MAEER PUNE'S

M.I.D.S.R. DENTAL COLLEGE & HOSPITAL

DEPARTMENT OF ORTHODONTICS & DENTOFACIAL ORTHOPEDICS

Students Name SHREYA SADASHIV BAHIR.

Roll No _____ Batch _____

Exam No _____

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DEPARTMENT OF ORTHODONTICS & DENTOFACIAL ORTHOPEDICS

CERTIFICATE

This I to certify that Mr./Miss Shreya Sadashiv Bali

Exam seat no_____has attended and completed all the wire bending exercises and model analysis in the Department of orthodontics as per MUHS regulations.

Date :

INSTRUCTOR'S SIGNATURE

PROFESSOR & H.O.D
DEPT. OF ORTHODONTICS

WIRE BENDING EXERCISES

SR NO	DATE	NAME OF THE EXERCISE	GRADE	SIGN
		A)GLASS SLAB EXERCISES 2ND YEAR QUOTA		
1	05/03/21	Straightening of 19 gauge wire of 15 cm.	A+	
2	18/06/21	Straightening of 19 gauge wire of 15 cm.	A+	
3	23/01/21	Straightening of 21 gauge wire of 15 cm.	B++	
4	18/06/21	Straightening of 21 gauge wire of 15 cm.	B++	
5	16/07/21	Preparation of equilateral triangle with 19 gauge wire of 2 inch each side.	A	
6	16/07/21	Preparation of rectangle with 19 gauges wire of sides 2 x 1 inch.	B+	
7	17/07/21	Preparation of square with 19 gauges wire of 2 inch each side.	B++	
8	17/07/21	Preparation of circle of 5cm diameter with 19 gauge wire	A	
9	13/11/21	Preparation of 5 'U'- 'V' loops in a series with 19 gauge wire	B++	
		B)CAST EXERCISES 3RD YEAR QUOTA		
10	~~19~~/11/21	Preparation of "C" clasp with 19- gauge wire on ideal cast.	A+	
11	23/11/21	Preparation of "C" clasp with 19- gauge wire on patient cast.	A	
12	02/12/21	Preparation of full clasp with 19- gauge wire on ideal cast.	A	
13	02/12/21	Preparation of full clasp with 19- gauge wire on ~~ideal cast~~. patient cast.	A	
14	07/12/21	Preparation of Adam's clasp with 22- gauge wire on ideal cast.	A	
15	08/12/21	Preparation of Adam's clasp with 22- gauge wire on patient cast.	A	
16	14/12/21	Preparation of Short Labial Bow with 21&23- gauge wire on ideal cast.	A	
17	17/12/21	Preparation of Short Labial Bow with 21&23- gauge wire on patient cast.	A	
18	20/12/21	Preparation of Long Labial Bow with 21&23- gauge wire on ideal cast.	B+	

9	20/12/21	Preparation of Long Labial Bow with 21&23-gauge wire on Patient cost.	B+	
20	21/12/21	Preparation of Signal Cantillever spring with 23-gauge wire on 11and 21 ideal cost.	B+	
21	21/12/21	Preparation of Signal Cantillever spring with 23-gauge wire on 11and 21 patient cost.	B+	
22	23/12/21	Preparation of "Z" spring with 23-gauge wire on 11and 21ideal cost.	A	
23	10/02/22	Preparation of "Z" spring with 23-gauge wire on 11and 21patient cost.	A	
24	24/02/22	Preparation of Finger spring with 23-gauge wire on 11and 21in ~~patient~~ ideal cost.	A	
25	10/03/22	Preparation of Finger spring with 23-gauge wire on 11and 21 ~~ideal~~ patient cost.	A	
26	31/03/22	Preparation of "T" spring with 23-gauge wire on premolars in ideal cost	B+	
27	20/04/22	Preparation of "T" spring with 23-gauge wire on premolars in patient cost	A	
28	28/04/22	Preparation of Self Supported Canine Retractor with 23-gauge wire on both sides	A	
29	05/05/22	Preparation of Reverse/Helical Type Canine Retractor with 23-gauge wire on both sides	B+	
30	05/05/22	Preparation of "U" Loop Canine Retractor with 23-gauge wire on both sides	B+	
31	11/08/22	Preparation of Palatal Canine Retractor with 23-gauge wire on both sides	A	

