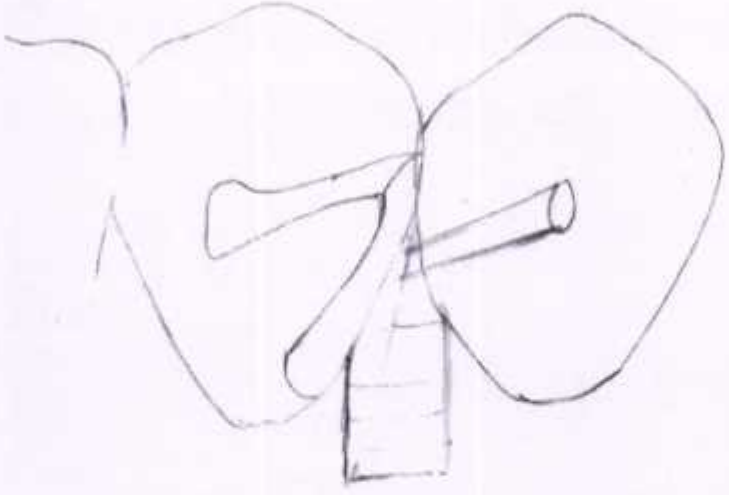
* Spacing between adjacent teeth when single wedging is not sufficient
* wedging of proximal box in buccolingual dimension



→ COMPOUND FOR SUPPORTING WEDGES

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2) Wedge wedging
- In this technique, two wedges are used
- one wedge is inserted from lingual embrasure and another is inserted between the wedge and matrix band at right angle to first wedge
- primarily indicated while treating mesial aspect of maxillary first premolar
- These are indicated in upper first premolar because of presence of plate in root near the gingival area



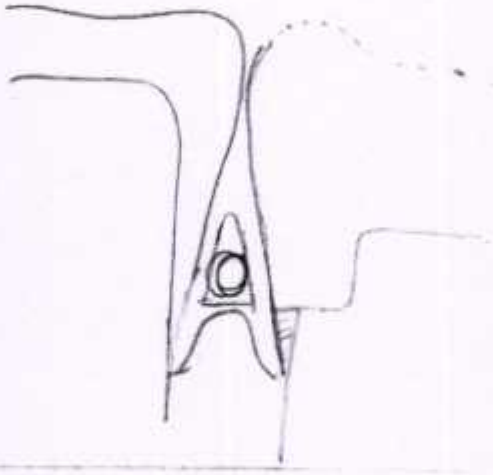
3) Piggy back wedging
- In this technique two wedges are used
- one (large) wedge is inserted & used normaly, while the other smaller wedge (piggy back) is inserted above the larger one
- It is indicated in cases of shallow proximal box with gingival recession.
- This technique provides closer adaptation and contour of the matrix band



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4) Triangular v/s round wedge

- The round tooth pick wedge is usually the wedge of choice with conservative proximal boxes, however because its wedging action is more occlusal
- Triangular wedge is recommended for
  * preparation with a deep gingival margin
  * with the tofflemire mesio-occluso-distal matrix band
  * when the gingival margin is deep (cervically), the base of the triangular wedge more readily engages the tooth gingival to the margin without causing excessive soft tissue displacement



20) classify separators ?

A) Principles used in rapid separator :-

I) Transitori principle :-

a) Ferrie double blow separator

b) Non interfering wire separator

II wedge principle :

a) Elliot separator

b) wedges

B) Based on the method of separation

a) Slow separation → Seperation should not exued more than 2.5 mm

Separators used are

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Separating wire
orthodontic appliances
wood or rubber
Methods for achieving slow separation

(1) separating rubber ring bands
(2) Rubber dam shut
(3) Ligature wire / copper wire
(4) Gutta percha stick
(5) Oversized temporary crown
(6) Fixed orthodontic prosthesis

21) what are the objectives and methods of condensation ?

Objectives :-

- Being excess mercury on the surface of restoration
- Reduces the number and sizes of voides in restoration
- Prepare the surface of restoration for carving adapt analysis to the proper wall and floor

Methods of condensation :

- A smaller condensation is used while filling the preparation larger or Each portion is thoroughly condensing prior to the placement of next investment
- Each condensing stroke should overlap the permission in condensing stroke to ensure that the entire mass is well condensed
- The preparation should be overpacked more using heavy pressure ensures the cavosurface margin are completely covered with well amalgam final condensation covers cavosurface margin should be perpendicular to the internal enamel and adjacent to the margin

22) What are the types of burnishing and mention it's objective

Types

1) Pre cavve burnishing :- obtain a rough anatomy of tooth, remove voids its a form of condensation to improve the benefits of condensation It provides a dense analogues of the margin of occlusal preparation restored with high copper amalgam and initial carving

2) Post cavve burnishing :- Due to improve smoothness and produce a shiny appearance

Objectives

- Adapt the amalgam well to cavosurface margin
- As a continuation of condensation to reduce voids
- To bring out excess mercury to the surface
- To produce smooth and shiny surface of restoration

23) What are the types and causes for failure seen in amalgam restoration

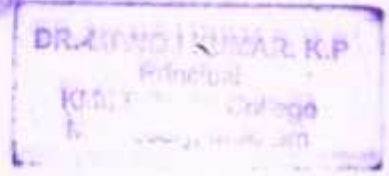
Types :

Fracture lines
Marginal ditching
Proximal overhang
Poor anatomic contour
Marginal ridge incompatibility
Improper proximal contour
Recurrent caries
Voids
Poor occlusal contact

Causes

- Poor case selection
- Defective tooth preparation
- Defective amalgam manipulation





- Defective matrix adaptation
- Post restorative failures

24) what are the principles and sequence of carving of amalgam?

- with care, sharp discoid-cleoid carvers of suitable sizes are recommended for carving which may begin immediately after condensation
- The larger end of the discoid-cleoid instrument is used first followed by the smaller instrument in region not accessible to the large instrument. alternatively the Hollen back carver can be used.
- Deep occlusal grooves should not be carved slightly deeper than proximal marginal ridges.

25) what are the objectives of cavosurface bevel in composite?

- Increases the micromechanical bonding between tooth surface
- Reduces polymerization shrinkage
- Bevel merges the restoration to tooth surface which enhances the aesthetics

26) what are the difference between affected and infected dentin

INFECTED DENTIN	AFFECTED DENTIN
• It is a superficial layer of demineralised dentin	• It is a deeper layer
• Cannot be remineralized	• Can be remineralized
• Lacks sensation	• It is sensitive

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INFECTED DENTIN	AFFECTED DENTIN
• Intertubular layer is demineralized with regularly scattered crystals • Collagen fibers are broken down appear as only indistinct cross band • It can be stained with 0.2% propylene glycol 10% acid red solution 0.5% basic solution	• Intertubular layer is only partly demineralized. • Distinct cross bands are present • It cannot be stained with any solution

26) Explain direct and indirect pulp capping?

Indirect pulp capping

It is the procedure performed in a tooth with deep carious lesions adjacent to the pulp

- In this procedure all infected carious dentin is removed except soft undiscoloured carious dentin which lies adjacent to the pulp.
- Caries near the pulp is left in place to avoid pulp exposure and preparation is covered with biocompatible material.

Indications

1) Deep carious lesions near the pulp tissues but not involving it
2) No mobility of tooth
3) No history of spontaneous tooth ache
4) No tenderness to percussion
5) No radiographic evidence of pulp pathology

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contraindication

- Presence of pulpexposure
- Radiographic evidence of pulp pathology
- History of spontaneous toothache
- Tooth sensitive to percussion
- Mobility present

Clinical technique

- Band the teeth if tooth is grossly decayed
- Anasthetize the tooth
- Apply rubber dam to isolate the tooth
- Remove soft caries either with spoon excavator or round bur
- A thin layer of dentin and some amount of caries is left to avoid exposure
- Place calcium hydroxide paste on the exposed dentin
- Cover the calcium hydroxide with zinc oxide eugenol base
- If restoration is to be given for a longer time, then amalgam restoration should be given
- Tooth should be evaluated after 6-8 weeks
- After 2 to 3 months remove the cement and evaluate the tooth preparation If due to remineralization or formation of secondary dentin, the soft dentin has become hard then remove any residual soft debris and then finally give protective cement base and place the permanent restorative material

The success of indirect pulp capping.

- Age of the patient
- Size of the patient
- Restorative procedure
- Evidence of pulp vitality

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Direct pulp capping

Direct pulp capping procedure involves the placement of biocompatible material over the size of pulp exposure to maintain vitality and promote healing.

Indications

- Small mechanical exposure of pulp during
  - Tooth preparation
  - Traumatic injury
- No or minimal bleeding at the exposure site.

Contraindications

- Wide pulp exposure
- Radiographic evidence of pulp pathology
- History of spontaneous pain
- Presence of bleeding at exposure site

Clinical procedure:

- Administer local anaesthesia
- Isolate the tooth with rubber dam.
- When vital and healthy pulp is exposed, check the fresh bleeding at exposure site
- clean the area with distilled water or saline solution and then dry it with a cotton pellet
- Apply calcium hydroxide over the exposed area
- Use interim restoration such as zinc oxide eugenol for 6 to 8 weeks.

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Success depends on

- Age of the patient
- Type of exposure
- Size of the exposure
- History of pain

2%) Define pulpotomy write the material used for pulpotomy procedure

Surgical removal of the entire coronal pulp leaving vital tissues in the canals followed by placement of a medicament or dressing over the remaining pulp stump in an attempt to promote healing and retention of the vital tissue

Materials used :

- Electro
- Laser
- formocresol
- glutaraldehyde
- Ferrous sulphate
- Calcium hydroxide

2%) Name different methods of moisture control

- Direct methods
  - → Rubber dam
  - → Absorbent materials (cotton rolls and cellulose wafers)
  - → Low volume evacuator
  - → High volume evacuator
  - → Air way syringe
  - → Throat shield

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→ Cheek retractor
→ Mouth prop

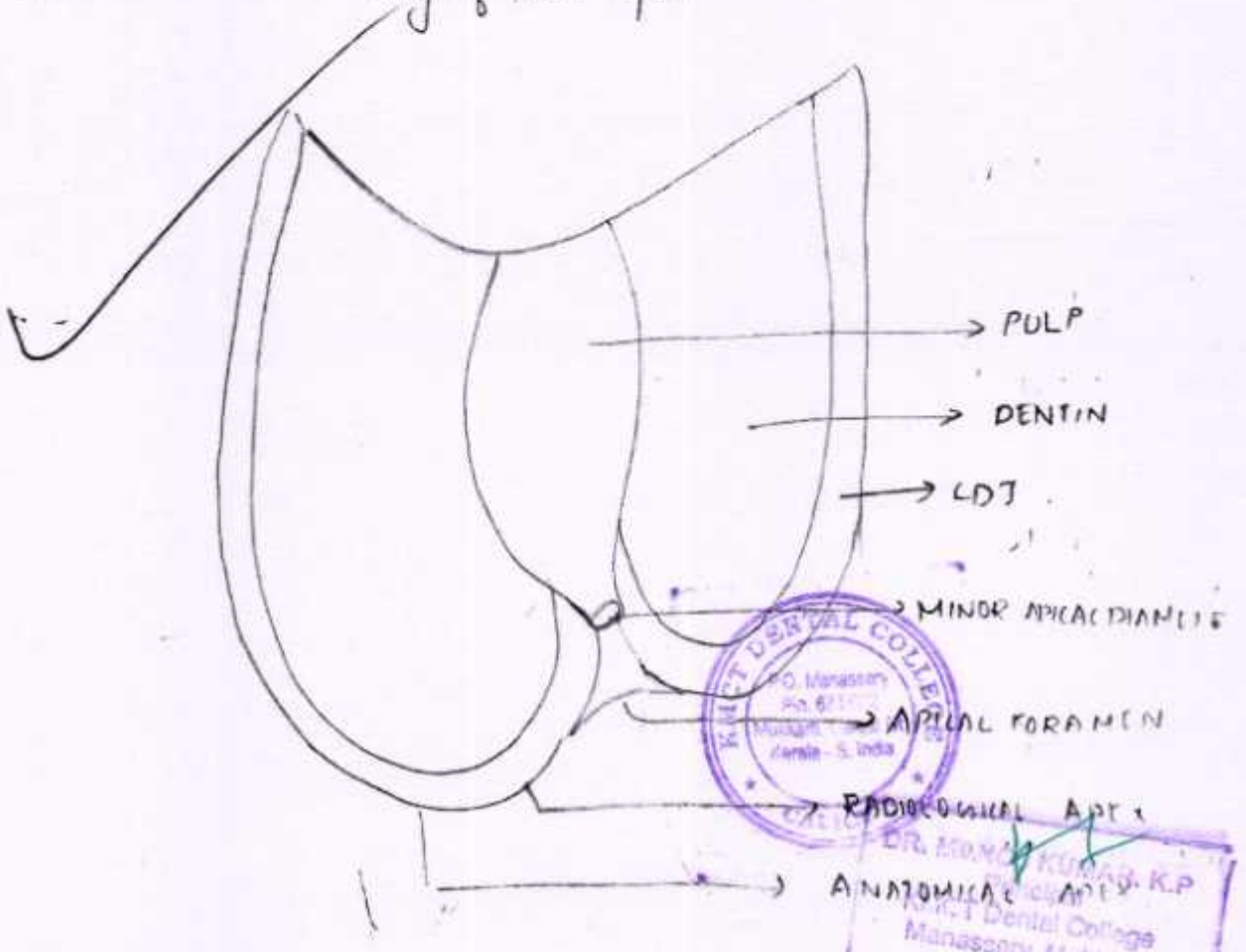
• Pharmacological methods

→ Antisialagogues
→ Anticholinergic drugs
→ Muscular relaxants

• Methods used for gingival tissue management

→ Physiomechanical
→ Chemical
→ Chemomechanical
- Rotary
- Electrochemical
- Surgical

29) Draw and label anatomy of root apex.



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CLINICAL SKILL LAB IN PRE CLINICAL PROSTHODONTICS AND CONSERVATIVE DENTISTRY

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MANASSERY P.O, MUKKOM, KOZHIKODE
PHONE : 0495 - 2290693

DEPARTMENT OF PROSTHODONTICS

PRECLINICAL PROSTHODONTICS

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Plus

Name : Anjana V P

Date of Birth : 19.11.1997

Name of the Parent/Guardian : Unnikrishnan V P

Residential Address : Vakkanaparambil (H) Pariyapuram (po) Tanur

With Telephone No : Malappuram (dist)

: Pin : 676302

:

:

:

Present Address : Vakkanaparambil (H)

With Telephone No : Pariyapuram (po)

: Tanur

: Malappuram

: 0494 - 2442592

Date of Admission :

Specimen Signature :

Year of Study:

I BDS : 2017 - 2018

II BDS :

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CERTIFICATE

This is to certify that Mr /Miss Anjana V P

Reg. No. 17002054T *has satisfactorily completed the exercises in* ***Preclinical Prosthodontics*** *prescribed by the University for the BDS Course during the year* 2019-2020

Date:

Lecturer-in-charge

Professor & HOD
DEPT. OF PROSTHODONTICS
KMCT DENTAL COLLEGE
MANASSERY, MUKKAM, KERALA

Head of the Department

Record of submission

Name of the candidate ANJANA V P

University Reg. No 17002054T

Date of Practical Examinations

Signature of Examiners 1) 25/01/20

2) 28/1/2020

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PRE CLINICAL EXERCISES

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GENERAL INSTRUCTIONS

1. Bring this record book to all practical classes and the record must be kept neat and in good condition.
2. Credit will be given to the records kept neat and submitted in time.
3. Students should wear apron with identity cards while working in the laboratories.
4. After doing the practical's, record your observations and results in the book. Write a relevant inference to the experiment.
5. Submit the record book complete with observations, discussions, diagrams and calculations for valuation when you come to the next practical examinations.
6. Marks will be awarded for the records during practical examinations.
7. Unnecessary wastage of water, gas or any other materials should be avoided.
8. Containers of materials / chemicals must be kept closed in their proper places when not in use.
9. Excess or waste materials must be thrown into the waste bins and should not be thrown into the sink.
10. Students should enter the laboratories with ail the required instruments. Borrowing will not be permitted.
11. Equipment's borrowed from the departments should be returned before leaving the laboratory.
12. Students should keep the laboratory neat and tidy and should not cause any damage to the furniture, equipment's etc.
13. Student is liable to replace or compensate for the equipment that is lost or damaged.
14. Strict discipline should be maintained while working in the laboratory

STUDENTS DECLARATION

I have carefully read the above rules and undertake to abide by them.

Signature of the Student

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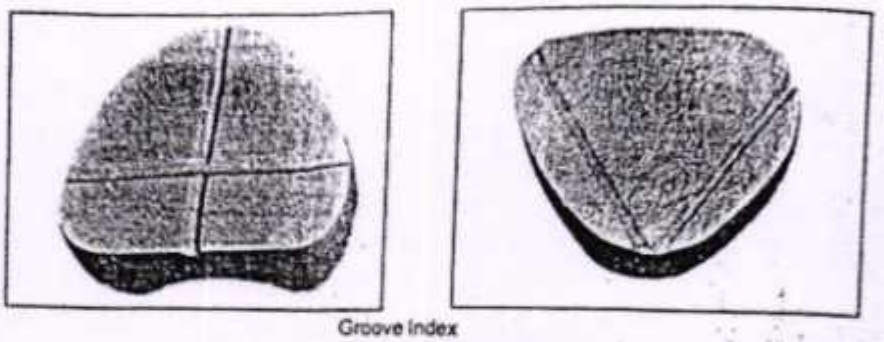
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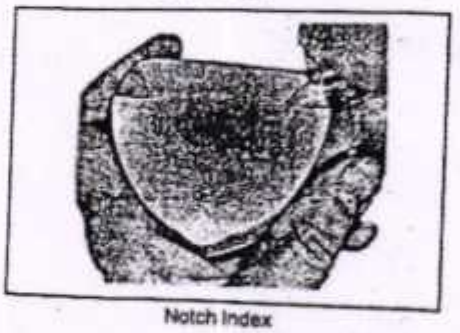
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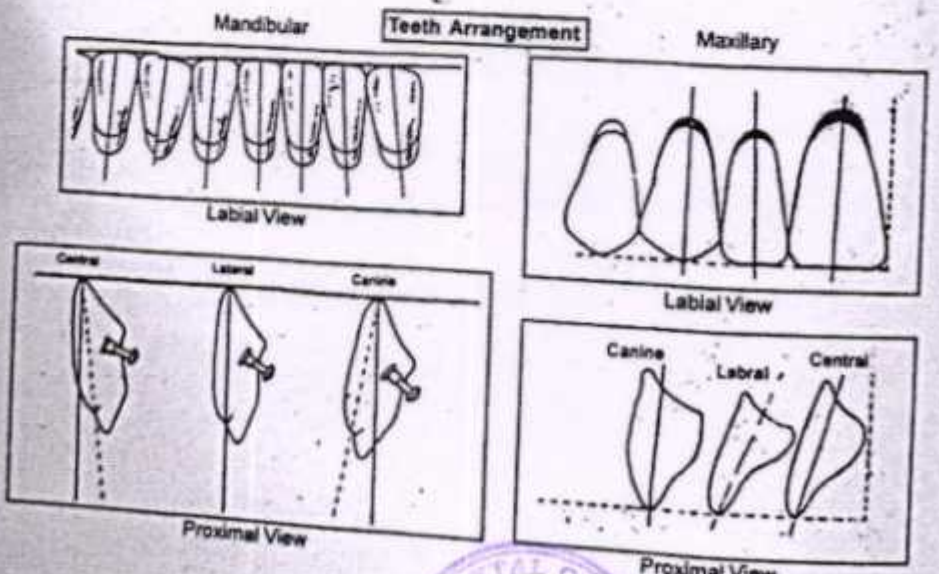
INDEXING THE CAST