C) APPLIANCE WITH WAX PATTERN

33	14/10/22	Hawley's appliance	B++	
34	17/10/22	Oral Screen	A	
35	19/10/22	Inclined plane	B++	
36	28/10/22	Removable appliance with "Z" Spring with Posterior bite plate	B++	

Basic Wire Bendine Exercise Obiectives

STRAIGHTENING OF WIRE :

Objective of the exercise is into familiarize with properties of austenite stainless steel during the process of straitening one gets approch cold working or stress incorporation. The plasticity and resistance both can be felt.

EQUILATERAL TRIANGLE, RECTANGLE AND SQUARE :

The aim of the exercise is to familiarize our self with a wire bending with pliers utilizing the plasticity/formability of austenitic stainless steel.

MAKING A CIRCLE :

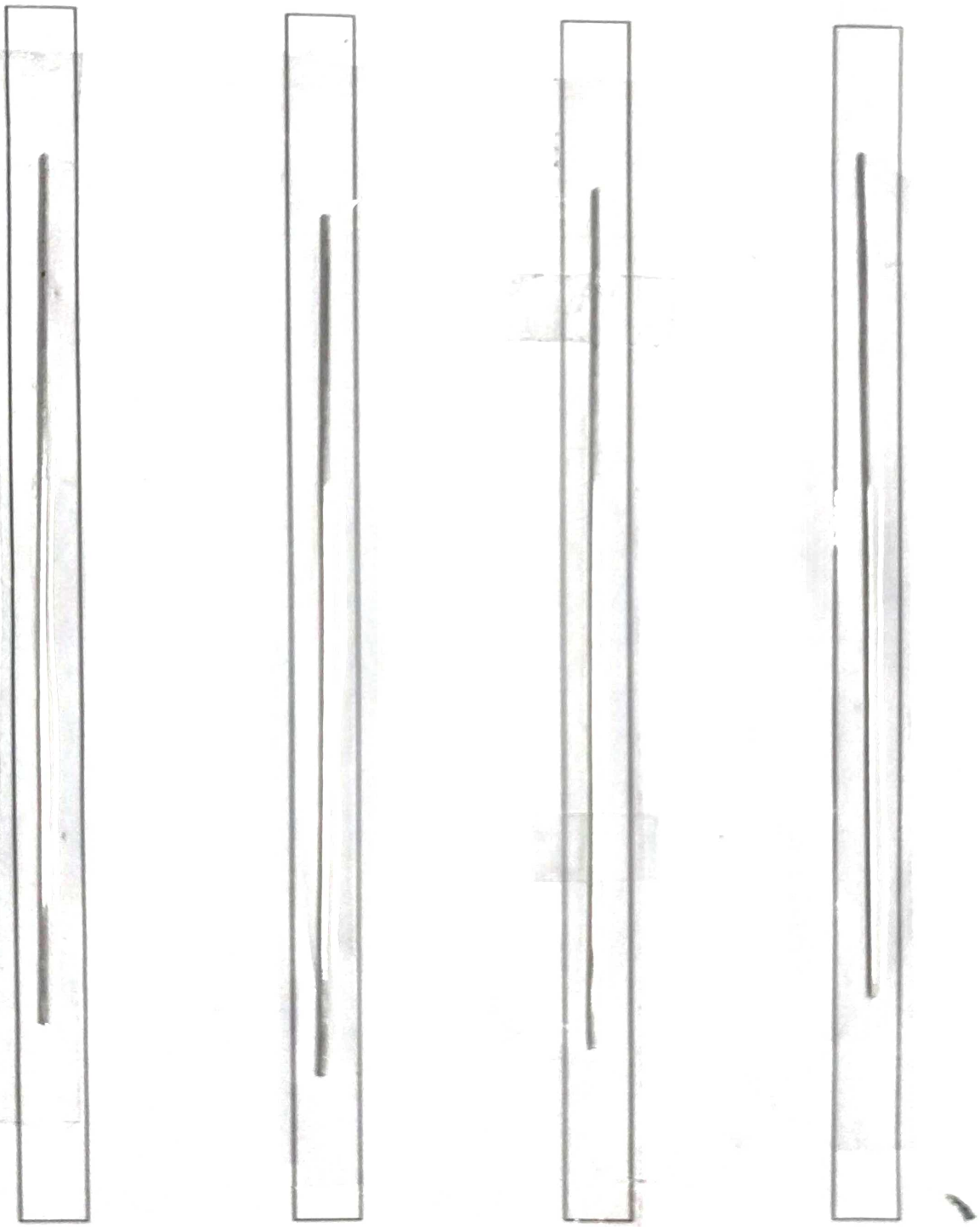
To familiarze our self by bending of wire using thumb and forefingers without using plier. In this exercise plasticity and formability of the stainless can be felt.

U'-'V' LOOPS IN A SERIES :

To familiarize the operator in forming sharp bends and maintaining the plane of the wire

Basic Wire Bending Exercise

STRAITENING



19Gauge

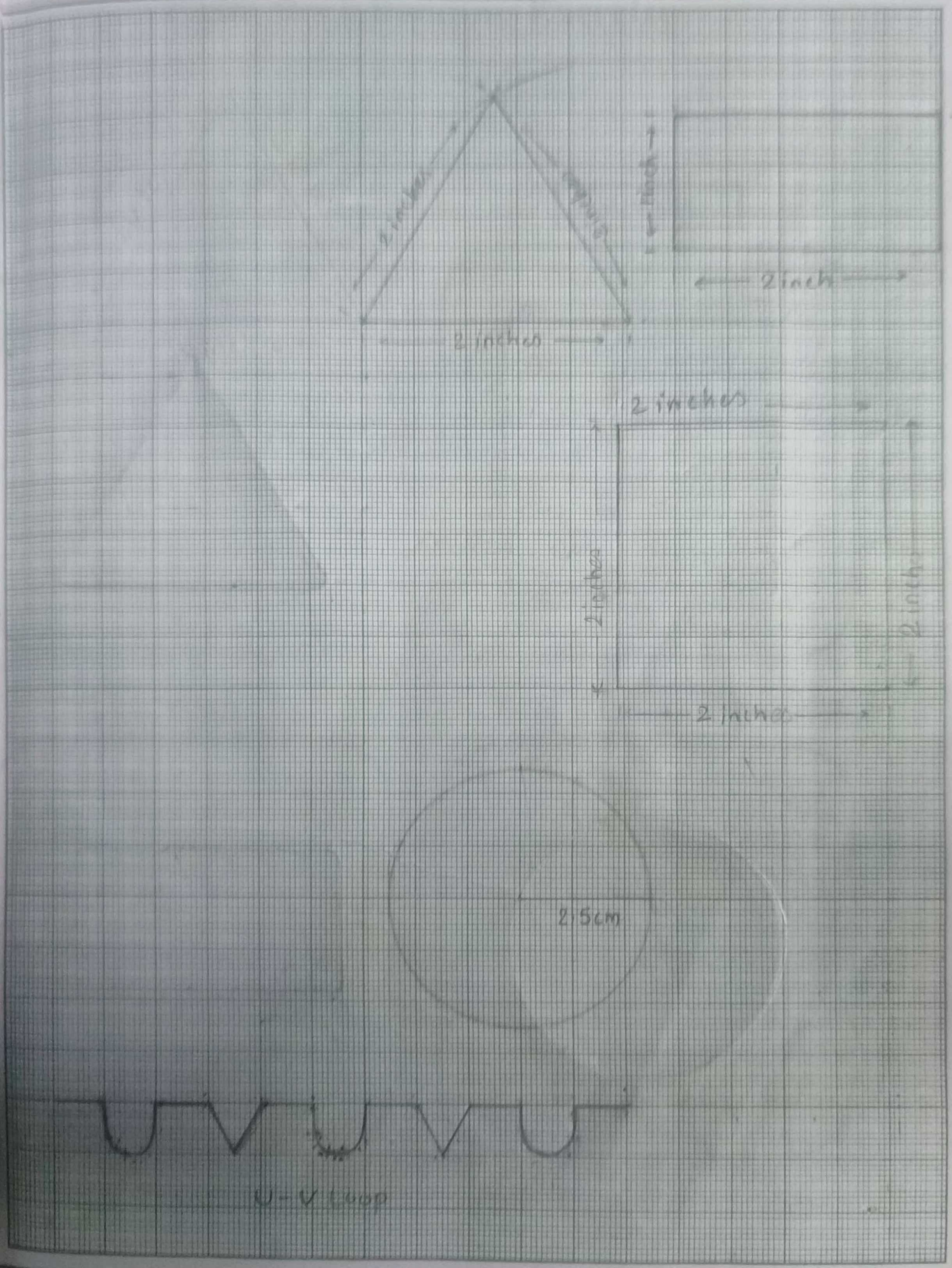
19 Gauge

21 Gauge

21 Gauge

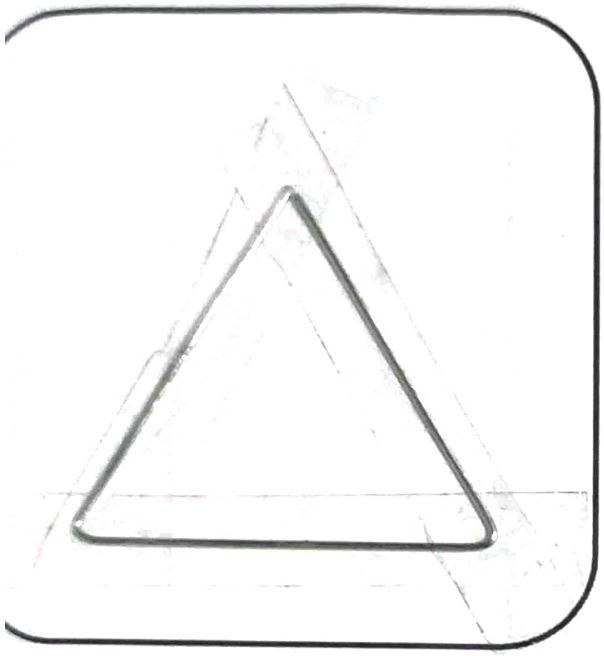
Name

Date / / 20

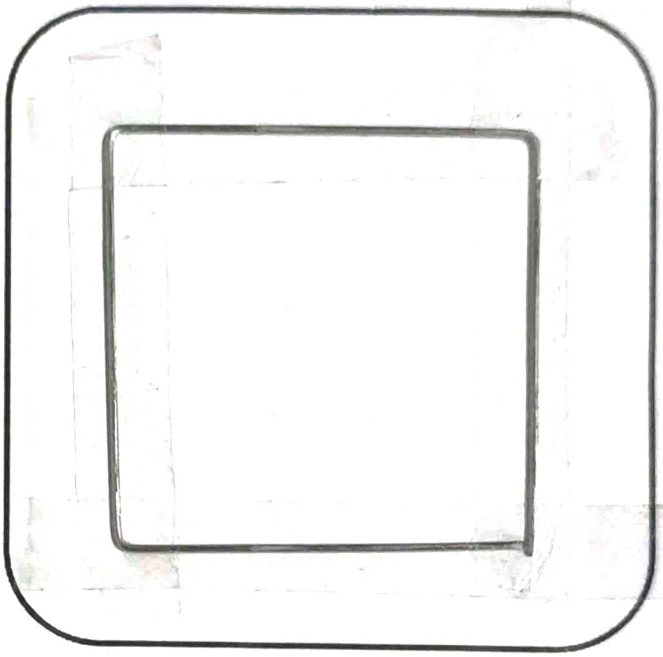

2 inches
2 inches
2 inches
2 inches
2 inches
2 inches
2 inches
2.5cm
U-V Lines

Basic Wire Bending Exercise

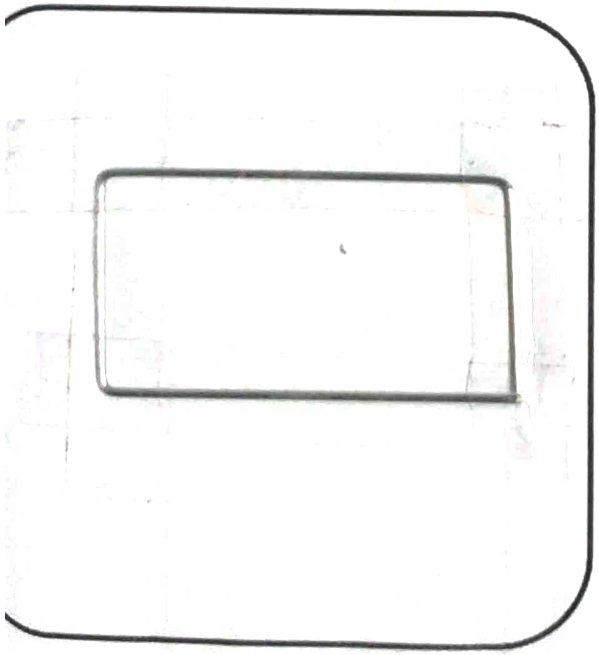
TRIANGLE



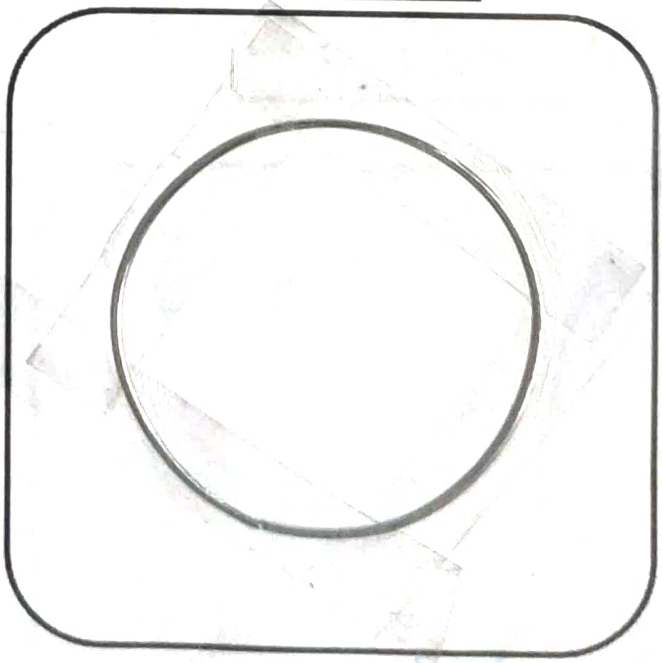
SQUARE



RECTANGLE

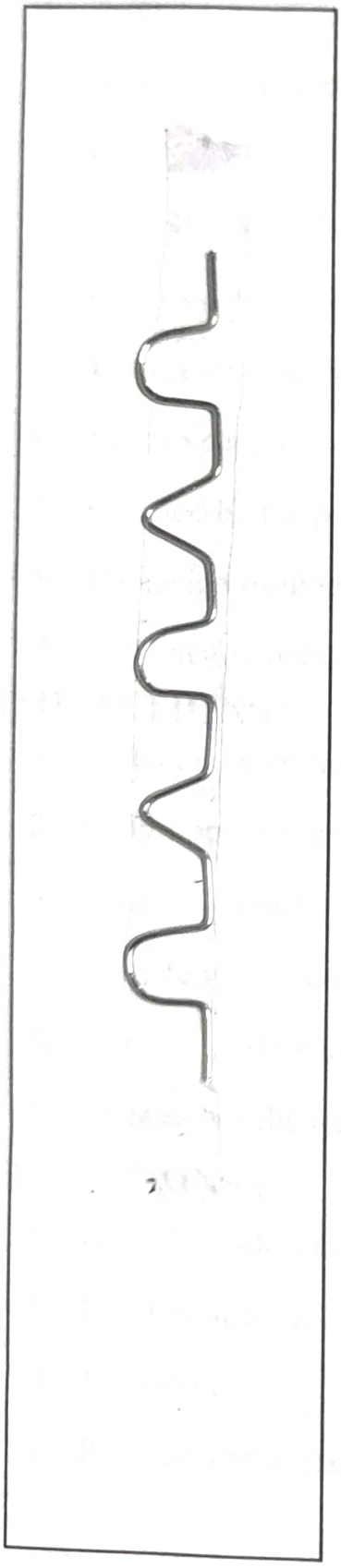


CIRCLE