Groove Index

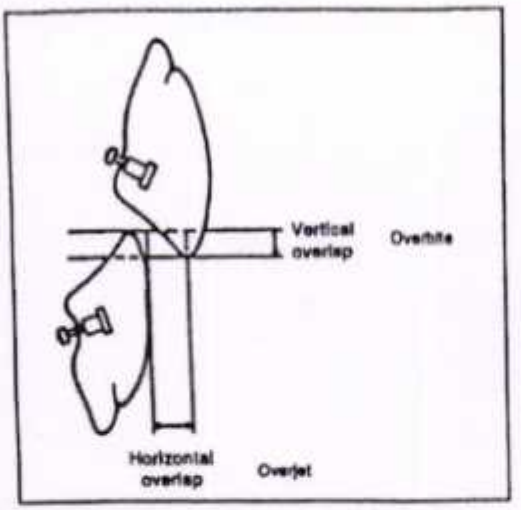


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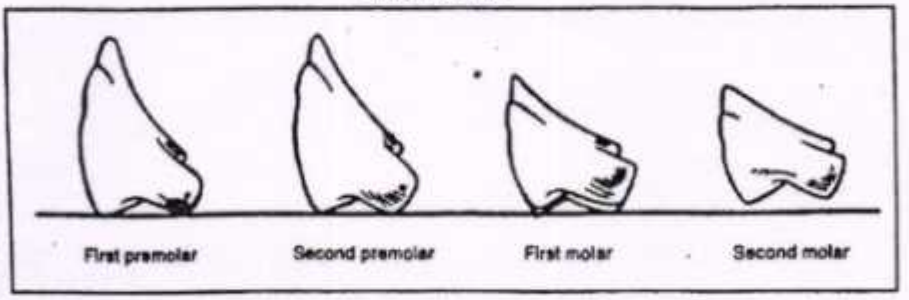


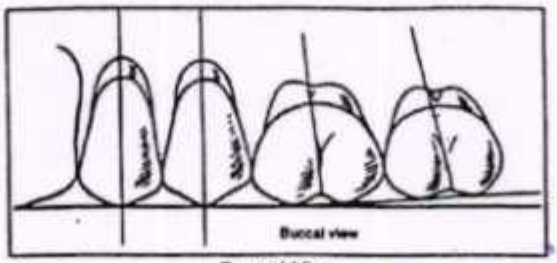
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Proximal View



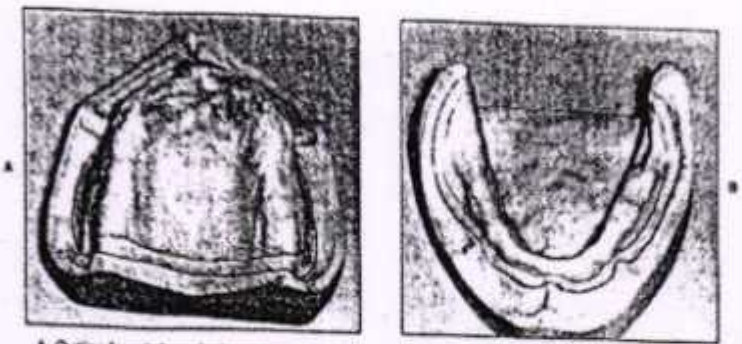


Buccal View

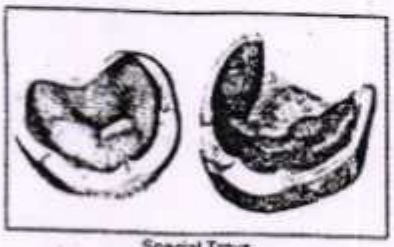
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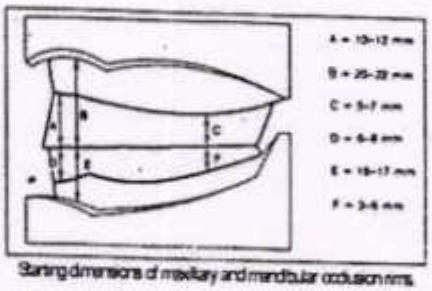
I BDS PRECLINICAL EXERCISE



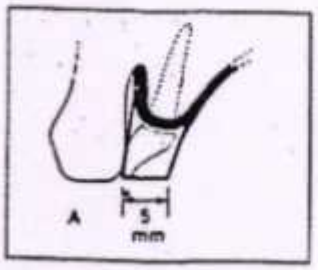
A. Outline for relief wax is drawn on cast. B. Edge of relief wax is usually 2 to 3mm short of tray border

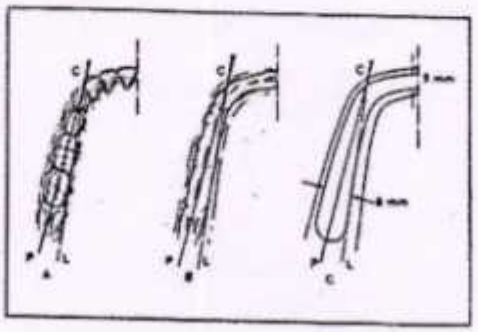


Special Trays



Starting dimensions of maxillary and mandibular occlusion rims

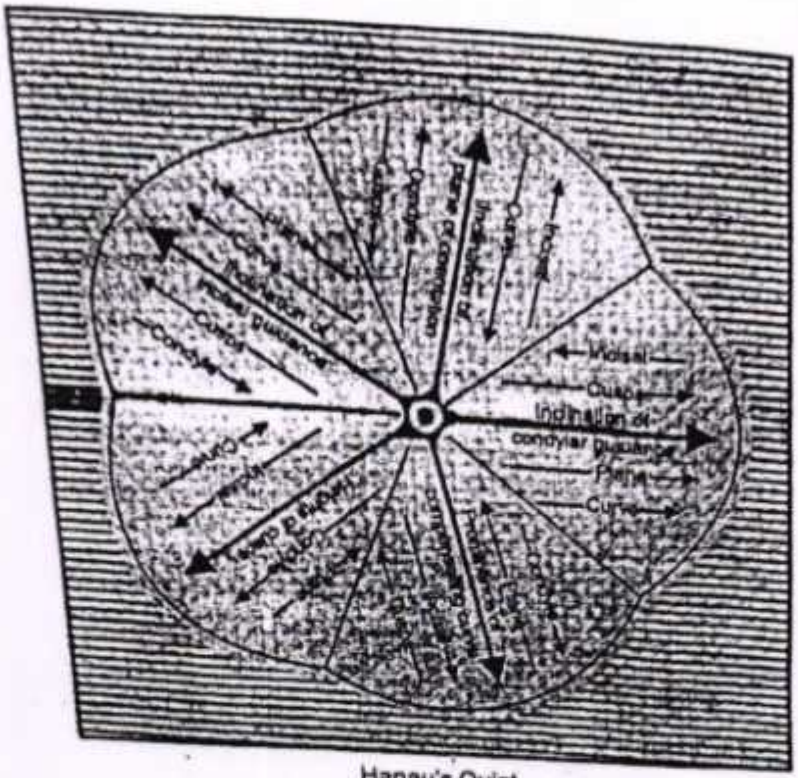




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Hanau's Quint

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I BDS PRECLINICAL EXERCISE

COMPLETE DENTURE

Sl. No.	Exercise	Date of Commencement	Date of Completion	Max. Score	Score Obtained	Signature of Instructor
1	Making free forms in model plaster.			10		
2	Making geometric shape - Cube 1 inch		11.11.2017	10	8	
3	Making edentulous models in dental stone using rubber moulds		18.11.17	10	7	
4	Identifying and marking anatomic landmarks in maxillary and Mandibular edentulous models		11.12.17	10	8	
5	Making edentulous impression using impression compound. a) Maxillary b) Mandibular		 22.01.18 22.01.18	 10 10	 7 7	

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6	Making cast in plaster of paris by inversion method. A Maxillary B Mandibular		7.04.18 9.04.18	10 10	6 5	
7	Making custom tray in shellac base plate - Trimmed margin a) Maxillary b) Mandibular		19.05.18 19.05.18	10 10	Cast Cast	
8	Making custom tray with spacer in auto polymerizing acrylic resin a) Maxillary b) Mandibular			10 10 10		
9	Border moulding the special tray using low fusing impression compound/putty elastomer a) Maxillary b) Mandibular			10 10		

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10	Making secondary impression using Zinc oxide Eugenol Impression material. a) Maxillary b) Mandibular			10 10		
11	Beading & Boxing the secondary impression a) Maxillary b) Mandibular		19.02.18 26.02.18	10 10	7 7	
12	Making the master cast a) Maxillary b) Mandibular		5.09.18 6.09.18	10 10		
13	Fabrication of jaw relation records A) Making records base in shellac base plate a) Maxillary b) Mandibular B) Making Occlusal rims a) Maxillary b) Mandibular		 27.09.18 4.10.18	 10 10 10 10	 7 7	
14	Articulation of jaw relation records		12.10.18	10		

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TEETH ARRANGEMENT

Sl. No.	Exercise	Date of Commencement	Date of Completion	Max. Score	Score Obtained	Signature of Instructor
1.	1st teeth arrangement.					
	a) Upper anteriors		29.03.19	10	7½	
	b) Upper posteriors		10.04.19	10	7½	
	c) Lower anteriors		4.04.19	10	7½	
	d) Lower posteriors		26.04.19	10	7½	
	e) Wax- up & Carving for Try-in					
2.	2nd teeth arrangement					
	a) Upper anteriors		13.05.19	10	7½	
	b) Upper posteriors		18.05.19	10	7½	
	c) Lower posteriors		16.05.19	10	7½	
	d) Lower anteriors		20.05.19	10	7½	
	e) Wax- up & Carving for Try-in			10		
3.	3rd teeth arrangement					
	a) Upper anteriors		13.06.19	10	7	
	b) Lower anteriors		15.06.19	10	7½	
	c) Lower posteriors		4.10.19	10	7½	
	d) Upper posteriors		17.06.19	10	7½	
	e) Wax- up & Carving for Try-in			10		

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4.	4th teeth arrangement. a) Upper anteriors b) Lower anteriors c) Upper posteriors d) Lower posteriors e) Wax- up & Carving for Try-in		8.07.19 11.07.19 6.11.19	10 10 10 10 10	7 7 7½	★ ORI
5.	Fabrication of complete denture in heat cure acrylic resin a) Wax- up for processing b) Investing c) Dewaxing d) Packing & Curing e) Deflasking F Finishing & Polishing		8.11.19 13.11.19 13.11.19 18.11.19 18.11.19 3/12/19	10 10 10 10 10 10	7½ 7 7½ 7½ 7½ 7½	★ ORI ORI ORI ORI
6.	Repair of complete denture a) Maxillary-self cure acrylic - Aligning the Denture - Cast prep. - Repair of CD			10		

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	b) Mandibular-Heat Cure acrylic - Aligining & Cast prep. - Aligining & Cast prep. - Wax-up & caning - Processing & finishing denture		5/12/9	10	7	
7.	Relining the complete denture a) Maxillary-Heat cure acylic - Making the impression - Cast Prep. - Articulation - Wax up & Carving - Dearticulation			10 10 10 10 10		
	- Investing, processing, finishing & polishing b. Mandibular self cure acylic - Making the impression - Cast Prep - Articulation - Lining with self cure acrylic - Finishing & Polishing			10 10 10 10 10 10		

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8.	Rebasing the complete denture. - Making the impression			10		
	- Cast Prep			10		
	- Articulation			10		
	- Removal of the denture base			10		
	- Wax up & Carving			10		
	- Investing, processing, finishing & polishing			10		

TOTAL SCORE 254/380

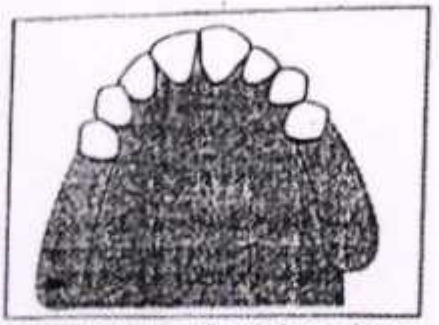
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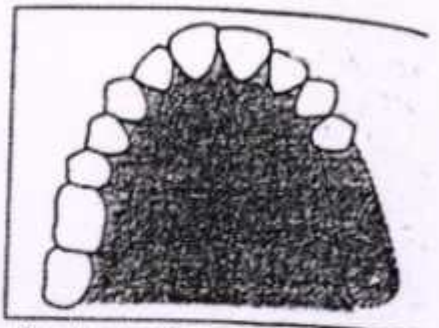
Head of the Department

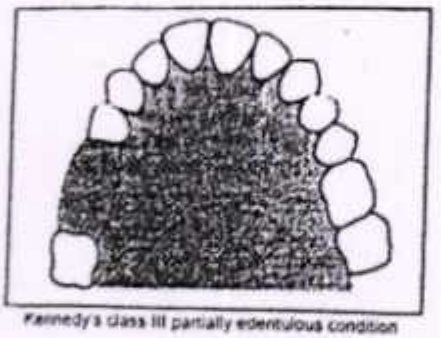
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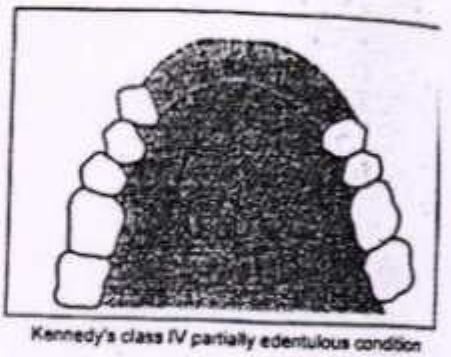
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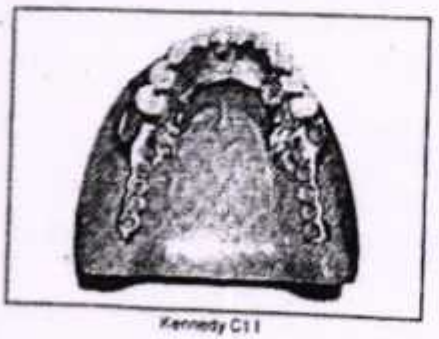
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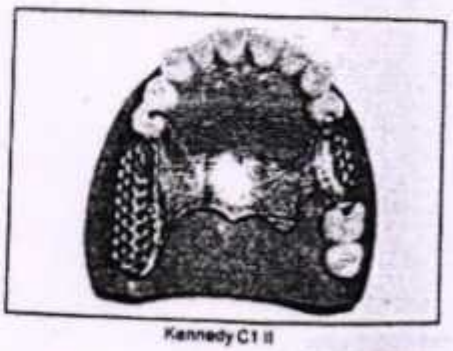

Kennedy's class I partially edentulous condition

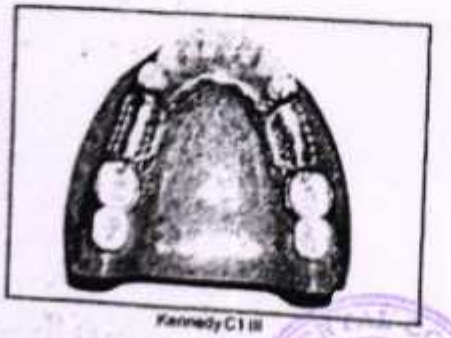

Kennedy's class II partially edentulous condition


Kennedy's class III partially edentulous condition


Kennedy's class IV partially edentulous condition


Kennedy C1 I


Kennedy C1 II


Kennedy C1 III


Kennedy C1 IV

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II BDS PRECLINICAL EXERCISE

REMOVABLE PARTIAL DENTURE

Sl. No.	Exercise	Date of Commencement	Date of Completion	Max. Score	Score Obtained	Signature of Instructor
1	Making dentulous Models in dental stone using rubber mold (4 pairs)		4/12/19	10	7 1/2	
2	Fabricating RPD in heat cure acrylic resin					
	a) Kennedy Cl 1 – Maxillary					
	- Prep. of J.R. record			10		
	- Articulation		6/12/19	10	7 1/2	
	- Arrangement of teeth		7/12/19	10	7 1/2	
	- Wax up & Carving		10/12/19	10	7	
	- Dearticulation			10		
	- Processing denture			10	8	
	b) Kennedy Cl II Mandibular					
	- Prep. of J.R. record			10		
	- Articulation		6/12/19	10	7 1/2	
	- Arrangement of teeth		10/12/19	10	7 1/2.	
	- Wax up & Carving			10		
	- Dearticulation			10		
	- Processing Denture			10		

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	c) Kennedy Cl III Mandibular					
	- Prep, of J.R. record		10			
	- Articulation		10			
	- Arrangement of teeth		10	7 1/2		
	- Wax up & Carving		10	7		
	- Dearticulation		10	7 1/2		
	- Processing Denture		10	8		
	d) Kennedy Cl IV Maxillary					
	- Prep, of J.R..record		10			
	- Articulation		10	7 1/2		
	- Arrangement of teeth		10	7 1/2		
	- Wax up & Carving		10	7		
	- Dearticulation		10			
	- Processing denture		10			
3.	Surveying on models		10			
4.	Outlining of caste RPD design					
	a) Kennedy Cl I - maxillary		10			
	b) Kennedy Cl II- Mandibular		10			

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	c) Kennedy Cl III- Mandibular			10		
	d) ennedy Cl IV- Maxillary			10		
5	Preparation of wax pattern					
	a) Kennedy Cl I- Maxillary			10		
	b) Kennedy Cl II Mandibular			10		
	c) Kennedy Cl III Mandibular			10		
	d) Kennedy Cl IV Maxillary			10		
6.	Outlining & Wax pattern - Clasps					
	Akers clasp			10		
	Roach clasp			10		

TOTAL SCORE 105 / 140

Date:

Head of the Department

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ASSIGNMENTS

PROSTHODONTICS

1) What is prosthodontics?

Prosthodontics is a branch of dentistry pertaining to the diagnosis, treatment planning, rehabilitation and maintainence of the oral functions, comfort, appearance and health of the patients with clinical conditions associated with missing or deficient teeth and/or maxillofacial tissues using biocompatible substitutes.

2) BRANCHES OF PROSTHODONTICS

PROSTHODONTICS

- Removable
  - Partial
  - Complete
- Fixed
- Maxillofacial
- Implant

Removable prosthodontics

This branch of prosthodontics is concerned with the replacement of missing teeth and adjacent structures for edentulous and partially edentulous patients by artificial prosthesis that can be removed by the patient.

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Fixed prosthodontics

The branch of prosthodontics pertaining to the replacement of missing teeth by artificial substitute that cannot be removed by the patient.

Maxillofacial prosthodontics

The branch of prosthodontics that deals with replacement of the stomatognathic and craniofacial structures.

Implant Prosthodontics

The branch of prosthodontics that deals with replacement of missing teeth and the associated structures by restorations that are retained by the dental implants

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ANATOMICAL LANDMARKS OF MAXILLARY ARCH

Anatomical landmarks of maxillary arch.

1. Anatomy
2. Clinical significance.

Anatomical landmarks

- Limiting structures or peripheral structures
- Supporting structures
  - Primary stress-bearing area
  - Secondary stress bearing area
  - Relief area

Anatomical landmarks of Maxillary Arch

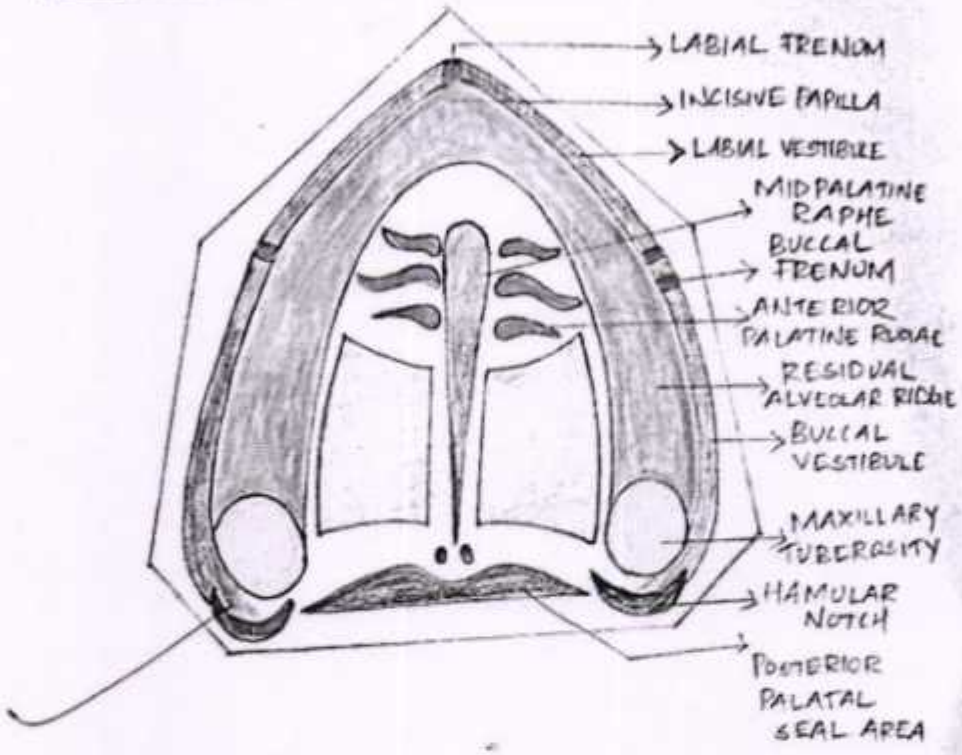
Limiting structures or Peripheral structures

- Labial frenum
- Labial vestibule
- Buccal frenum.
- Buccal vestibule
- Hamular notch
- Posterior palatal seal

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ANATOMICAL LANDMARKS OF MAXILLARY ARCH.



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- Fovea palatinae

Supporting structures

Primary stress bearing area

- Hard palate
- Posterior lateral slopes of the residual alveolar ridge.

Secondary stress bearing area

- Rugae.

Relief area

- Incisive papilla.
- Midpalatine raphe

Labial frenum

Anatomy

- Fibrous band covered by mucous membrane that extends from labial aspect of the residual alveolar ridge to the lip.
- It may be single or double and narrow or broad.
- It contains no muscle fibres.

Clinical significance

- Relief for the labial frenum must be given during final impression procedure.
- When relief is not given in the denture, it results in pain and it may cause dislodgement of the denture.

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Labial Vestibule

Anatomy

- Potential space bounded by the labial aspect of the residual alveolar ridge, mucolabial alveolar fold and orbicularis muscle.
- Area extends on both sides from labial frenum to the buccal frenum.
- The mucosa lining is thin with non keratinized epithelium
- Submucosal layer is thick and contains large amount of loose areolar tissue and elastic fibres.

Clinical significance

- The labial flange of the denture provides the support for the upper lip.
- The labial flange of the denture will be in complete contact with labial vestibule to provide a peripheral seat in the denture

Buccal frenum

Anatomy

- Band of tissue that overlies the levator anguli oris muscle
- Orbicularis oris - pulls the frenum ~~outward~~ forward.
- Buccinator - pulls the frenum backward
- Its reflection is in anteroposterior direction.

Clinical significance

As there is muscle attachments in the buccal frenum, sufficient

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during functions like chewing and smiling.

Buccal Vestibule

Anatomy

- It extends from buccal frenum to the hamular notch.
- Bounded externally by cheek and internally by residual alveolar ridge.

Clinical significance

- The width and the height of the buccal flange of the upper denture is determined by the coronoid process of the mandible.
- When the patient moves the mandible side to side, the coronoid process affects the width of the buccal flange.
- The patient's mouth should be kept half open during the final impression procedure.
- When the mouth is kept wide open, the coronoid process of the mandible comes forward narrowing the buccal vestibule.

Hamular notch

Anatomy

- It forms distal limit of buccal vestibule and situated between the hamulus of the medial pterygoid and tuberosity.
- The pterygomandibular ligament is attached to the hamular notch.

Clinical significance

- The denture border should extend till the hamular notch.
- If the denture border is short of the hamular notch, the denture will not have a posterior seal resulting in loss of retention of the denture.

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•If the denture border is extended beyond the hamular notch, the pterygomandibular raphe is pulled forward when the patient opens the mouth wide open causing dislodgement of the denture.

Posterior Palatal Seal

Anatomy

•Soft tissue along the junction of the hard and soft palates on which pressure within the physiological limits of the tissues can be applied by the denture to aid in the retention of the denture.

•It is not a straight line from hamular notch to hamular notch but follows the contour of the distal border of palatal bone.

•At the midline, it usually passes about 2mm in front of fovea palatine.

•Posterior palatal seal is bounded anteriorly by the anterior vibrating line, posteriorly by posterior vibrating line and laterally by the hamular notch.

•Anterior vibrating line is at the junction between immovable tissues over the hard palate and slightly movable tissues of the soft palate.

•Posterior vibrating line is at the junction between aponeurosis of tensor veli palatine muscle and muscular portion of the soft palate.

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Functions

- Aids in the retention of the denture by maintaining the constant contact with the soft palate during functional movements
- Reduces the tendency for gag reflex.
- Prevents food accumulation between the posterior border of the denture and the soft palate.
- Compensates for polymerisation shrinkages of the denture base resin.

Clinical significance

- Distal end of the maxillary denture should extend at least 1-2 mm beyond the vibrating line
- Posterior palatal seal provides posterior seal for the maxillary denture.

Hard Palate

Anatomy

- The main support for the maxillary denture is the bone of the maxilla and palatine bone.
- Covered by keratinized epithelium.
- Soft tissue covering the median palatal suture is non resilient and may be relieved to avoid trauma
- In the area of rugae, the palate is set at an angle to the residual alveolar ridge and is thinly covered by soft tissue which contributes to the secondary stress bearing area.

Clinical significance

- Horizontal portion of the hard palate lateral to midline provides

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Residual Alveolar Ridge

Anatomy

- Mucous membrane covering the crest of the ridge is firmly attached to the periosteum of the bone by the connective tissue of submucosa.
- Lined by thick stratified squamous epithelium.
- Crest of the alveolar ridge is the primary stress-bearing area.
- Even though the submucosa is thin, still sufficiently provide adequate resiliency support the denture

Clinical significance

- Residual alveolar ridge forms the main supporting area for the maxillary denture.

Maxillary Tuberosity

Anatomy

- It is the bulbous extension of the residual alveolar ridge in the 2nd and 3rd molar region, terminating in the hamular notch.
- Hamular notch is a soft area of areolar tissue between the distal surface of the tuberosity and the hamulus; it houses the distobuccal termination of the denture base.
- It is considered to be the secondary stress-bearing area of the maxillary arch.

Clinical significance

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Rugae

Anatomy

- These are mucosal folds located in the anterior region of the palatal mucosa
- Folds of mucosa play an important role in speech.
- These are considered to be secondary stress-bearing area.

Clinical significance

- While making final impression for the maxillary arch, one should make sure pressure is not applied on the rugae area which can cause distortion of the tissue.

Incisive Papilla

Anatomy

- Incisive foramen is located beneath the incisive papilla on a line immediately behind the central incisors.
- As resorption progresses, it comes to lie nearer to the crest of the ridge.
- Nasopalatine nerves and vessels pass through the foramen.

Clinical significance

- While making final impression of the maxillary arch, pressure should not be applied on the incisive papilla region.
- Compression of the incisive papilla region will cause compression of the blood vessels and nerves causing necrosis and paraesthesia of anterior palate.

Midpalatine Raphe

Anatomy

This is the median suture area covered by smooth submucosa.

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- This soft tissue area is sensitive to pressure application

Clinical significance

- As the submucosa is very thin, pressure cannot be applied over the midpalatine raphe region during making of final impression
- If pressure is applied during impression making, the denture base will cause soreness over the midpalatine raphe region.

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ANATOMICAL LANDMARKS OF MANDIBULAR ARCH

Limiting structures

- Labial frenum
- Labial vestibule
- Buccal frenum
- Buccal vestibule
- Lingual frenum.
- Alveololingual sulcus
- Retromolar pads.
- Pterygomandibular raphe.

Primary Stress-Bearing Area

- Buccal shelf area.
- Residual alveolar ridge

Relief Area

- Mental foramen
- Genial tubercles.

Labial frenum

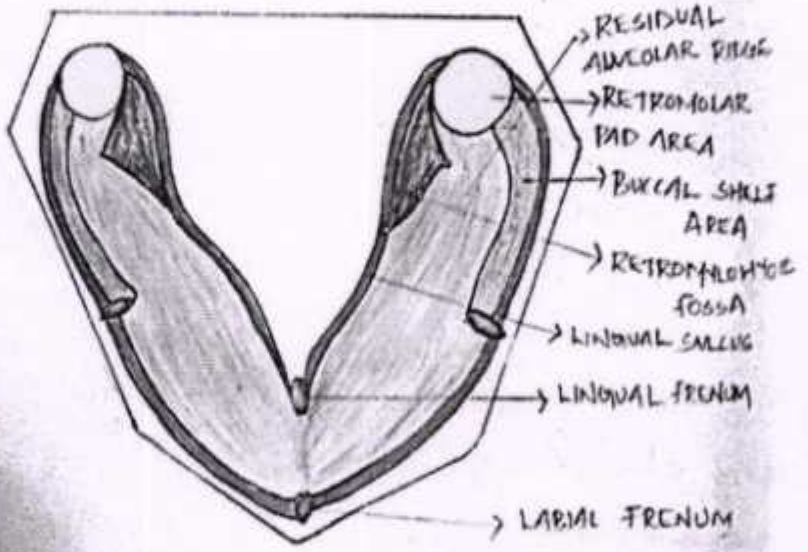
Anatomy

- The mandibular labial frenum contains a band of fibrous connective tissue and helps to attach orbicularis oris muscle. therefore the frenum is sensitive and ...

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ANATOMICAL LANDMARKS OF MANDIBULAR ARCH



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Clinical Significance

- During final impression making, sufficient relief must be given for the labial frenum without compromising the peripheral seal.

Labial Vestibule

Anatomy

- It runs from the labial frenum to buccal frenum.
- Fibres of orbicularis muscle, incisivus, and mentalis are inserted near the crest of the ridge. Mentalis muscle is particularly the active muscle.

Clinical Significance.

- Extent of the denture flange in this region is often limited because of muscles that are inserted close to the crest of the ridge. Thick denture flanges may cause dislodgement of dentures when patient open the mouth wide open.
- Depth of the flange is determined by the mucolabial fold.

Buccal Vestibule.

Anatomy

- It extends from buccal frenum to the outside back corner of the retromolar pad.
- It is nearly at right angles to biting force.
- Extent of the vestibule is influenced by buccinators muscle, which extends from modiolus anteriorly to pterygomandibular raphe posteriorly and has its own fibres attached to buccal shelf

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and external oblique ridge.

- The masseter muscle contracts under heavy closing force and pushes inward against the buccinators muscle to produce a masseteric notch in the distobuccal border of the lower denture.

Clinical significance.

- The distobuccal border of the lower denture should accomodate the contracting masseter muscle so that denture does not dislodge during heavy closing force.

Buccal frenum

Anatomy

- It is a fold of mucous membrane extending from buccal mucous membrane reflection toward the slope or crest of the residual ridge in the region just distal to the cuspid eminence.
- May be single or double, broad U/V shape.
- It overlies depressor anguli oris muscle.

Clinical significance.

- Relief for the buccal frenum is given in denture to avoid displacement of the denture.

Lingual frenum

Anatomy

- It is a fold of mucous membrane existing when the tip of tongue is elevated.

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• It overlies the genioglossus muscle which takes origin from the superior genial tubercle

Clinical Significance

• The relief for the lingual frenum should be registered during function.
• Relief for the lingual frenum should be provided in the denture.

Retromolar Pad

Anatomy

• It is a triangular soft-pear shaped pad of tissue at the distal end of the lower ridge.
• Mucosa composed of thin, non keratinized epithelium and loose alveolar tissue
• Submucosa contains glandular tissue, fibres of buccinators and superior constrictor muscle, pterygomandibular raphe and terminal part of the tendon of temporalis

Clinical significance

• The distal end of the denture pad should cover two-thirds of the retromolar pad.
• The retromolar pad provides the peripheral posterior seal for the lower denture.

Alveololingual Sulcus

Anatomy

• It is the space between residual ridge and tongue. It extends from lingual frenum to retromylohyoid curtain posteriorly

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- The borders are the following:

Anterior region

- Extends from lingual frenum to premylohyoid fossa where the mylohyoid ridge curves down below the level of the sulcus.

Middle region

- Extends from premylohyoid fossa to the distal end of the mylohyoid ridge curving medially from body of mandible.

Posterior region

- The flange passes into the retromylohyoid fossa. No longer influenced by mylohyoid muscle.

Clinical Significance

- The lingual flange of the lower denture will be short anteriorly than posteriorly.
- The lingual flange in the middle region slopes medially towards the tongue and maintains the peripheral seal in the middle region
- The lingual flange in the posterior region passes into the retromylohyoid fossa and turns laterally towards the ramus and forms the typical S-shaped form of the lower denture.

Retromylohyoid fossa

Anatomy

- It is the area posterior to the mylohyoid muscle and bounded by

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• Posterolateral portion of the retromylohyoid curtain overlies superior constrictor muscle • posteromedial to the palatoglossal muscle and blend surface of tongue and the inferior wall the submandibular gland. • Protrusion of the tongue causes the retromylohyoid curtain to move forward.

Clinical Significance

The over extension of the lingual flange in the retromylohyoid fossa area can cause soreness and dislodgement of denture during swallowing.

Pterygomandibular Raphe

• It arises from the hamular process of the medial pterygoid plate and gets attached to the mylohyoid ridge.

Clinical Significance

• It is very prominent in some patients where a notch-like relief may be required on the denture
• A simple wide open visual and digital inspection is sufficient to determine the need for clearance

Residual Alveolar Ridge

Anatomy

• Covered by fibrous connective tissue and underlying bone is cancellous without cortical bony plate covering it.
• Since it is cancellous (crest of the residual ridge), it may not be favourable as primary stress bearing area.

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• The slopes of the residual alveolar ridge have thin plate of cortical bone. The slopes of the ridge are at an acute angle to the occlusal forces. Hence it is considered as a secondary stress bearing area

Clinical Significance.

• Any movable soft tissue overlying the residual alveolar ridge should not be compressed while making impression.

Buccal Shelf Area

Anatomy

• The area between the mandibular buccal frenum and anterior edge of the masseter muscle is known as buccal shelf area.
• Bounded medially by the crest of the alveolar ridge, laterally by the external oblique ridge, distally by the anterior aspect of the retromolar pad and anteriorly by the buccal frenum
• Buccal shelf area is covered by a layer of dense and smooth cortical bone.
• Buccal shelf area lies at right angles to the vertical occlusal forces; making it suitable as primary stress-bearing area for the lower denture.

Mental foramen

Anatomy

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closer to the crest of the ridge.

- Mental nerve and vessels may be compressed by denture unless relieved.
- Pressure on the nerve cause numbness of lower lip.

Genial Tubercles

Anatomy

- These lie away from the crest of the ridge.
- With resorption, genial tubercles become increasingly prominent.

Torus Mandibularis

Anatomy

- Bony prominences usually found bilaterally and lingually near the 1st and 2nd premolar midway between the soft tissues of the floor of the mouth and crest of the alveolar process.
- It should be removed surgically as it is difficult to provide relief within the denture.

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IMPRESSION TRAYS

Definition

A receptacle or a device that is used to carry, control and confine the impression material while making an impression.

Requirements of Impression Tray

i) The impression tray should be rigid.

ii) It should be dimensionally stable.

iii) It should provide space for impression material while making an impression.

iv) The borders of the tray should be smooth so that it does not injure the oral tissues.

v) The method of construction of the custom trays should be sim

vi) The borders of the tray should be easy to trim.

Types of Impression Trays

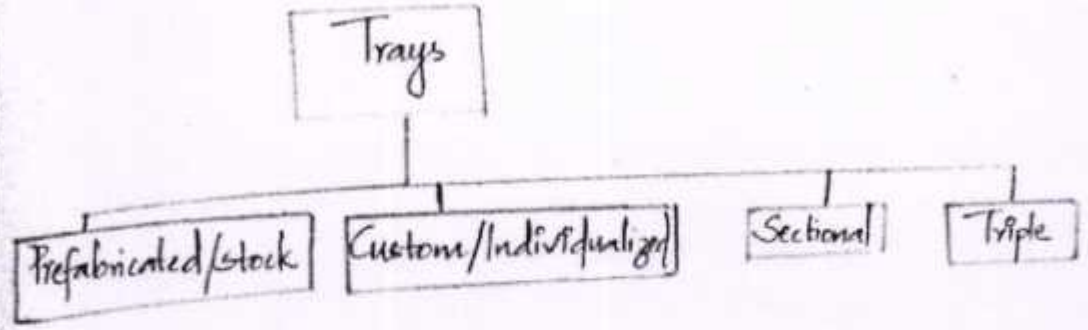
Impression trays can be classified as:

1. Based on purpose or use.
2. Based on material.

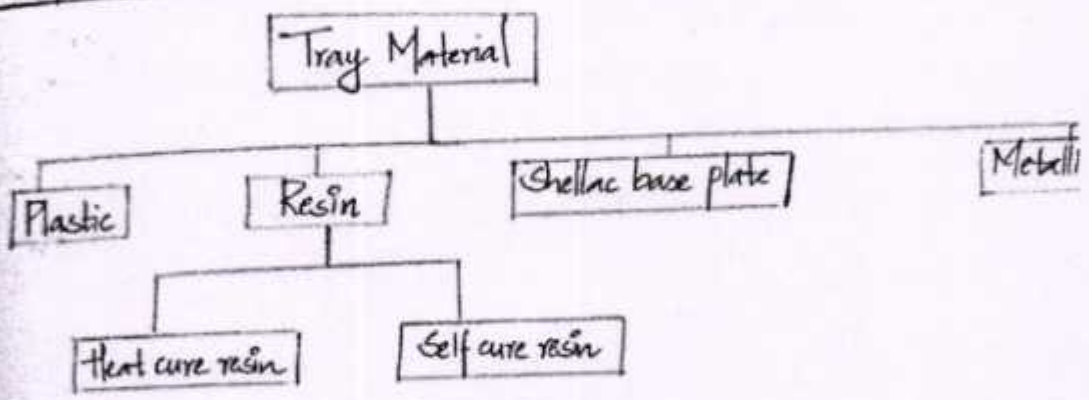
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Based on Purpose or Use



Based on Material.

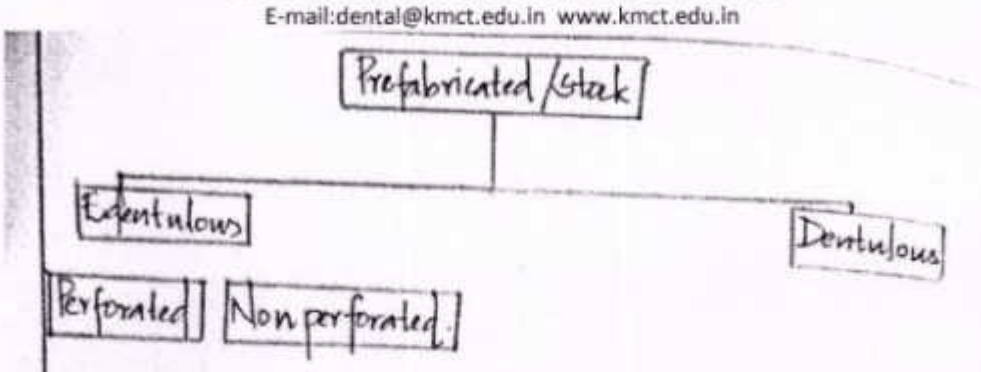


Stock rays or prefabricated trays

i) Stock trays are rigd.
ii) They are dimensionally stable.
iii) The trays can be used several times.
iv) They are available in different sizes and specifically for upper and lower arches
v) The perforations in the trays help in retention of the set impressio material while removing the impression from the patient's mouth.
vi) Tray adhesives have to be applied for elastomeric impression materia
vii) The flanges of the stock tray cannot be contoured.

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Custom trays

- Custom/Individualized trays can be fabricated and used for individual patients.
- Custom trays can be made for both dentulous and edentulous arches.
- The custom trays are fabricated on the preliminary casts.
- Custom trays can be made with self cure resin and shellac base
- Custom trays provide uniform space for the impression material
- The flanges of the tray can be modified according to the sulcur extension.
- The dimensional stability and the rigidity is less compared to the stock trays.
- The fabrication process is time consuming.



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Sectional trays

- Sectional trays are used for making impressions of dentulous arche in sections, like anterior and posterior sections.
- Sectional impressions are usually used for making provisional or temporary restorations in fixed prosthodontic procedures
- Sectional trays are perforated trays made of plastic material

Triple trays

- Triple trays are used for making impressions in fixed prosthodontics
- While making impressions, registration of teeth to receive the prosthesis, opposing teeth and the interocclusal relationship between the teeth are registered at the same time.
- Triple trays are available in section as for anterior and posterior quadrants.

IMPRESSIONS IN COMPLETE DENTURE.

Definition of Impression

A complete denture impression is a negative registration of the entire denture bearing, stabilizing and border seal areas present in the edentulous mouth.

Objectives of Impression Making

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1. Preservation of residual alveolar ridge.
2. Retention.
3. Stability.
4. Support
5. Aesthetics

Preservation of Residual Alveolar Ridge.

According to Devan. It is important to preserve what already exists to replace what is missing. Hence, while making impression one should keep in mind to reduce soft tissue abuse, minimise bone resorption and to cover maximum support areas.

Retention

Retention of a denture is the resistance of the denture to the forces acting in a vertical direction. The factors responsible in denture retention are :

- Adhesion
- Cohesion.
- Interfacial surface tension.
- Peripheral seal
- Atmospheric pressure.
- Oral and facial musculature.

Atmospheric pressure and peripheral seal are dependent on the impression accuracy. Adhesion, cohesion and interfacial surface tension. depend on the patient's saliva.

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Stability

Stability is the ability of the denture to be firm, steady and constant and the resistance of the denture to forces acting in a lateral or horizontal direction. The factors responsible in denture stability are:

- Proper contour and form of the polished surfaces of the denture.
- Neuromuscular control of the patient.
- Orientation of occlusal plane.
- No interferences in denture occlusion with slopes of the ridges
- Adaptation of the labial and buccal flanges.

Support

Support is the ability of the denture to resist vertical and other forces in a direction towards the basal seat. The support of the denture is achieved by wider coverage of the maxillary and mandibular support areas, like:

- Anterior and posterior ridges and slopes within the limitations.
- Horizontal surface of the hard palate.
- Buccal shelf.

Aesthetics

During impression making, aesthetics is achieved by:

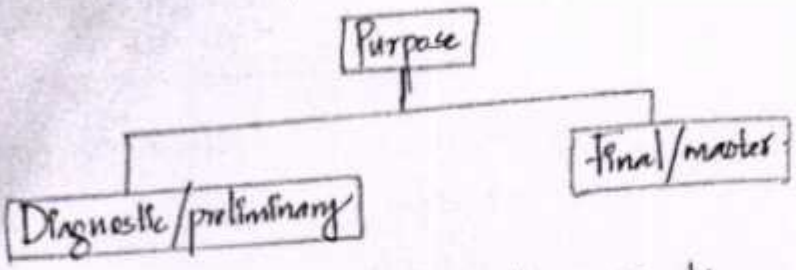
: Adequate support for the lips and cheeks during border moulding labial and buccal borders.

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Types of Impression

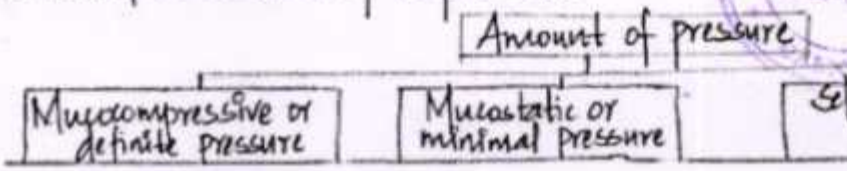
1. Based on the Purpose.



Preliminary/diagnostic impression: A negative likeness made for the purpose of diagnosis, treatment planning, or the fabrication of a tray. An impression of the edentulous arch used to make a cast for the fabrication of the custom tray or individualized tray Alginate impression material or impression compound is used in a stock impression tray for making preliminary impressions

Master/final impression: A negative likeness made for the purpose of fabricating a prosthesis. An impression that represents the completion of the registration of the surface or object. Elastom Impression material or zinc oxide eugenol impression material is used for making final impressions using a custom tray or individ ized tray

2. Based on theories of Impression



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The impression techniques are based on the amount of pressure applied during making of impression

Mucocompressive theory

The tissues of the oral cavity are recorded in the functional position. The impression of the tissues are recorded when pressure is applied on the stress bearing and non-stress bearing areas causing maximum tissue displaceability. In this impression technique, impression material with high viscosity like impression compound and putty consistency of elastomeric impression material can be used.

Mucostatic impression theory

In mucostatic impression technique, the tissues are recorded in rest position. The pressure applied in this technique is very minimal. There is no displaceability of tissue. In this impression technique, impression material with low viscosity like light body consistency of elastomeric impression material, impression plaster and alginate can be used.

Selective Pressure theory

Selective pressure technique employs both mucostatic and mucocompressive techniques. The pressure is applied on the stress bearing areas and less pressure is applied on the non-stress bearing areas. This is achieved using custom trays with spacer designs. Impression materials like zinc oxide eugenol impression paste and light body consistency of elastomeric impression material are used. The spacer designs are done by adapting wax on the preliminary cast before making the custom tray. The spacer designs are based on the areas of relief where only minimal pressure is applied. Tissue stops are given in the full spacer design. Four tissue stops are given, two

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In the canine region and two in the molar region in the maxillary arch spacer design and in the mandibular arch, two tissue stops are placed in the anterior canine region and the buccal shelf area is relieved in the spacer design which acts as a tissue stop. The wire is cut in a square dimension of 4mm by 4mm Tissue stops help in reseating of the tray while making final impression and prevent in the apical displacement of the impression while making an impression.



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DENTAL CASTS

CAST

A life-size likeness of some desired form.

DENTAL CAST

A positive life-size reproduction of the oral cavity

Casts

- Preliminary diagnostic/Study
- Definitive cast
  Final cast
  Master cast
  Working cast
- Refractory cast/ Investment cast
- Remount cast

Types of cast

1) Dental cast

a. Preliminary cast or diagnostic cast, study cast.
b. Final/definitive/master/working cast.
c. Refractory cast.
d. Remount cast.

Requirements of the cast.

1. Include all anatomic surfaces of the final impression.
2. Show a full peripheral border with a depth of 2-3mm.
3. Include a 2-3mm of land area around the entire periphery.

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4. The land area should be slightly tapered outward.
5. The base of a cast should not be less than 10–12mm at the thinnest point.
6. The cast contains no bubbles or flaws.

Parts of a Cast

i. Anatomic portion.
ii. Art portion.

Anatomic portion

It is the part of the cast that represents the parts of the oral cavity.

Art portion

It is the portion of the cast which forms the base of the cast

Study or Diagnostic Cast

A life size reproduction of a part or parts of the oral cavity and/or facial structures for the purpose of the study and treatment planning. It is made from a preliminary impression. The casts are usually made of dental plaster and dental stone.

Master Cast or Final Cast or Working Cast

A positive replica of the tooth surface and other parts of the dental arch or facial structures which is used for the fabrication of dental restorations or prosthesis. Master casts are made in dental stone and die stone. Dental stone and die stone have better

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strength compared to dental plaster.

Refractory Cast

A positive replica of the tooth surface or other parts of the dental arch which can withstand high temperatures used in the fabrication of dental prosthesis with metal denture bases and cast partial dentures. The master casts are duplicated into refractory casts. Type V gypsum-dental stone with high strength and high expansion is used for making refractory casts.

Remount Cast.

Remount cast is used for the purpose of mounting of the prosthesis on an articulator. Remount casts are used in the articulator for the correction of processing errors of the complete denture by selective grinding of artificial teeth. The remount casts are made in dental plaster or dental stone.

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RECORD BASES

Definition: Record base is an interim denture base used to support the record rim material for recording maxillomandibular relations.

Requirements:

i. The record bases should be rigid.
ii. The record bases should be dimensionally stable.
iii. The borders of the record bases should be the same as the finished denture.
iv. The record base should be closely adapted to the tissue surfaces of the cast.
v. The record base constructed should permit its use as a base for setting the teeth.
vi. It should be easy to construct and the material should be inexpensive

TYPES OF RECORD BASE

- Record Bases
  - Temporary
    - Shellac record base
    - Self-cure resin.
    - Light cure resin.
  - Permanent
    - Heat-cure acrylic resin.
    - Metal denture base.

Temporary Record Base.

Shellac record base

It is the most commonly used material for the fabrication of a record base. Shellac is obtained from the resinous exudate of an insect.

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Advantages

- Record bases can be easily fabricated - it is not time consuming.
- They are closely adapted to surface the master cast.
- They are inexpensive and easily available.
- Record bases with shellac baseplate can be easily corrected.
- Uniform thickness can be maintained.

Disadvantages

- Shellac baseplates have less strength.
- Shellac baseplates easily break.
- During setting of teeth or fabrication of rims, they tend to distort / warp due to repeated changes in temperature.

Self-cure resin

Advantages

- They have better strength.
- They are dimensionally stable.
- They have better stability and do not warp due to repeated changes in temperature.
- They are closely adapted to the tissue surface of the cast.
- They can be easily trimmed with the acrylic burs.

Disadvantages

- Fabrication process is time consuming.
- During fabrication, it is difficult to control the thickness.
- Residual monomer present in record bases can cause irritation to oral tissues.

Light-cure resin

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- They have better stability.
- They are closely adapted to tissue surface of the cast.
- They can be easily trimmed with acrylic burs.
- Residual monomer content is less when compared to self-cure resin

Disadvantages

- Fabrication process requires a special equipment for curing of the material.
- They have less strength when compared to heat-cure and self-cure resin.
- It is difficult to maintain uniform thickness of the record base.
- The denture base tends to warp after prolonged use.

Permanent Record Base.

Heat-cure acrylic resin.

Advantages

- They are rigid, accurate and dimensionally stable record bases.
- The record bases will become part of the completed prosthesis.
- The processing errors will be minimized.
- They require only minimal finishing and polishing.

Disadvantages.

- It is a time consuming process and need to prepare a mounting cast for articulation.

Metal denture bases.

Advantages.

- They form rigid, accurate, dimensionally stable record bases
- They become part of the final denture.

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- They are good conductors of heat and help in improving sensibility to heat and cold.
- They are formally advised for patients with frequent breakage and high gag reflex patients.

Disadvantages

- The fabrication process is time consuming.

OCCLUSION RIM.

Definition : Occluding surfaces fabricated on the Purlerine or final denture bases for the purpose of making maxillomandibular relationship records and arranging teeth.

USES OF OCCLUSION RIM

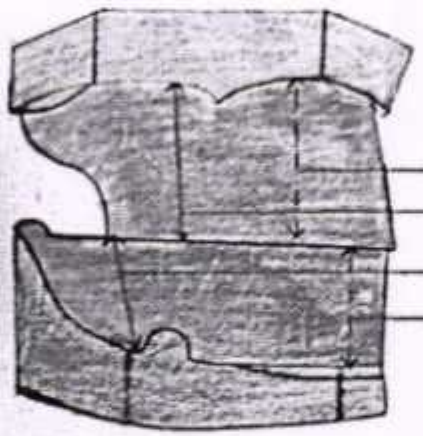
- Occlusion rims are used to establish the level of occlusal plane.
- Occlusion rims are used to establish maxillomandibular records, like vertical and horizontal jaw relations.
- The midline, canine line, high lip line and low lip line, and Intercanine distance are recorded on the wax occlusion rims
- Occlusion rims help to determine the length and width of the artificial teeth.
- Midline of the arch for the correct placement of the central incisors
- Occlusion rims help to obtain proper lip support.

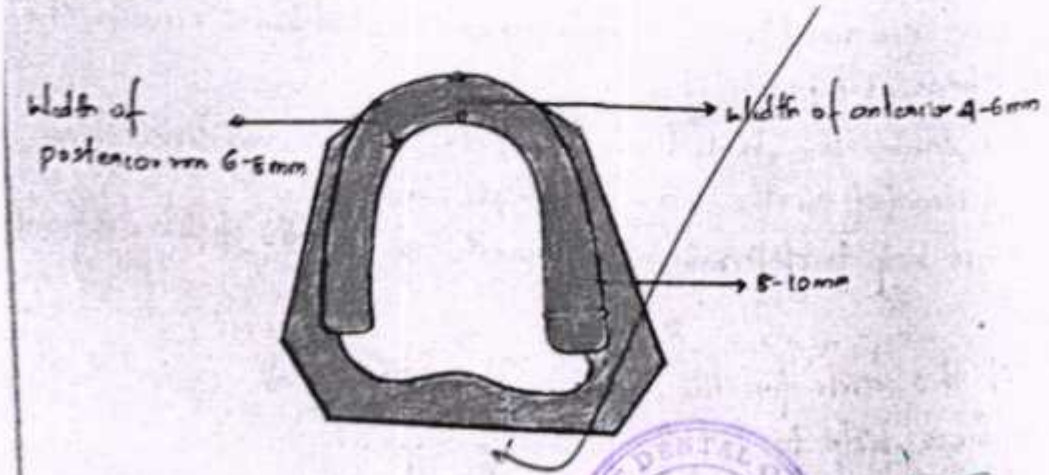
DIMENSION OF OCCLUSION RIMS.

The occlusion rim should follow the archform of the residual alveolar ridge and should be placed on the ridge where the natural teeth were originally present. The position of occlusion on alveolar ridge

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Arch	Anterior	Premolar	Posterior
Maxillary	Labial to the ridge	On the ridge	Buccal to the ridge
Mandibular	Labial to the ridge	On the ridge	Lingual to the ridge

DIMENSIONS OF OCCLUSION RIMS

Arch	Anterior Region		Posterior Region	
	Height	Width	Height	Width
Maxillary	20-22mm from the deepest part of the sulcus.	3-5 mm	16-18 mm from the deepest part of buccal sulcus in the molar region	6-8 mm
Mandibular	16-18 mm from the deepest part of the sulcus.	3-5mm	At a level of the junction roof, the anterior 2/3rd and posterior 1/3rd of the retromolar pad.	6-8mm

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ARTICULATOR

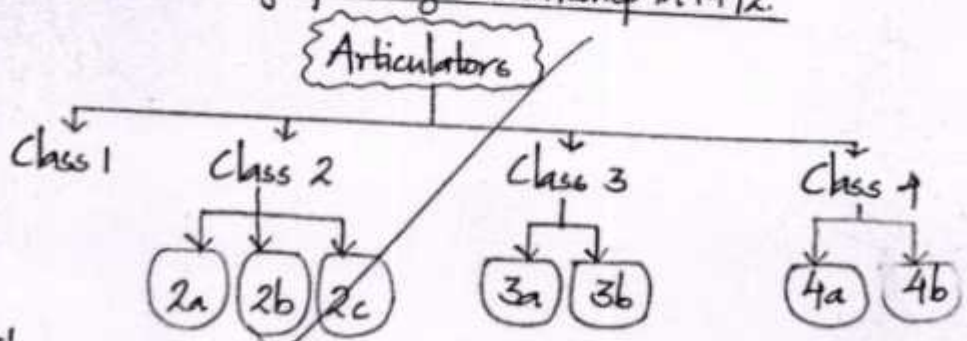
Definition: A mechanical device that represents the temporomandibular joints and the jaw members to which the maxillary and mandibular casts may be attached to simulate some or all mandibular movements.

Classification:

Articulators are classified as:

- Based on University of Michigan workshop in 1972 (based on the capacity to accept registrations).
- Based on theory of occlusion.
- Based on the adjustability of the articulators.
- Bergstrom classification of articulators.

Based on University of Michigan Workshop in 1972.



Class 1: Simple holding instruments capable of accepting single static registration; e.g. hinge joint articulator, Barn-Door hinge articulators.

Class 2: Instruments which permit both horizontal and vertical

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motions these are divided into three subclasses.

Class 2a: Eccentric motion permitted is based on average or arbitrary values; e.g. Bonwill-theory articulators, Simplex designed by Alfred Gysi

Class 2b: Eccentric motion permitted is based on theories of occlusion, e.g. Monson's articulator.

Class 2c: Eccentric motion permitted is determined by the patient using engraving methods, e.g. the House articulator.

Class 3: Instruments that simulate the condylar pathways by using average or mechanical equivalent values for all part of the motion. These are divided into two subclasses.

Class 3a: They accept a static protrusive registration and use equivalents for other movements, e.g. Hanau model H, Hanau H2, Dentatus, Bergstrom articulator.

Class 3b: They accept a static lateral registration and use equivalents for other movements, e.g. Trubyte articulator, Panadent, the Kinoscope, Stanberry articulator, Ney articulator, Hanau 130-21, Teledyne articulator.

Class 4: These are instruments which accept three dimensional registration. These are divided into two subclasses.

Class 4a: The condylar pathway is recorded by the patient through engraving method and it cannot be modified, e.g. the TMJ articulator

Class 4b: This is similar to class 4a but it can be angled or customized, e.g. Gnathoscope the Denar (D4A) fully adjustable articulator.

Based on Theory of Occlusion.

1. Bonwill-theory articulators: It was designed by WGA Bonwill based on theory of occlusion which says that "the distance between the condyles is equal to the distance between the condyle and the

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midpoint of the mandibular incisors. It is also known as the theory of Equilateral Triangle. Theoretically the dimension of the triangle is 4 inches.

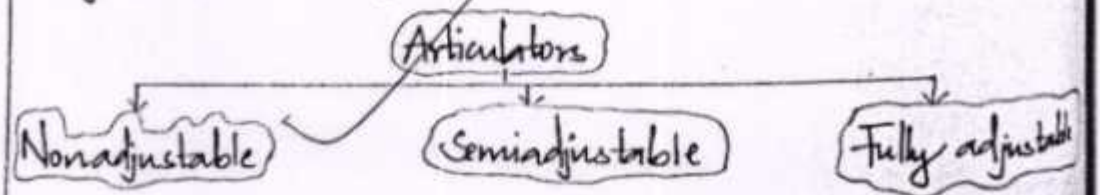
2. Conical theory articulators: It was proposed by RE Hall. The conical theory says that the lower teeth move over the surfaces of the upper teeth as over the surface of the cone, generating an angle of 45° to the occlusal plane.

3. Spherical theory articulators: This theory proposes that the lower teeth moves over the upper teeth over a surface of sphere with a diameter of 8 inches. The centre of the sphere was located in the region of glabella. Monson's articulator is a good example based on spherical theory of occlusion.

Based on the Adjustability of Articulators

The articulators are classified based on the adjustability features like:

- Acceptance of centric relation records.
- Acceptance of face bow records.
- Acceptance of lateral records.
- Adjustable intercondylar distance.



Non adjustable articulators: They can open and close in a fixed horizontal axis. They have fixed ~~scanned by Scanner~~ pattern. The incisal

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guide tables are fixed. They can accept fixed centric relation record.

Semi adjustable articulators: These articulators have adjustable horizontal condylar paths, lateral condylar paths, incisal guide tables and intercondylar distance. These articulators can be further divided as Arcon and non-Arcon articulators.

Bergstrom classification:

Arcon articulators: This term Arcon was derived by Bergstrom from the words articulating and condyle. The condylar element is attached to the lower member whereas the condylar guidance is attached to the upper member of the articulator. This articulator resembles the TMJ, e.g. Hanau series and whip Mix articulator.

Non-Arcon articulators: These articulators are vice versa to the Arcon type. In these articulators, the condylar elements are attached to the upper member and the condylar guidance is attached to the lower member, e.g. Hanau H series and Dentatus

Requirements

1. It should hold the casts in the established horizontal and vertical relationship.
2. It should provide a correct anterior vertical stop.
3. The casts should be reattached accurately.
4. It should always open and close in the same hinge movement.
5. It should have enough space between the upper and lower segments.
6. The upper and the lower members should be always parallel.
7. It should be made of non corrosive and rigid material and resist wear and tear.

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8. The moveable parts should be non rigid whereas the non movable parts should be rigid.

Parts of the mean value articulator.

Mean value articulator: Mean value articulator has a fixed condylar guidance of 33 degrees and Incisal guide table.

1. Upper member
2. Lower member
3. Incisal guide table.
4. Vertical incisal rod.
5. Central pin
6. Condylar guide.
7. Stabilizing rod.

Upper member: The upper member is a triangular frame with base of the triangle placed posteriorly and two condylar elements seen projecting on either side of the base. The apex of the triangle is seen anteriorly and it has a provision to hold the incisal rod with a central pin. The vertical incisal rod can be locked with the help of a thumb screw. The maxillary cast is mounted to the upper member during articulation.

Lower member: The lower member of the articulator consists of two components, the horizontal frame and the vertical frame. The horizontal frame is triangular in shape and corresponds to the lower member. In the centre, the lower mounting plate attached. The anterior aspect of the horizontal frame houses the incisal guide table. The upper part of vertical frame houses the condylar guide

Mounting plates: They are two in number, one for the upper member and other for the lower member. The mounting plates are attached with the help of thumb screw to the articulator. The upper and lower

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casts are attached to the articulator with the help of mounting plates.

Incisal guide table: Incisal guide table determines the incisal guidance of the articulator. The upper surface of the incisal guide table is concave and the vertical incisal rod should be in centre during the articulation. The depth of the concavity is designed to have a slope equal to the average of 15 degree incisal guide angle

Vertical incisal rod: Vertical incisal rod helps to maintain a fixed distance between the upper and lower members. It has a pointed tip which should rest in the centre of incisal table during articulation. The positioning of the incisal pin can be adjusted with the thumb screw attached to the upper member.

Central pin: At the midpoint of the incisal rod, there is a hole provided to fix the central pin. The tip of the central pin corresponds to the anterior plane of occlusion during articulation. During teeth setting, the incisal edge of the maxillary incisors should be in contact with the central pin.

Condylar guide: Condylar guide guides the movement of the condyle. In a mean value articulator, the condyle guidance is in two parts, which are condylar track and the condylar element. The condylar track is located in the lower member, inclined at an angle which is average inclination of condylar guidance of the population. The condylar element is seen projecting out from the base of the triangle of the upper member. A spring is placed within the track to hold the condylar element in its most posterior position.

Stabilizing rod: Some mean value articulators have the provision of attaching the stabilizing rod. It is of help to the dentist. It helps to stabilise the lower member of the articulator while it is kept out

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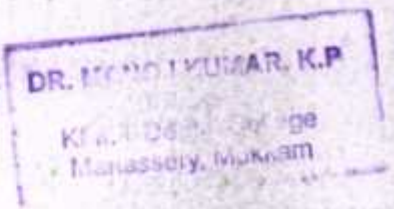
Uses of an articulator

1. To simulate the patient's temporomandibular joint movements and mandibular movements
2. Mounting the dental casts in a fixed relationship.
3. Mounting the dental casts for proper diagnosis, treatment planning and presentation to patient.
4. To help in the fabrication of fixed and removable restorations.
5. To arrange artificial teeth.
6. To correct and modify the existing restorations.

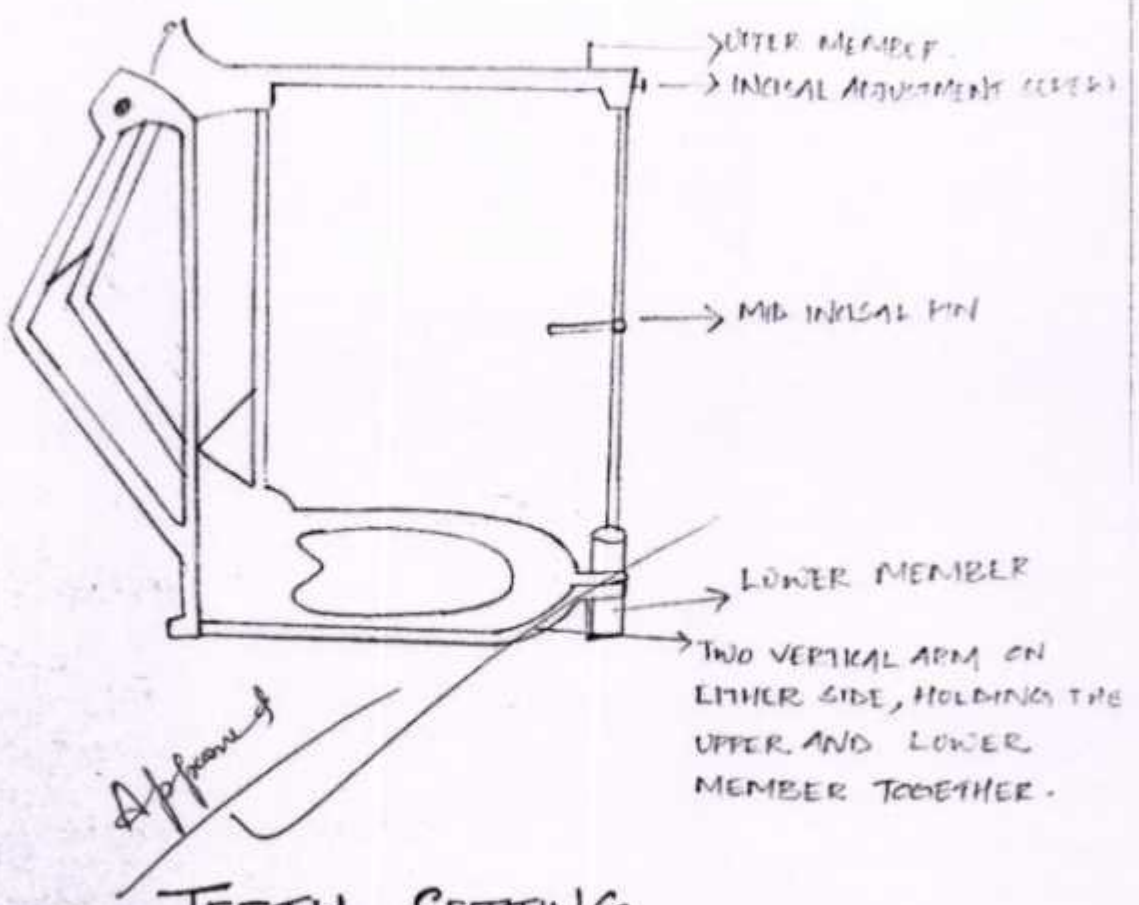
Advantages of an articulator.

- It is helpful in visualizing the patient's occlusion with much more ease, especially the lingual occlusion.
- Patient cooperation is not needed while using the articulator because the articulator itself provides the necessary movements.
- It is more comfortable and there is refinement in the work, as their is no disturbance, like shifting of denture base or resiliency of the soft tissues.
- Reduced chair time with the patient.
- Role of patient's saliva, tongue, cheeks and posture is avoided.





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TEETH SETTING

Armamentarium

- Maxilly occlusal rim with cast.
- Mandibular occlusal rim with cast.
- Mean value articulator.
- Teeth shade
- Measurement scale.
- Wax knife
- Roach carver.
- [illegible]

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- Wax sheet
- Gas torch
- Cotton
- Rubber bowl with cold water
- Marking pencil

Guidelines for anterior teeth setting are marked on the cast and the land area of the cast.

I. The centre of the incisive papilla (marked in red).
II. A line is drawn along the midline of the cast through the centre of the incisive papilla. (marked in black).
III. A perpendicular line is drawn to the above line through the centre of incisive papilla till the land area (marked in blue).
IV. During setting of maxillary canine, the cuspid tip of the canine should be placed in line with this point.

The crest of the lower residual alveolar ridge is marked in red color along the posterior aspect of the lower cast. A corresponding line is marked on the upper cast in blue.

Setting of Maxillary Anterior Teeth

Steps in placement of maxillary central incisor.

Step 1: Measure the maxillary central incisor in width and length
Step 2: Transfer the measurements into the occlusal rim
Step 3: Scoop out the wax
Step 4: Placement of the maxillary central incisor in relation to all three

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Measure the mesiodistal width and cervicolingual height of the maxillary central incisor tooth with a scale.

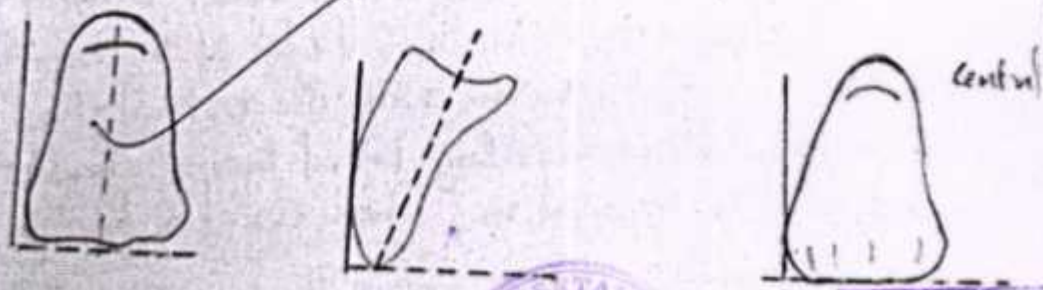
The mesiodistal width and the cervicoincisal height of the maxillary central incisor are marked on the upper occlusal rim with the scale and outline is marked on the occlusal rim with a heated wax carver.

The required amount of softened wax is removed/scooped out with heated wax carver. The cervical portion of the cut portion is softened with a heated wax knife. Over heated instrument will remove excess wax in the area of tooth placement. Under heated instrument will not soften the wax adequately for proper placement of the ~~wax~~ tooth.

The long axis of the central incisor is positioned parallel to the vertical axis when viewed from the front.

The incisal edge of the maxillary central incisor is positioned in line with the anterior occlusal plane. The central pin of the articulator will point the mesioincisal edge of the central incisor.

The outline of the incisal edge of the maxillary central incisor should follow the outline of the maxillary occlusal rim when viewed occlusally. The position adjustments should be carried out when wax is soft



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When viewed from:

Front : Long axis parallel towards the vertical axis.

Side : slopes labially about 15°

Occlusal plane : Incisal edge is in contact with occlusal plane

Steps in placement of maxillary lateral incisor.

Step 1 : Measure the dimension of the teeth.

Step 2 : Mark the desired outline.

Step 3 : Scoop out the wax.

Step 4 : Placement of the maxillary lateral incisor in relation to all three planes.

The cervicoincisal height and the mesiodistal width of the lateral incisor is measured and the outline is marked on the maxillary occlusal rim. The required amount of softened wax is removed/scooped out with the heated wax carver from the occlusal rim. The long axis of the lateral incisor is placed slightly inclined to the vertical axis. The incisal aspect of the tooth is inclined towards the vertical axis when viewed from the front. The incisal edge of the maxillary lateral incisor is placed slightly short of the occlusal plane. The incisal edge of the maxillary central incisor is placed in line with the occlusal plane. The incisal edge of the maxillary lateral incisor should follow the outline of the occlusal rim when viewed occlusally.

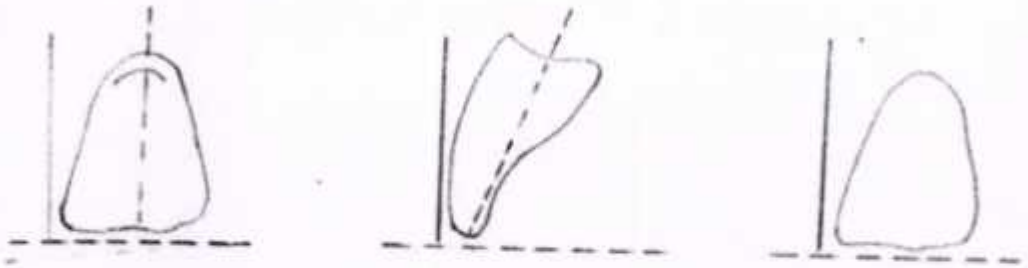
When viewed from:

Front: Long axis slopes towards midline at incisal edge

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Side: Slopes labially about 20°
Occlusal plane: Incisal edge is 1mm short of occlusal plane.



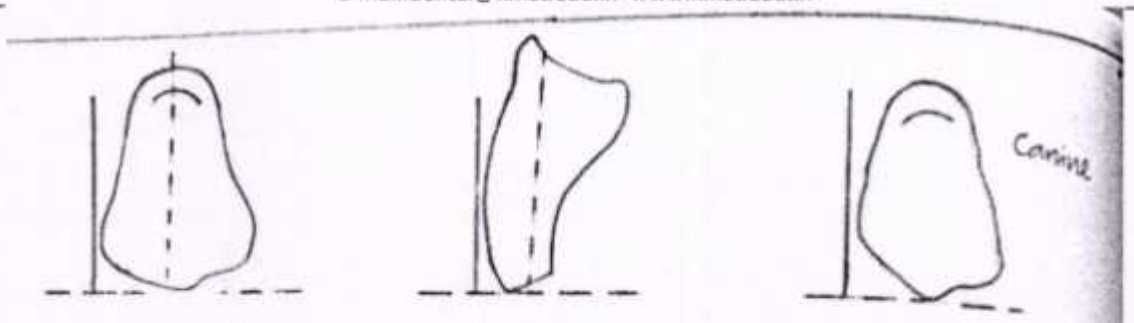
Steps in placement of maxillary canine.

Step 1: Measure the dimension of the tooth.
Step 2: Mark the desired outline on the occlusal rim.
Step 3: Scoop out the wax.
Step 4: Placement of the maxillary canine.

The outline of the maxillary canine is marked on the maxillary occlusal rim with a heated wax carver and the required amount of the wax is scooped out.
The long axis of the maxillary canine should be parallel to the vertical axis when viewed from the front. The cervical part of the maxillary canine is placed more prominent when compared to the incisal aspect when viewed from the front.
The long axis of the maxillary canine should be parallel to the vertical axis when viewed from the side
The cuspid of the maxillary canine is placed in contact with the occlusal plane.
Maxillary canine follows the outline of occlusal rim and the tip of the canine corresponds to the canine papilla.

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When viewed from:
Front: Long axis parallel towards the vertical axis.
Side: Long axis parallel towards the vertical axis.
Occlusal plane: Cuspid tip is in contact with occlusal plane.

Setting of Mandibular Anterior Teeth

Steps in placement of mandibular central incisor

Step 1: Measure the tooth dimension.
Step 2: Mark the desired outline.
Step 3: Scoop out the wax.
Step 4: Placement of the mandibular central incisor.
The long axis of the tooth is placed parallel to the vertical axis. The incisal edge of the teeth is placed 0.5mm above the occlusal plane when viewed from the front.
The incisal edge of the mandibular lateral incisor is placed slightly lingually when viewed from the side.
The incisal edge of the mandibular central incisor should follow the outline of the occlusal rim. And the incisal edge of the mandibular central incisor tooth should not cross over the [illegible]

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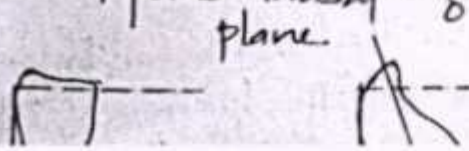
When viewed from:
Front: Long axis inclines slightly towards the vertical axis.
Side: Slopes labially
Occlusal plane: Incisal edge is 0.5 - 1mm above the occlusal plane

Steps in placement of mandibular lateral incisor.

Step 1: Measure the dimension of the mandibular lateral incisor.
Step 2: Mark the desired outline with the heated wax carver.
Step 3: Scoop out the wax.
Step 4: Placement of the mandibular lateral incisor.

The long axis of the mandibular lateral incisor is placed parallel to the vertical axis and the incisal edge is placed 0.5 - 1mm above the occlusal plane when viewed from the front.
The incisal edge of the mandibular lateral incisor tooth is placed straight when viewed from the side.
The incisal edge of the mandibular lateral incisor should follow the outline of the occlusion rim and the incisal edge should not cross over the land area of the cast when viewed occlusally.

When viewed from:
Front: Long axis inclines towards the vertical axis.
Side: Slopes labially less than central incisor.
Occlusal plane: Incisal edge is 0.5-1mm above the occlusal plane.



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Steps in placement of mandibular canine.

Step 1: Measure the dimension of the tooth
Step 2: Mark the desired outline of the tooth on the occlusal rim.
Step 3: Scoop out the wax.
Step 4: Placement of the mandibular canine

The cuspid tip of the mandibular canine is placed 0.5-1mm over the occlusal plane and long axis of the mandibular canine is inclined mesially when viewed from the front.
The cuspid tip of the mandibular canine slopes slightly lingually when viewed from the side.
The cuspid tip of the mandibular canine should follow the outline of occlusal rim and the cuspid tip should not cross over the land area when viewed occlusally



When viewed from:
Front: Long axis inclined towards midline.
Side: Slopes lingually
Occlusal plane: Cuspid tip is 0.5 - 1mm above the occlusal plane

⇒ Completed setting of Maxillary and Mandibular Anterior Teeth.
The vertical overlap between the maxillary and mandibular incisal edge should be 0.5 - 1mm and the horizontal overlap (overjet) between the maxillary and mandibular incisal edge

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should be 1-2mm. The horizontal overlap should be uniform from left maxillary to right maxillary canine.
The mesial slope of the maxillary canine should overlap the distal slope of the mandibular canine.

Posterior Teeth Setting

Guidelines for posterior teeth setting.

Step 1: Mark a line on the occlusal surface of the lower occlusal rim, corresponding to the lower residual ridge and extend the line on the land area of the mandibular cast posterior to retromolar pad.
This line represents the central groove of the lower posterior teeth.
Step 2: Mark a line on the occlusal surface of the upper occlusal rim, line connecting the midpoint of lateral incisor and the line on the land area posterior to the tuberosity which is exactly opposite to the line on the land area posterior to the retromolar pad.
The line represents the palatal cusps of the upper posterior teeth.

Steps in Placement of Maxillary first Premolar.

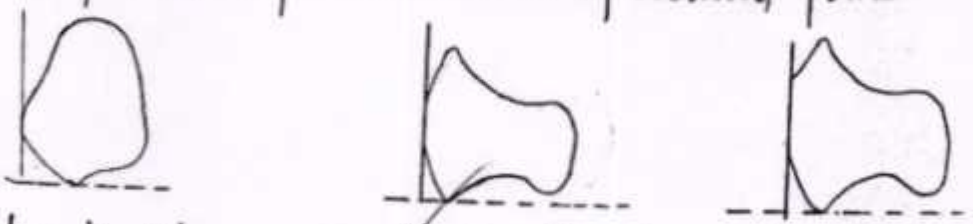
Step 1: Scoop out the wax.
Step 2: Placement of the maxillary first premolar in relation to all three planes.
The outline of the maxillary posterior is marked on the maxillary occlusal rim with a heated wax carver and

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the required amount of wax is scooped out.
The buccal cusp tip of the maxillary first premolar is in contact with occlusal plane and the palatal cusp 1mm short of the occlusal plane.
The long axis of the maxillary first premolar is parallel to the vertical axis.
The long axis of the maxillary first premolar is placed parallel to the vertical axis when viewed from the front. When viewed from the front only small amount of buccal surface should be visible when the patient smiles.

When viewed from:
Front: Long axis parallel towards the vertical axis.
Side: Long axis parallel towards the vertical axis.
Occlusal plane: Buccal cusp is in contact with occlusal plane and palatal cusp 1 mm short of occlusal plane.



Steps in Placement of Maxillary Second Premolar

Step 1: Scoop out the wax.
Step 2: Placement of the maxillary second premolar in relation to all three planes.
The outline of the maxillary posteriors is marked on the maxillary occlusal rim with a heated wax carver and the required amount of wax is scooped out.

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The buccal cusp tip and palatal cusp should be in contact with the occlusal plane.
The long axis of the maxillary second premolar should be parallel to the vertical axis.
The buccal surface of the maxillary second premolar is barely visible when the patient smiles when viewed from the front.
The buccal cusp of the maxillary second premolar corresponds with the buccal cusp of maxillary first premolar and the palatal cusps of both the premolars correspond to the previous line.



When viewed from:
Front: Long axis parallel towards the vertical axis
Side: Long axis parallel towards the vertical axis
Occlusal plane: Both buccal cusp and palatal cusp is in contact with occlusal plane

Steps in Placement of Maxillary First Molar

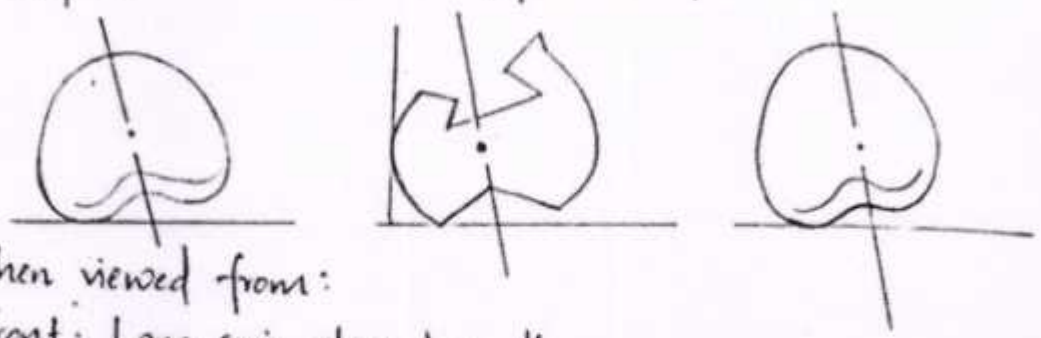
Step 1: Scoop out the wax.
Step 2: Placement of the maxillary first molar in relation to all three planes.

The outline of the maxillary posterior is marked on the maxillary occlusal rim with a heated wax carver and the required amount of wax is scooped out. The long axis of the tooth is inclined distally in relation to vertical axis. Only the mesiopalatal cusp is in contact with the occlusal plane

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The maxillary first molar is slightly inclined when reviewed from the front. When the patient smiles, very minimal buccal surface should be visible when viewed from the front.



When viewed from:

Front: Long axis slopes buccally.

Side: Long axis slopes distally.

Occlusal plane: Only mesiopalatal cusp is in contact with occlusal plane.

Steps in Placement of Maxillary Second Molar

Step 1: Scoop out the wax.

Step 2: Placement of the maxillary second molar

The outline of the maxillary second molar is marked on the maxillary occlusal rim with a heated wax carver and the required amount of the wax is scooped out. The long axis of the maxillary second molar is distally inclined in relation to the vertical axis. When viewed from the front. All the cusps are short of the occlusal plane



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When viewed from:
Front: Long axis slopes buccally more steeply than first molar
Side: Long axis slopes distally more steeply than first molar
Occlusal plane: Only mesiopalatal cusp is nearest to occlusal plane

Steps in Placement of first Premolar

Step 1: Scoop out the wax.
Step 2: Placement of mandibular first premolar in relation to all three planes.

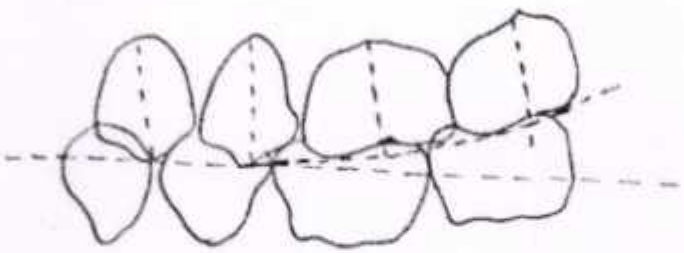
The outline of the mandibular first premolar is marked on the mandibular occlusal rim with a heated wax carver. The outlined area and required amount of wax is scooped out.
A reference guideline of the crest of the residual alveolar ridge is marked on the posterior occlusion rim. The central fossa of the posterior teeth should be along the reference line
The long axis of the tooth is placed parallel to the vertical axis when viewed from the front. The mandibular first premolar is placed between maxill. any canine and the maxillary first premolar.
The long axis of the mandibular first premolar should be inclined lingually when viewed from the front.
The buccal surface of the tooth should be barely visible when viewed from the front. There is no lingual intercuspation when viewed lingually
When viewed from:
Front: Long axis parallel towards the vertical axis.
Side: Long axis parallel towards the vertical axis.

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Occlusal plane: Lingual cusp below the horizontal plane, buccal cusp is 2mm above the occlusal plane.

Occlusal contact: Buccal cusp contacts the mesial marginal ridge of upper first premolar



Steps in Placement of Mandibular Second Premolar

Step 1: Scoop out the wax.

Step 2: Placement of the mandibular second premolar in relation to all other planes.

The mandibular second premolar is placed on the occlusal rim. The central fossa of the posterior tooth should be placed along the reference line.

The mandibular second premolar is placed between the maxillary first and second premolars.

The central groove of the lower mandibular second premolar is in contact with the palatal cusp of the maxillary second premolar when viewed lingually.

When viewed from:

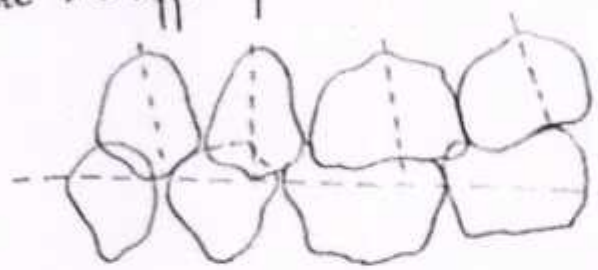
Front: Long axis parallel towards the vertical axis.

Side: Long axis parallel towards the vertical axis.

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Occlusal plane: Both cusps are about 2mm above the occlusal plane.
Occlusal contact: The buccal cusp contacting the fossa between the two upper premolars.



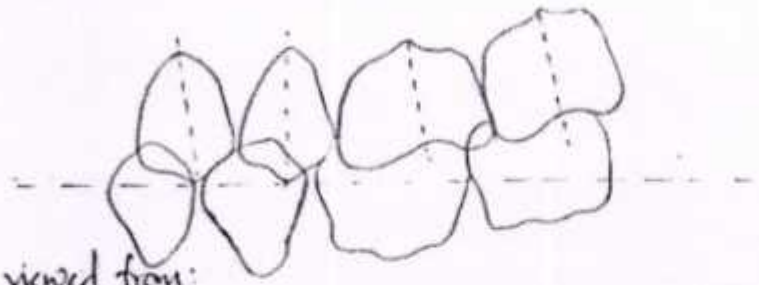
Steps in Placement of Mandibular First Molar

Step 1: Scoop out the wax.
Step 2: Placement of the mandibular first molar in relation to all three planes.

The outline of the mandibular first molar is marked on the mandibular occlusal rim with a heated wax carver and the required amount of wax is scooped out. The mandibular first molar is placed on the occlusal rim. The central fossa of the mandibular first molar is placed along the reference line.
The mandibular first molar is positioned in the occlusal rim below the maxillary first molar. The mesiobuccal cusp of the maxillary first molar should rest on the mesiobuccal groove of the mandibular first molar.
The mandibular first molar is slightly inclined lingually. The buccal surface of the tooth is barely visible when viewed from the front. The mesiopalatal cusp of the maxillary first molar interdigitates with the central groove of the mandibular first molar.

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When viewed from:
Front: Long axis runs lingually
Side: Long axis runs mesially.
Occlusal plane: All cusps are at higher level than second premolar, buccal and distal cusps higher than the other two.
Occlusal contact: The mesiobuccal cusp occludes in the fossa between upper second premolar and first molar.

Steps in Placement of Mandibular Second Molar.

Step 1: Scoop out the wax.
Step 2: Placement of the mandibular second molar in relation to all three planes.

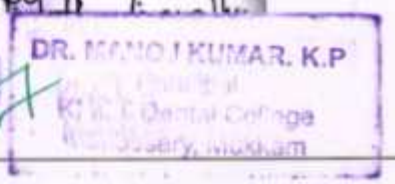
The outline of the mandibular second molar is marked on the mandibular occlusal rim with a heated wax carver and the required amount of wax is scooped out. The mandibular second molar is positioned in the occlusion rim such that the central fossa or groove of the second molar is in line with the reference line.

The mandibular second molar is placed on the occlusion rim below the maxillary second molar. The mesiobuccal cusp of the maxillary molar, should rest on the mesiobuccal groove of the mandibular second molar.

The mandibular second molar [illegible]

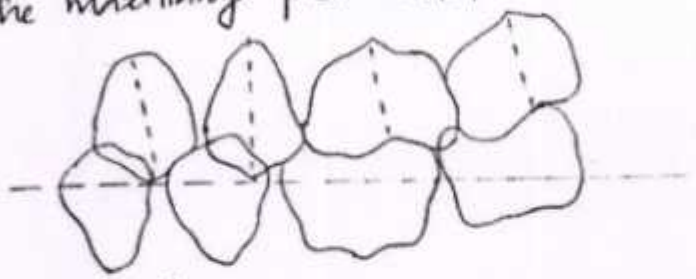
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inclined when viewed from the front. The buccal surface is barely visible when viewed from the front.
The lingual view shows that the central groove of the lower second molar is in contact with the palatal cusps of the maxillary first molar.



When viewed from:
Front: Long axis lean more lingually.
Side: Long axis lean more mesially
Occlusal plane: All cusps are at higher level than first molar, buccal and distal cusps higher than the other two.
Occlusal contact: The mesiobuccal cusp occludes in the fossa between the two upper molars.

Same steps are followed to do the teeth setting on the other side.

COMPENSATORY CURVES

It is the anteroposterior curvature and the mediolateral curvatures in the alignment of the occluding surface and incisal edges of the artificial teeth that are used to develop balanced occlusion

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Compensatory Curves

- Curves in natural dentition
  - → Curve of spee
  - → Curve of Monsoon
  - → Curve of Wilson.
- Curves in artificial dentition
  - → Anteriorposterior cure
  - → Mediolateral curve
  - → Curve of pleasure

ANTERIOPOSTERIOR CURVE

The anatomic curve established by the occlusal alignment of the teeth, as projected onto the medial plane, beginning with the cusp tip of the mandibular canine and following the buccal cusp tips of the premolar and molar teeth continuing through the anterior border of the mandibular ramus, ending with the anterior most portion of the mandibular condyle. It was first described by Ferdinand Graf spee, German anatomist in 1890.

CURVE OF MONSON

Eponym for a proposed ideal curve of occlusion in which each cusp and incisal edge touches or confirms to a segment of the surface of a sphere 8 inches in diameter with its centre in the region of the glabella.

CURVE OF PLEASURE

Eponym for a helicoid curve of occlusion that when viewed in the frontal plane, conforms to a curve that is convex from the superior view, except for the last molars, which reverse that

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pattern. In excessive wear of the teeth, the obliteration of the cusps and formation of either flat or cupped out occlusal surface, associated with reversal of the occlusal plane of the premolar, first and second molar teeth (the third molars being generally unaffected) whereby the occlusal surfaces of the mandibular teeth slope facially instead of lingually and those of the maxillary teeth incline lingually.

CURVE OF WILSON.

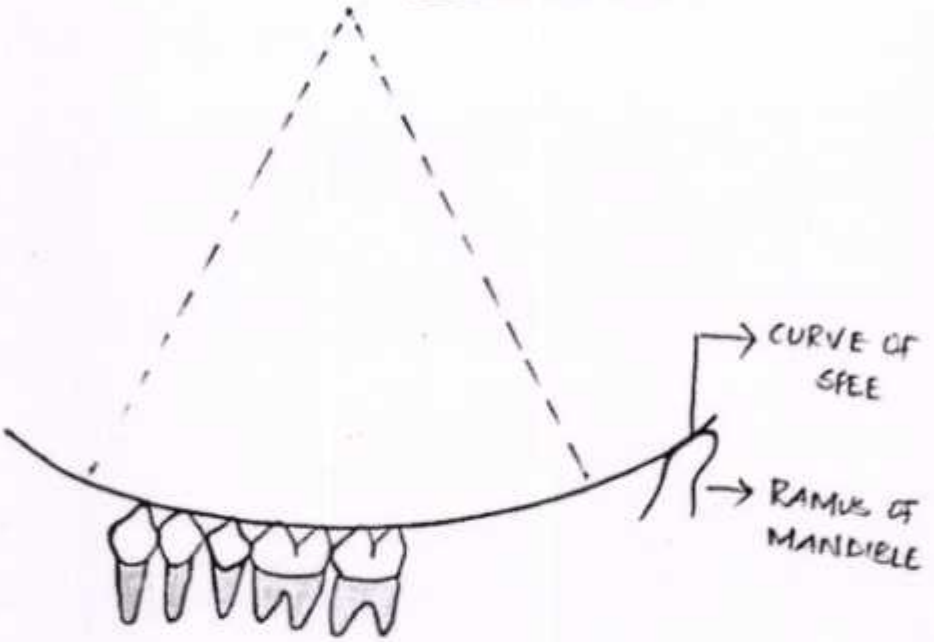
Eponym for the mediolateral curve: In the theory that occlusion should be spherical, the curvature of the cusps are projected on the frontal plane expressed in both arches, the curve in the lower arch being concave and the one in the upper arch being convex. The curvature in the lower arch is affected by an equal lingual inclination of the right and left molars so that the tip point of the corresponding cross aligned cusp can be placed into the circumference of a circle. The transverse cuspal curvature of the upper teeth is affected by the equal buccal inclinations of their long axes

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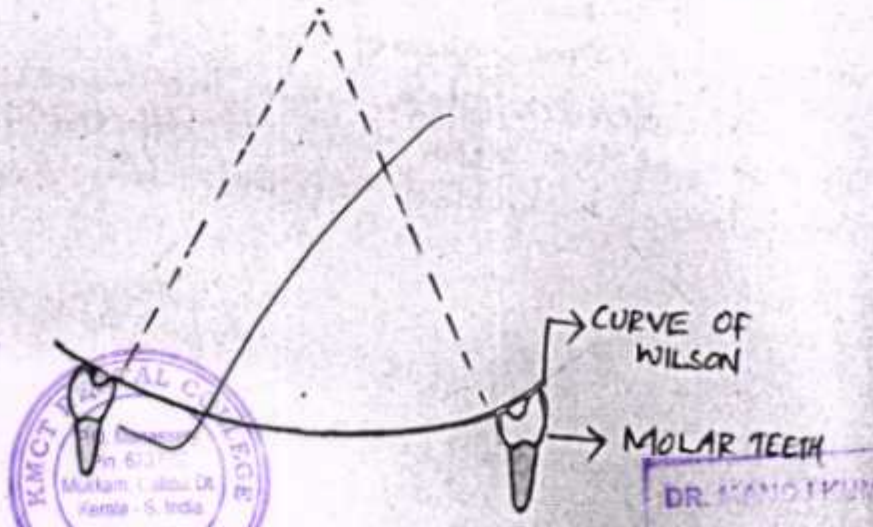
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CURVE OF SPEE

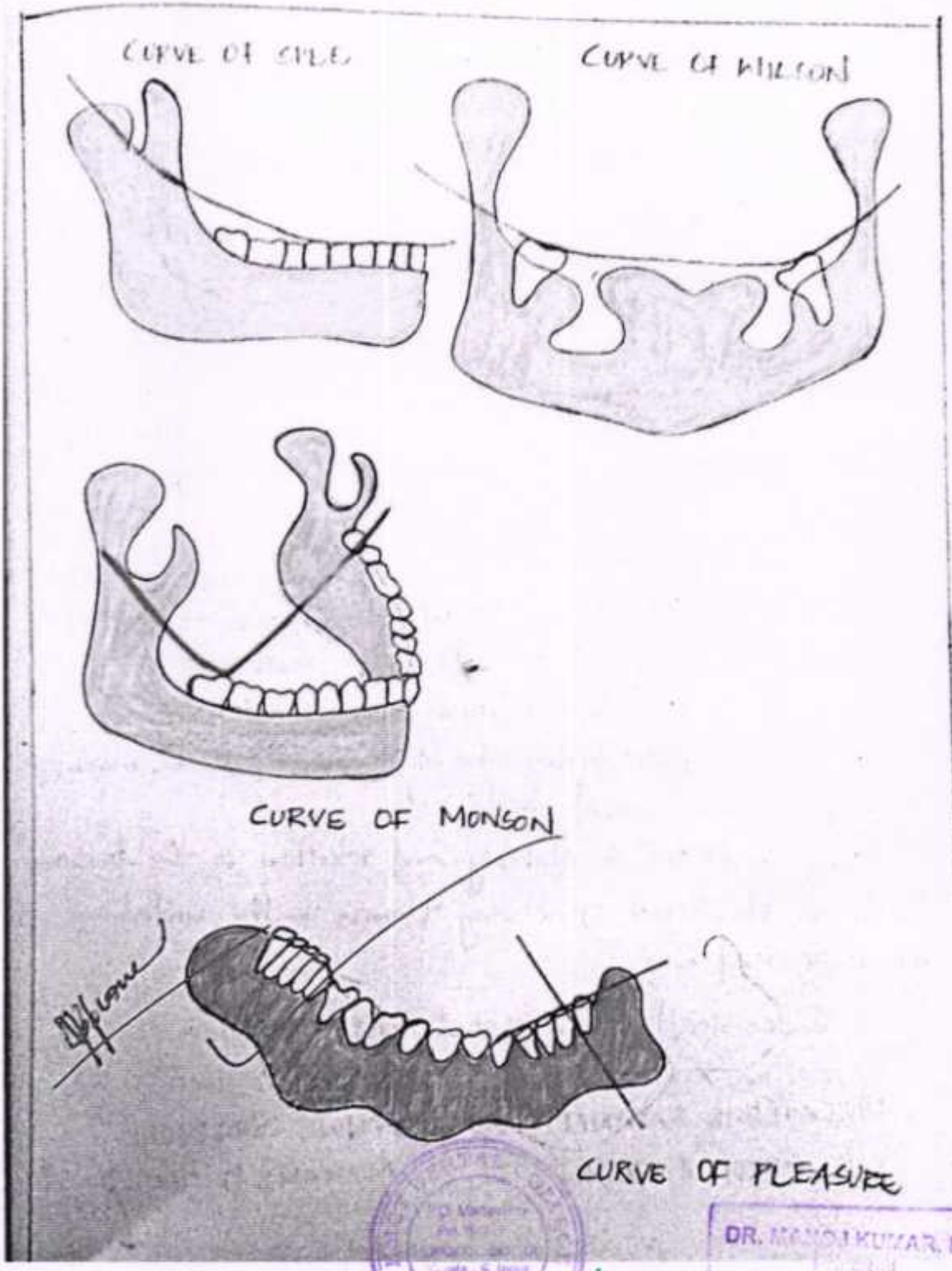


CURVE OF WILSON



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OCCLUSION IN COMPLETE DENTURE

OCCLUSION

The relationship between the occlusal surfaces of the maxillary and mandibular teeth when they are in contact.

ARTICULATION

Articulation is the dynamic movement of contacting teeth as the mandible moves to and fro from centric relation and eccentric relation.

OBJECTIVES

- Occlusion should provide maximum intercuspation of the maxillary and mandibular teeth in centric relation position
- Occlusion should provide maximum chewing efficiency.
- Occlusion in complete denture should ~~provide maximum~~ minimize the stresses to the residual alveolar ridges.
- Occlusion should provide stability and retention to the denture.
- Occlusion should not cause any trauma to the underlying soft tissues and bones

OCCLUSION IN NATURAL DENTITION.

→ UNILATERAL BALANCED OR GROUP FUNCTION

→ CANINE GUIDED OR MUTUALLY PROTECTED

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Unilateral balanced / Group function	Canine guided / mutually protected
• Multiple contact relations between the maxillary and mandibular teeth in lateral movements on the working side whereby simultaneous contact of several teeth acts a group to distribute occlusal force. • First advocated by Schuyler.	• In mutually protected occlusion the vertical and horizontal overlaps of the canine teeth disengage the posterior teeth in the excursive movements of the mandible. • First advocated by Stuard and Stallard. • Christensen's phenomenon the space that occur between opposing occlusal surfaces during mandibular protrusion.

Monoplane

OCCLUSION IN ARTIFICIAL DENTITION.

Bilateral Balanced Occlusion.

It is the bilateral simultaneous anterior and posterior occlusal contact of teeth in centric and eccentric position.

Objective

In natural dentition, space occurs between the occlusal surfaces posteriorly during mandibular protrusion is called Christensen's phenomenon.

The concept of Christensen's phenomenon occuring in natural dentition cannot be incorporated in complete dentures because during protrusion the maxillary denture will be displaced downwards resulting in instability of denture. Hence simultaneous contact of all teeth should be provided in complete

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dentures during lateral movement of the mandible.

FACTORS INFLUENCING BALANCED OCCLUSION.

* Condylar guidance.
* Incisal guidance.
* Plane of Occlusion.
* Cuspal inclination.
* Compensating curves.

Condylar Guidance

It is the mandibular guidance generated by condyle and the articular disc traversing the contour of the glenoid fossa.

Incisal Guidance

The influence of the contacting surface of mandibular and maxillary anterior teeth during mandibular movements.

Plane of Occlusion

It is the average plane established by the incisal and occlusal surface of the teeth.

Cuspal Inclination

It is the angle by the average slope of a cusp with occlusal plane.

Compensating Curves.

It is the anteroposterior curvatures and the mediolateral curvatures in the alignment of the occluding surfaces and incisal edges of the artificial teeth that are used to develop balanced occlusion.



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PARTS AND SURFACES OF A COMPLETE DENTURE.

SURFACES OF THE DENTURE

Surface of denture
- Tissue surface
- Polished surface
- Occlusal surface.

Tissue surface

It is that part of the denture which is in contact with the patient's tissue. It should always be free of voids and nodules to avoid irritation to the tissues

Polished surface.

It is that part of the denture which refers to the labial, lingual and buccal flanges and the palatal surface. This surface of the denture should be well polished.

Occlusal surfaces.

It is that part of the denture which refers to the occlusal plane of the artificial denture teeth. It usually contours the cusps of the teeth and sluice ways which aids in mastication.

PARTS OF THE DENTURE

Parts of Denture
- Artificial teeth
- Denture base
- Denture flange

Artificial teeth

They are the most important part of the denture accordine to both patient and the dentist as they are responsible

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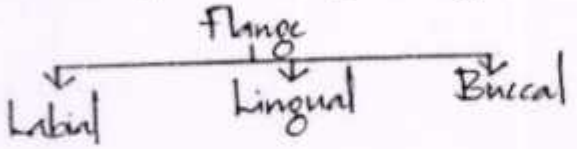
for patient's aesthetics, mastication and speech.

Denture base

It is that part of the denture to which the artificial teeth are attached. It is usually made of acrylic resin but metals like gold, silver, nickel and chromium alloys, can be used.

Denture flanges

There are 3 different flanges. They are :-



Labial flange

The portion of the flange which occupies the labial vestibule is the labial flange and usually has "U" shaped notch to accomodate the labial frenum.

Lingual flange

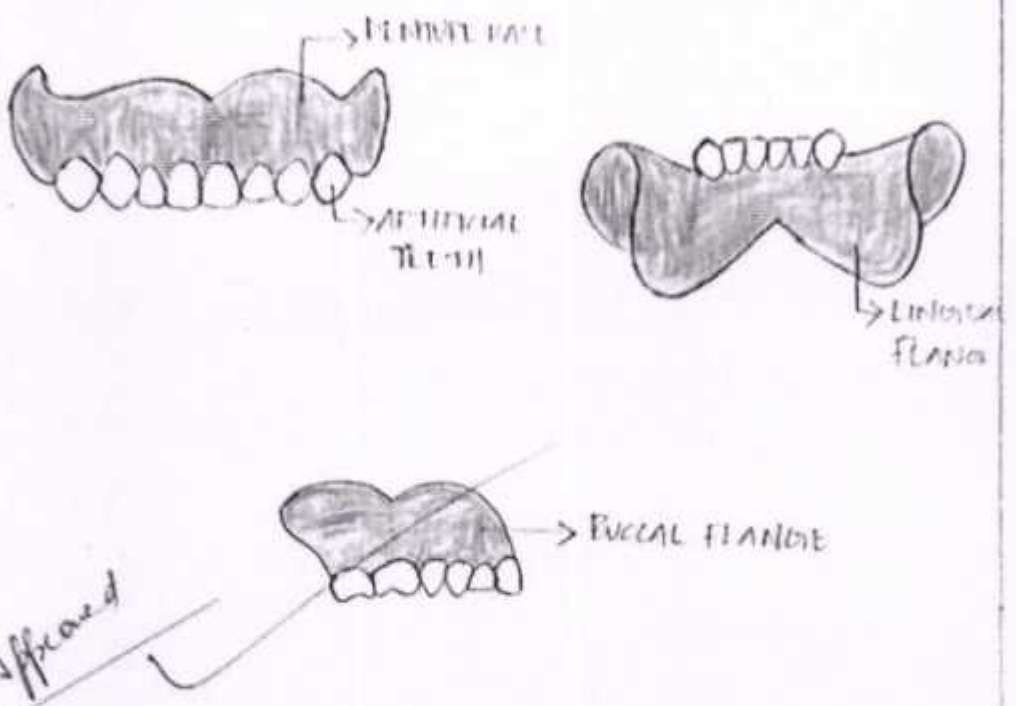
It is that part of the mandibular denture which occupies the space between the tongue and ridge of the mandible, it should be in contact with the floor of the mouth to provide peripheral seal.

Buccal flange

The portion of the denture which occupies the buccal vestibule is the buccal flange. It provides fullness to cheeks in the maxillary denture and has a relief or a wide notch to accomodate the buccal frenum. The buccal flange helps to transfer the occlusal force to the buccal shelf area in the mandibular dentures.

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REMOVABLE PARTIAL DENTURE

CLASSIFICATION OF PARTIALLY EDENTULOUS ARCH AND APPLE-GATES RULES

Any prosthesis that replaces some teeth in a partially dentate arch. It can be removed from the mouth and replaced at will, also called partial removable dental prosthesis.

COMPONENTS

- Removable partial denture
  - Connectors
    - Major connector
    - Minor connector
  - Retainers
    - Direct retainer
    - Indirect retainer
  - Tooth replacement / denture bases

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KENNEDY'S CLASSIFICATION.

Edward Kennedy in 1925 proposed the classification of partially edentulous arches. Kennedy's classification is the most widely accepted classification.

Requirements of a method of classification

1. The classification should permit easy visualization of the type of partially edentulous arch.
2. It should differentiate between tooth supported and tissue supported partial dentures.
3. The classification should help the clinician to design the partial denture.
4. It should be universally acceptable.

CLASS I.

Bilateral edentulous areas located posterior to the remaining natural teeth.

CLASS II

Unilateral edentulous areas located posterior to the remaining natural teeth.

CLASS III

Unilateral edentulous area with natural teeth both anterior and posterior to it.

CLASS IV.

Single bilateral edentulous area located anterior to the remaining natural teeth and crossing the midline.

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Advantages

- It permits easy visualization of the partially edentulous
- It gives a clear distinction between tooth supported, partial denture and tissue supported partial dentures
- It gives a logical approach to the partial denture design.

Disadvantages

- The classification does not give a clear idea of the amount of available support for the design of the prosthesis.

APPLEGATE'S RULES

Kennedy's classification will be difficult to apply in every clinical situation. Hence O C Applegate put forth eight rules for application of Kennedy's classification of partially edentulous arches. The rules are:

Rule 1: Classification should follow rather than precede extraction that might ~~other~~ alter the original classification

Rule 2: If the third molar is missing and not to be replaced, it is not considered in the classification

Rule 3: If a third molar is present and is to be used as an abutment, it is considered in the classification.

Rule 4: If a second molar is missing and is not to be replaced, it is not considered in the classification.

Rule 5: The most posterior edentulous area or areas always determines the classification.

Rule 6: Edentulous areas other than those determining the classification are referred to as modification spaces and are designated by their number.

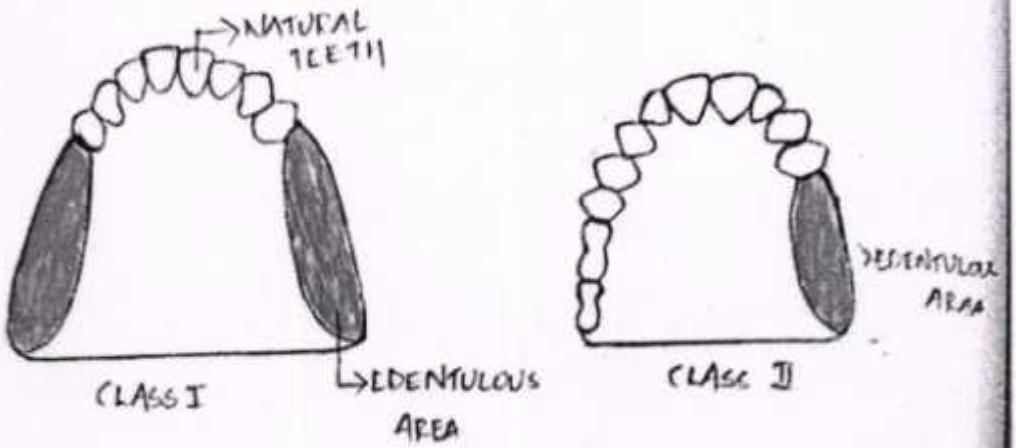
Rule 7: The extent of the modification is not considered, only the number of additional edentulous areas.

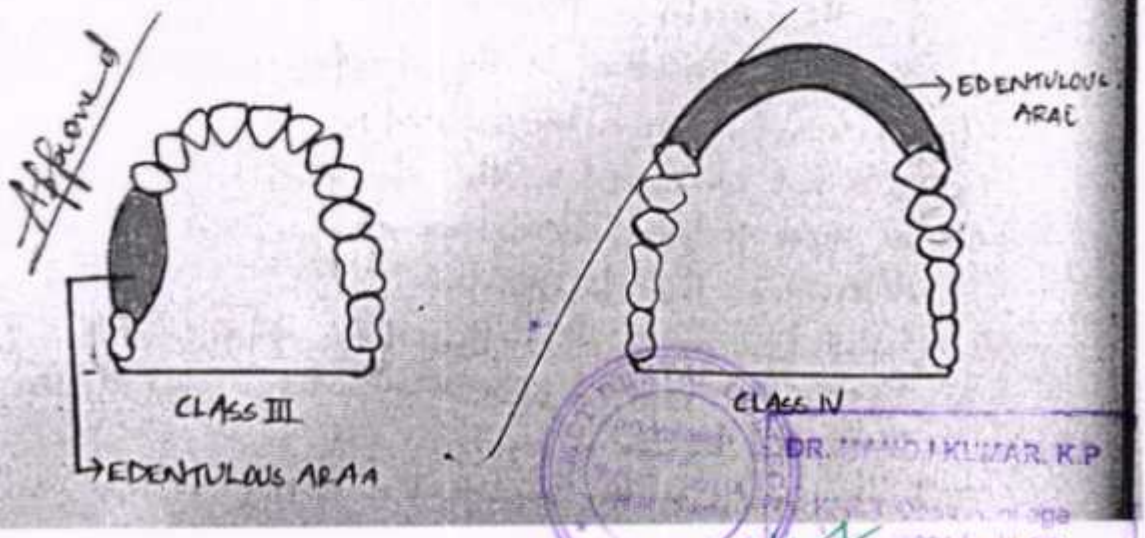
Rule 8: There can be no modification areas in CLASS IV

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arches. Any edentulous areas lying posterior to single bilateral area determines the classification.





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SURVEYORS

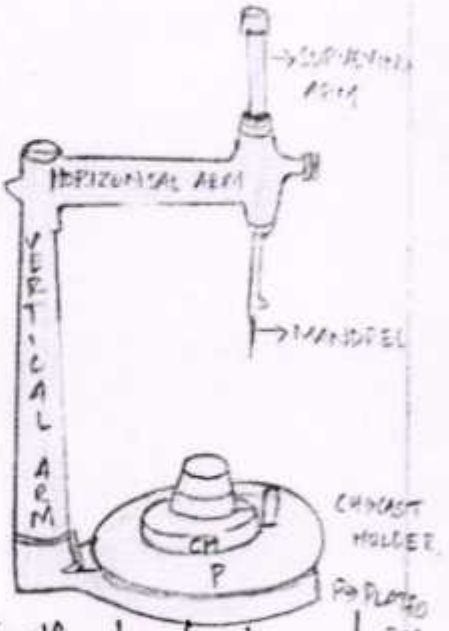
The surveyor is essentially a parallelometer, an instrument used to determine the relative parallelism of the surface of the teeth or other areas on the cast.

TYPES

1. 1818 - A.J. Fortunati - Parallelometer
2. 1923 - Ney - Surveyor
3. Wills Surveyor

PARTS OF THE SURVEYOR

- Platform (P)
- Vertical arm (VA)
- Horizontal arm (HA)
- Surveying arm (SA)
- Cast holder (CH)
- Surveying tools



1. A level platform that is parallel to the bench top and on which the cast holder is moved.
2. A vertical arm that supports the superstructure.
3. A horizontal arm that extends at a right angle from the vertical column from which extends the other part of the superstructure, the surveying arm. (In Ney Surveyor, the horizontal arm is fixed, whereas in the Wills instruments it may move horizontally around the

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4. A surveying arm that drops vertically from the horizontal arm. The surveying arm is capable of movement in a vertical direction. (In the Wills surveyor, the surveying arm is spring loaded. When the arm is not in use, it is held at the most vertical position by spring tension. In the Ney instrument, the arm is completely passive dropping to its lowest position unless secured at another height by a locking device). The lower end of the surveying arm contains a mandrel, in which the special tools used in the surveying procedure may be locked.

5. A cast holder or surveying table, to which the cast to be studied is attached the table, equipped with a clamp to lock the cast in place, is mounted on a ball and socket joint that permits the cast to be oriented in various horizontal planes so that the axial surfaces of the teeth as well as other areas of the cast can be analyzed in relation to the vertical plane.

6. An analyzing rod or paralleling tool: This tool contacts the convex surface of the object being studied in the same way a tangent contacts a curve. In this way, the parallelism of one surface to another may be determined. If a carbon rod or marker is substituted for the analyzing rod and the objects being studied are rotated in contact with the marker, as the horizontal plane of the cast is maintained by the cast holder, a survey line indicating the height of contour will be transferred to those surface.

7. Additional tools that may be attached to the vertical surveying arm and used in conjunction with the surveyor

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a. Undercut Gauge : These guage are used to identify the specific amount and location of desired retentive undercut on the surface of abutment tooth.

b. Wax knife : This instrument is used in late stages of removable partial denture construction to eliminate or block out areas of considerable undercuts with wax on the cast before the framework is made

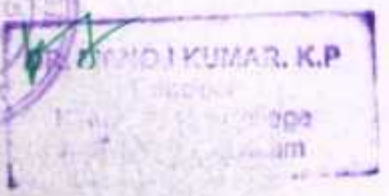
c. Carbon marker : The marker may be used to scribe the survey line and to delineate an undercut area of the soft tissue or ridge.

USES

1. Surveying diagnostic cast.
2. Tripoding the cast.
3. Transferring tripod marks to another cast.
4. Contouring wax patterns.
5. Contouring crowns and cast restorations.
6. Placing internal attachments and rests.
7. Surveying the master cast

Applications





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COMPONENTS OF CAST PARTIAL DENTURE

• Types

Connectors

- Major connectors
  - Maxilla
    1. Single posterior palatal bar.
    2. Palatal strap
    3. Anteroposterior or double palatal bar.
    4. Horseshoe or U-shaped connector.
    5. Closed horseshoe or anteroposterior palatal strap.
    6. Complete palate
  - Mandible
    1. Lingual bar
    2. Double lingual bar or Kennedy bar
    3. Lingual plate.
    4. Labial bar
- Minor connectors
  1. Join the clasp assembly to the major connector.
  2. Join indirect retainer or auxillary rest to the major connector.
  3. Join denture base to the major connector.
     a. of lattice work construction.
     b. of mesh work construction
     c. bead, wire or nail-head minor connectors
  4. Serve as an approach arm for a vertical projection or bar type clasp.

Major Connector.

It is that component that connects the parts of the prosthesis located on one side of the arch with those on the opposite side.

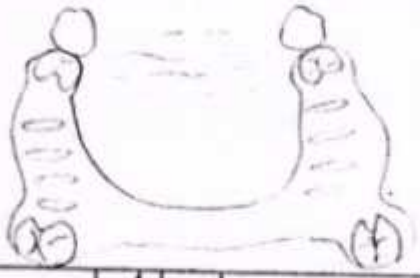
Requirements:

1. Be rigid.
2. Provide vertical support and protect the soft tissue
3. Provide a means of obtaining indirect retention where indicated.
4. Provide an opportunity of positioning denture bases where needed.
5. Maintain patient comfort.

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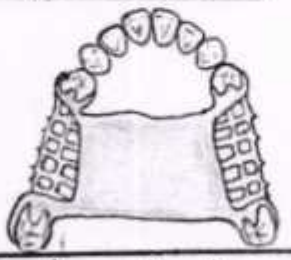
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Single Posterior Palatal Bar Major Connector



Indications	Advantages	Disadvantages
• Class I partially edentulous arches with the residual ridges that have undergone little vertical resorption • V or U shape plates • Strong abutments • Non interfering tori	• Can be used as an interim partial denture till the more definite treatment is planned.	• Too thick. • Limited to replace one or two teeth on each side of the arch • should not be placed anteriorly to second premolar as it interferes with the tongue movements

Single Palatal Strap Major Connector

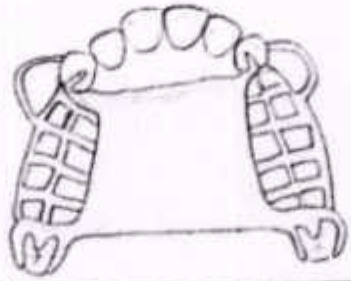


Indications	Advantages	Disadvantages
• Bilateral edentulous space • Short span tooth supported prosthesis	• Offers great degree of resistance. • Offers little interference with the tongue movements. • Helps to distribute the load evenly • Retention attained through the adhesion and cohesion • Helps in ~~retained~~ by Planner Go	• Excessive palatal coverage. • Excessive tissue reaction.

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Anteroposterior or Double Palatal Bar Major Connector



Indications	Advantages	Disadvantages
• Class I partially edentulous arches with the residual ridges that have undergone little vertical resorption • V or U shape palates • Strong abutments • Noninterfering tori.	• It offers excellent rigidity • It offers less palatal coverage	• It offers little support • The extra bulk of metal causes tongue interference. • Not indicated in high vault palate.

U-shaped Palatal Major Connector.

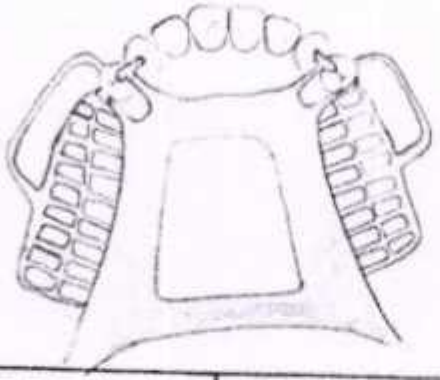


Indications	Advantages	Disadvantages
In case of inoperable tori that extends to the posterior limit of the hard palate. • Used in Kennedy's class I and class IV situation.	• Used when several anterior teeth are being replaced. • Derive some vertical support and indirect retention from the palate	• Great bulk of metal in the tongue area. • Problem in phonetics.

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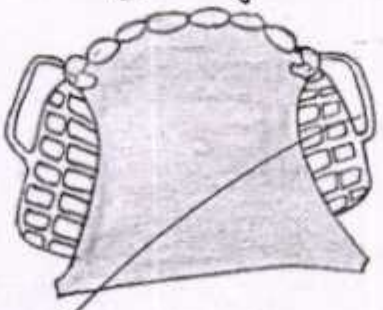
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Anteroposterior Strap Type Major Connector.



Indications	Advantages	Disadvantages
• Class I and II arches in which excellent abutment and residual ridge resorption support exist. • Long edentulous span in class II modification 1 arch • Class IV arches in which anterior teeth must be replaced with RPD. • Inoperable palatal tori that do not extent posteriorly till the junction of hard and soft palate	• The contoured contour provides more support. • The circle effect by the anterior and posterior strap contribute to rigidity.	• Contraindicated in case of teeth with reduced periodontal support. • High palatal vault cases. • Interfere with the phonetics

Complete Palatal Coverage Major Connector.



Indications	Advantages	Disadvantages
• Palatal cleft • Class II arch with large posterior modification space	• In individual with the well developed muscles of mastication Scanned with CamScanner Go at mandibular teeth	• Adverse tissue reaction • Problems in phone

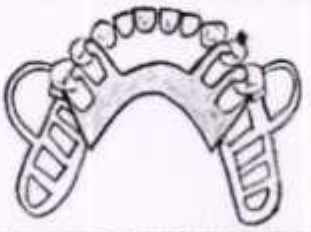
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REVIEW OF INDICATIONS FOR MAXILLARY MAJOR CONNECTORS.

1. If the periodontal support of remaining teeth is weak, more of the palate should be covered thus a wide palatal strap or a complete plate is indicated.
2. If the remaining teeth have adequate periodontal support and little additional support is needed, a palatal strap and double palatal bar can be used.
3. for long-span distal extension bases where rigidity is critical, a closed horseshoe or complete palate is indicated.
4. When anterior teeth must be replaced, a horseshoe, closed horseshoe or a complete palate may be used. The final selection be based on modifying factors such as number and location of posterior teeth missing, support of remaining teeth and type opposing occlusion.
5. If torus is present and is not removed, a horseshoe, a closed horsesh or an anterior posterior palatal bar may be used.
6. A single palatal bar is rarely indicated.

Mandibular Lingual Bar Major Connector.



Indications	Advantages	Disadvantages
• When 8mm space exists between the slightly elevated alveolar lingual sulcus and the lingual gingival tissue. • In Kennedy's class I & class II situation.	• Minimal contact to tissue. • Simple to construct.	• Proper care should be taken in the laboratory not to make it thin.

Double Lingual Bar / Kennedy Bar

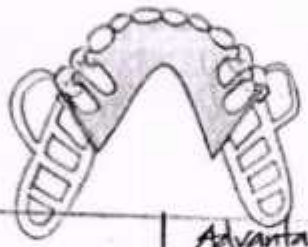


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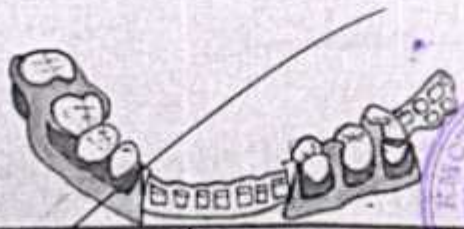
Indications	Advantages	Disadvantages
• When indirect retention is needed • When periodontal disease resulted in interproximal embrasure. • In class I and class II situation.	• Contribute horizontal stabilization. • Since gingival & interproximal space not covered free flowing of saliva is permitted. • Marginal gingiva receives natural stimulation.	• More tongue interference • Food entrapment

Mandibular Lingual Plate Major Connector



Indications	Advantages	Disadvantages
• When class I arch has a slight vertical resorption. • For periodontally weakened teeth. • When future addition of teeth is needed in existing RPD.	• Provides indirect retention • Provides more support and stabilization • Provide more tongue comfort and ease in phonetics.	• Decalcification of enamel surface • Irritation of soft tissue.

Mandibular Labial Bar



Indications	Advantage	Disadvantage
• Lingual inclined remaining teeth. • In Kennedy's class IV situation • Severe abrupt lingual tissue undercut.	• Conventional lingual major connectors cannot be used	• The bulk of the connector distorts the lower lip

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MINOR CONNECTOR

- The connecting link between the major connector or base of a removable partial denture and the other units of the prosthesis such as the chair assembly, indirect retainers, occlusal rests or cingulum rests.

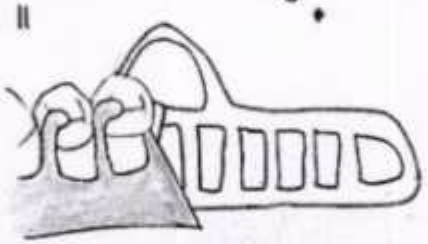
Functions:

- The primary function is to join other units of the prosthesis, such as clasps, rests, indirect retainers and denture bases to the major connector.
- It distributes the stresses that occur against certain components of the partial denture to other components

Types of Minor Connector Joining the Denture Base.

I. Lattice Work Construction

It consists of two struts of metal 12-16 guage thick extending longitudinally along the edentulous mandibular arch, positioned buccal and lingual to the ridge crest. It is commonly used in Kennedy's classification Class I and Class II



Advantages

- It is used when multiple teeth are to be replaced.
- It provides the strongest attachment.
- Easy to reline
- It gives more space for placement of artificial teeth.

II. Mesh Construction.

- It is a thin sheet of metal with multiple small holes that extend over the crest of the residual ridge
- Used when multiple teeth are used.

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- Used only when abundant inter-ridge space is available.
- It is commonly used in Kennedy's class I and class II.

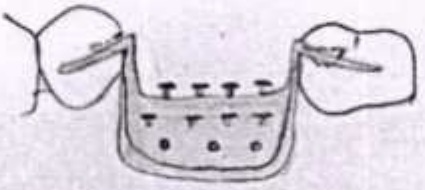


Disadvantages

- It does not provide strong attachment.
- It needs more pressure while packing the resin.

III. Bead, Wire, Nail Head Retention Minor Connectors

It is used with a metal denture base that fits directly to the ridge without relief. The denture base is attached only on the outer or superior surface and the retention is gained by beads wire projecting from metal base or nail heads. It is commonly used in Kennedy's Class III partially edentulous arches.



Advantage.

- Hygienic - due to better soft tissue response.

Disadvantages

- Difficult to reline
- Weakest attachment between metal base and the acrylic resin

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tooth or dental implant abutment, usually not covering the facial surface.

2. Posterior 7/8th crown

It is a three quarter crown whose vertical dictobuccal margin is positioned slightly mesial to the midline of the buccal surface.

3. Posterior Mesial Half Crown

It is a three quarter crown which has been rotated 90° so that a proximal surface, rather than the facial, is left unveneered.

Intracoronal Retainers

1. Inlays

A fixed intracoronal restoration; a dental restoration made outside of a tooth to correspond to the form of the prepared cavity, which is then luted into the tooth.

2. Onlays

A restoration that restores one or more cusps and adjoining occlusal surfaces or the entire occlusal surface and is retained by mechanically or using adhesive cements.

Radicular Retainers

1. Cast Posts

A one piece foundation restoration for an endodontically treated tooth that comprises a post within the root canal and a core replacing missing coronal structure to form the tooth preparation

2. Prefabricated Posts

Prefabricated posts and cores consist of two separate entities, each composed out of its material, that are joined by the dentist at the time of the procedure. A universal metal post, sized for the particular diameter of the root canal is obtained as for

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pron as possible into the post space and cemented with permanent cement, such as zinc phosphate or other luting agents.

Pontics

- An artificial tooth on a fixed dental prosthesis that replaces a missing natural tooth, restores its function, and usually fills the space previously occupied by the clinical crown.

Types of Pontics

Pontic design

- Based on contact with tissue
- Based on fabrication

Based on contact with tissue

- Mucosal contact
  - → Ridge lap
  - → Modified ridge lap
  - → Conical or ovate
- Nonmucosal contact
  - → Sanitary or hygienic
  - → Modified hygienic or
  - → Perel pontic

Based on fabrication

- Prefabricated
- Custom made

Based on material

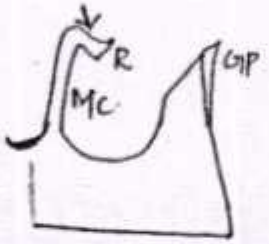
- Ceramic
- All metal
- All acrylic
- Combination
  - Metal with ceramic
  - Metal with acr...

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PARTS OF CAST PARTIAL DENTURE

RESTS

- The components of a removable partial denture that serve primarily to transfer forces occurring against the prosthesis down the long axis of the abutment teeth are called rests and a rest seat is the prepared surface of the tooth or fixed restoration into which a rest fits. When rest is used, stress can be absorbed by the fibres of the periodontal ligament without damaging the ligament or the supporting bone.



Functions of Rest

1. It helps in transferring occlusal load to the abutment teeth.
2. It provides vertical support to the partial denture and resists movement towards the tissue
3. It prevents impingement of soft tissue
4. It also maintains the relative clasp in its proper position.

Classification of Rest.

1. Primary Rest

- It is a part of a direct retainer unit.
- It prevents vertical movement of the prosthesis towards the tissue and also helps transmit lateral or horizontal forces applied to the partial denture during function to supporting teeth.
- For a distal extension partial denture, the rest seat should be shallow or saucer-shaped so that the rest can move slightly, like a ball and socket joint.

2. Secondary Rest

- It is used for indirect retention [illegible] classification

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of class I and class II partially edentulous arches.
- It is also called as auxillary rest.
- These rests are placed anteriorly or posterior to the axis of rotation to prevent the unsupported distal extension denture base from lifting away from the edentulous ridge.

Forms of Rests
Occlusal Rest | Cingulum Rest | Incisal Rest.

1. Occlusal Rest
- The outline form should be triangular.
- The base of the triangle resting on the marginal ridge and rounded apex directed towards the centre of the teeth.
- The floor of the occlusal rests must be towards the centre of the te
- It must be 0.5mm thick at its thinnest point and should be between 1.0 and 1.5mm thick when it crosses the marginal ridge.
- Occlusal rest will fail when there is insufficient reduction of the margin ridge.

2. Lingual or Cingulum Rest
- It is used primarily on maxillary canines.
- Lingual rests on incisor teeth are used when canines are missing. In this instance, multiple incisor teeth must receive lingual rest to distribute the stresses over a number of teeth because a single incisor tooth seldom offers adequate support.
- Lingual rests are preferred over incisal rests because:
1. It is close to the centre of rotation of the supporting tooth, so it does not tend to tip the tooth.
2. It is confined to the lingual surface of the anterior teeth.
3. It is more acceptable esthetically.
4. It is less subjected to breakage and distortion.

3. Incisal Rest
- It is most frequently used on mandibular canines.
- It is positioned near the incisal angles of the abutment teeth.
- Designed for the mesio-incisal or disto-incisal angle, depending on the type of clasp planned for the teeth.
- If the tooth is not to be clasped, the rest is placed on the disto-incisal surface for aesthetic reasons.

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DIRECT RETAINERS

- It is a component of removable partial prosthesis, which is used to retain and prevent dislodgement, consisting of a clasp assembly or precision attachment.

Parts of a Clasp

Rest, Body, Shoulder, Reciprocal arm, Retentive arm, Minor connector, Approach arm.

Requirements of a Clasp design

1. Retention

a. The resistance in the movement of a denture away from its tissue foundation especially in a vertical direction.

b. A quality of a denture that holds it to the tissue foundation and/or abutment teeth. Retention is inversely proportional to flexibility of the clasp arm. It is provided by the retentive clasp terminal by engaging the specified undercut.

2. Support

a. The foundation area on which a dental prosthesis rests. With respect to dental prosthesis, the resistance to displacement away from the basal tissue or underlying structures.

b. Support is provided by the rest.

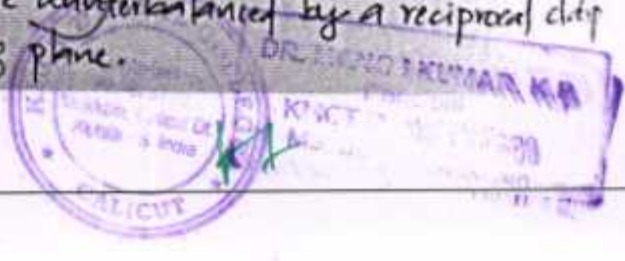
3. Stability

a. The resistance of a denture to movement on its tissue foundation, especially to lateral forces as opposed to vertical displacement.

b. A quality of a denture that permits it to maintain a state of equilibrium in relation to the tissue foundation and/or abutment teeth. Rigid components of the clasp assembly offers the stability.

4. Reciprocation

a. The mechanism by which lateral forces generated by a retentive clasp passing over a height of contour are counterbalanced by a reciprocal clasp passing along a reciprocal guiding plane.



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ncirclement

ach clasp must be designed to encircle more than 180° of the ntment tooth.

assivity

he quality or condition of inactivity or rest assumed by the teeth, ues and denture when a removable dental prosthesis is in ce but not under masticatory pressure.

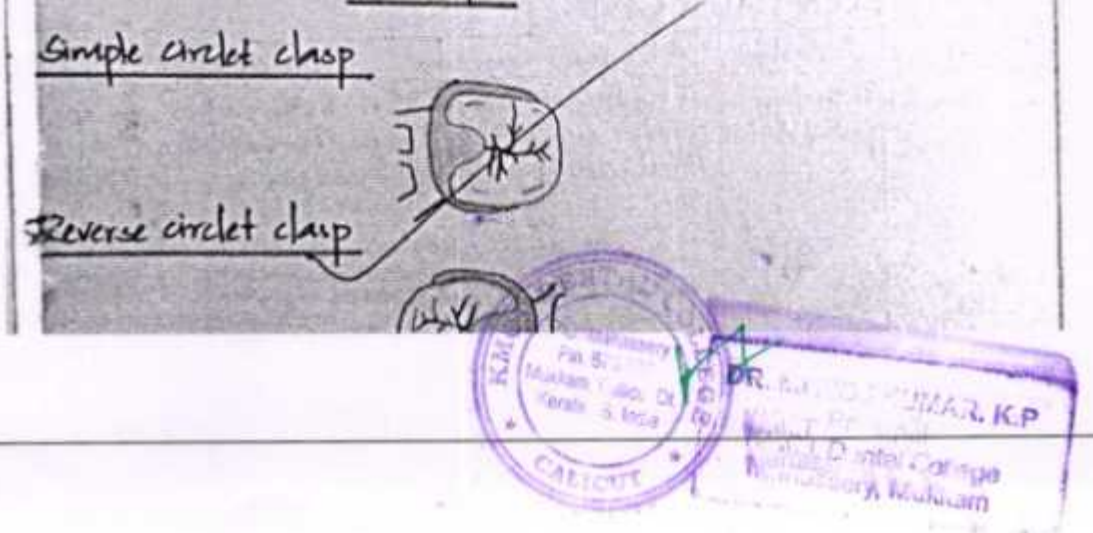
Types

- Intracoronal or Herman ES Chayes
- Extracoronal
  - Circumferential or Akers clasp or occlusally approaching clasp
    1. Simple circlet clasp
    2. Reverse, or reverse approach circlet clasp
    3. Multiple circlet clasp
    4. Embrasure clasp or modified crib clasp.
    5. Ring clasp.
    6. Fish hook or hairpin clasp.
    7. Onlay clasp.
    8. Combination clasp.
  - Vertical projection/bar/ Roach clasp/gingivally approaching clasp
    1. I clasp or I bar
    2. T clasp
    3. Modified T clasp
    4. Y clasp

CUMFERENTIAL OR AKERS CLASP OR OCCLUSALLY APPROACHING CLASP

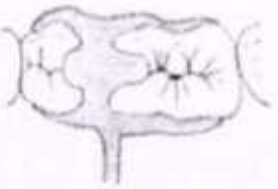
Simple circlet clasp

Reverse circlet clasp

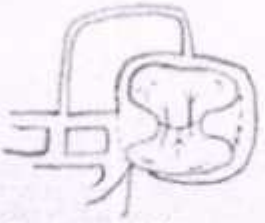


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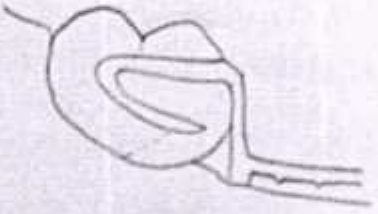
3. Embrasure clasp or modified crib clasp



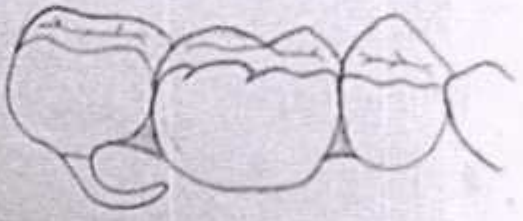
4. Ring clasp



5. Fish hook or hairpin clasp



6. Onlay clasp



CIRCUMFERENTIAL CLASP

Types of clasp	Indications	Advantages	Disadvantages
Simple circlet clasp	Tooth supported partial denture	•Easy to construct •Simple to repair •Most versatile clasp	•More tooth surface area is changes the morphology of the •Not accepted in the anterior due to aesthetics •Clasp cannot be adjusted the occlusogingival direction
Multiple circlet clasp	Showing of retention arms covered	Act as a form of splinting	•More tooth surface area covered changes the morphology

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	abutment teeth	weakened teeth	• Not accepted in the anterior tooth due to aesthetics • Clasp cannot be adjusted in the occlusogingival direction. • Need for two embrasures rather than a single common embrasure.
Ring clasp	Tipped molars	Occlusal rest of the clasp prevents further movement of the teeth.	• Large amount of tooth surface is covered by metal • Aesthetically objectionable.
Embrasure clasp	Class II and Class VI situation, used on side of the arch where there is no edentulous space	Single embrasure for two clasps.	High rate of fracture.
Fish hook or hair pin clasp	Lingual undercuts		1. Exposure of too much of metal, aesthetically objectionable. 2. Cannot be used on smaller crowns or teeth.
Onlay clasp	Occlusal surface of the primary abutment teeth below the occlusal plane.	Increases the height of the crown.	1. Teeth should be highly resistant to caries. 2. Chrome alloy onlays causes higher wear in opposing natural teeth.
Combination clasp	On abutment teeth adjacent to the edentulous space.	1. Wrought wire acts stress equalizer and helps to dissipate torquing forces, due to the greater flexibility it can be used in greater or deeper undercuts 2. Minimal surface contact.	Tedious lab procedure, breakage of clasp, distortion can happen due to the patient itself easily.

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1. I clasp or I-bar



2. T clasp



3. Y-clasp



4. Modified T-clasp



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Bar Clasps

Types of Clasp	Indications	Advantages	Disadvantages
I bar	1. Aesthetic regions 2. In distal extension partial denture.	Minimal tooth coverage	Encirclement and horizontal stabilization of is compromised.
T bar	1. Undercut on the distobuccal surface of abutment tooth 2. Used in tooth supported denture where the undercut is located adjacent to the edentulous space.	1. Minimal tooth coverage. 2. Reduce the torquing stresses. 3. Aesthetically superior to the circumferential clasp group.	1. Cannot be used on terminal abutment, if the undercut is mesial to the edentulous space. 2. Cannot be used over a soft tissue undercut.
Y bar	Height of contour on the facial surface is higher on the mesial & distal outlines & lower on the centre of facial surface.	1. Minimal tooth coverage. 2. Reduces the torquing stresses. 3. Aesthetically superior to the circumferential clasp group.	1. Cannot be used on terminal abutment, if the undercut is mesial to the edentulous space. 2. Cannot be used over a soft tissue undercut.
Modified T bar	Aesthetics	Least tooth coverage	Compromising encirclement for aesthetics

Factors influencing the flexibility of Clasp Design.

There are four factors which influence the flexibility of the clasp arm. They are:

1. Length of the clasp arm
2. Diameter of the arm.
3. Cross-sectional form of the clasp arm.
4. Material used.

Factors	
Length of the clasp	For L^3, flexibility is directly proportional to the length of the clasp arm
Diameter of the clasp arm	For $1/D^4$, flexibility is inversely proportional to the diameter.
Cross-sectional form	Flexibility increases in round form, flexibility decreases in ½ round form
Material used	1. Cast gold alloys are more flexible than Cobalt chromium Cobalt base alloys. 2. Wrought alloys are more flexible than cast alloys

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INDIRECT RETAINERS

-The effect achieved by one or more indirect retainers of a partially removable denture prosthesis that reduces the tendency for a denture base to move in an occlusal direction or rotate about the fulcrum line.

Factors Influencing the effectiveness of Indirect Retainers

1. The principal occlusal rests on the primary abutment teeth must be reasonably held in their seats by the retentive arms of the direct retainers.
2. Distance from the fulcrum line. The following three areas must be considered
   a. Length of the distal extension base
   b. Location of the fulcrum line.
   c. How far beyond the fulcrum line the indirect retainer is placed
3. Connectors supporting the indirect retainers should be rigid
4. Tooth inclines and weak teeth should never be used to support indirect retainers.

Forms of Indirect Retainer

a. Auxillary occlusal rest.
b. Canine rest.
c. Canine extension from occlusal rests.
d. Cingulum bar.
e. Rugae support.

TOOTH REPLACEMENT

Types

1. Porcelain or plastic denture teeth or denture base.
2. Facing.
3. Tube teeth
4. Reinforced acrylic pontics.

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DEPARTMENT OF PEDIATRIC AND PREVENTIVE DENTISTRTY

PRE CLINICAL WORKS

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REMOVABLE ORTHODONTIC APPLIANCES

Sl. No	Date	Op. No.	Name of Patient WORK DONE	Work Done WIRE BENDING	Staff Sign FABRICATION
1	20/9/21		Hawley's appliance		
2	17/9/21		Hawley's appliance with anterior bite plane		
3	17/9/21		Hawley's appliance with posterior bite plane		
4	18/9/21		Hawley's appliance with coffin spring		
5	28/9/21		Tongue crib	28/9/21	28/9/21.
6	25/9/21		Unilateral non functional removable space maintainer		
7	24/9/21		Unilateral functional removable space maintainer		
8	28/9/21		Bilateral non functional removable space maintainer		
9	23/9/21		Bilateral functional removable space maintainer		
10	20/9/21		Thumb guard		

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S.NO.	DATE	WORK DONE	SIGNATURE
1.	26/07/19	Slot Preparation in 55	
2.	26/07/19	Box cavity preparation in 65	
3.	26/07/19	Class I cavity prepared in 16.	
4.	26/07/19	Class II cavity prepared in 17.	
5.	26/07/19	GIC restoration in 55	
6.	26/07/19	GIC restoration in 65	
7.	2/08/19	GIC restoration in 16	
8.	2/08/19	GIC restoration in 17	

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