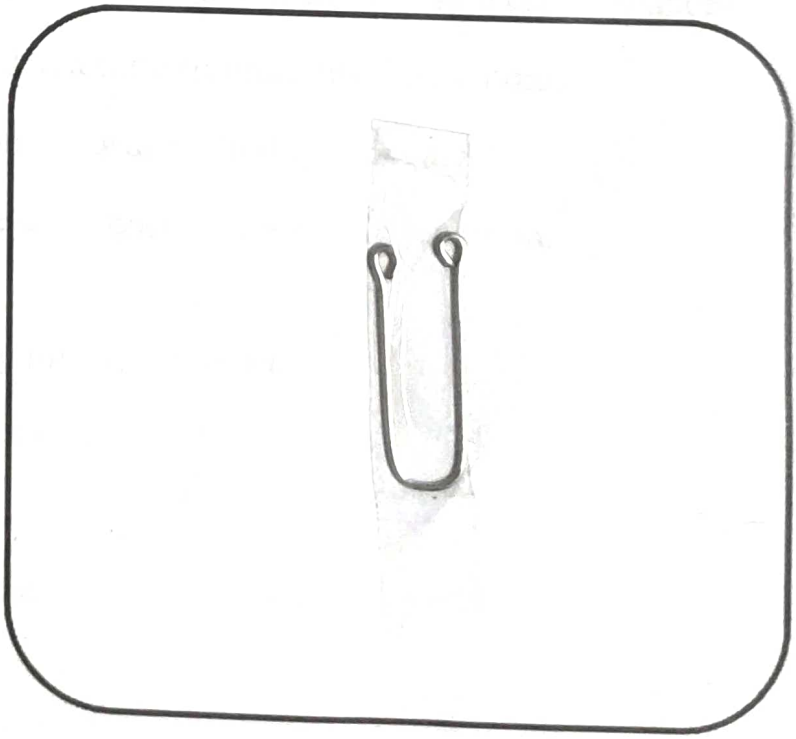
Basic Wire Bending Exercise

U'-'V' LOOPS



C-CLASP

U-CLASP



REMOVABLE APPLIANCE :

Removable appliance are orthodontic devices which can be taken out by the patient for cleaning and which are designed to apply forces to the teeth by means of springs screws and other mechanical components.

ADVANTAGES :

1. Tipping, overbite correction more readily undertaken.
2. less coplex control as less teeth moved at a time and simplle movements done.
3. Can eliminate occlusal interfernces.
4. Can be done be a genral practitioner.
5. Less chair side time.
6. Less expensive.
7. Cleaned by the patient.
8. If causign trouble to the patient can be removed.
9. Esthetically better.

LIMITIATIONS :

1. Patient cooperation necessary.
2. Only tipping is possible.
3. Rotation of only one or two teeth is possible if more than fixed appliances.
4. Only few teeth can be moved at a time so prolongs the treatment.
5. Can not be done in extraction cases as no bodily movement.
6. Encroaches the tongue space and hence a problem in retention.

INDICATIONS :

1. Growth modifications during mixed dentition.
2. Limited tipping, rotation required.
3. Arch expansion.
4. Retention after fixed treatment.

ORTHODONTIC APPLIANCE :

Orthodontic appliances are mechanical appliances by means of which pressure can be applied to a tooth or a group of teeth in a predetermined direction.

MECHANICAL APPLIANCES ARE DIVIDED INTO :

i Removable appliance

ii. Fixed appliance

iii. Semi-fixed appliance

iv. Sectional fixed appliance

ACTIVE APPLIANCE :

Appliance which have the means of creating and storing pressure are called as active appliance and these may be removable or fixed appliances.

PASSIVE APPLIANCE :

Passive appliance do not carry active component, they maintain the integrity of the arches or redirect the natural forces to bring about the desired changes.

Ex : Retention Appliance

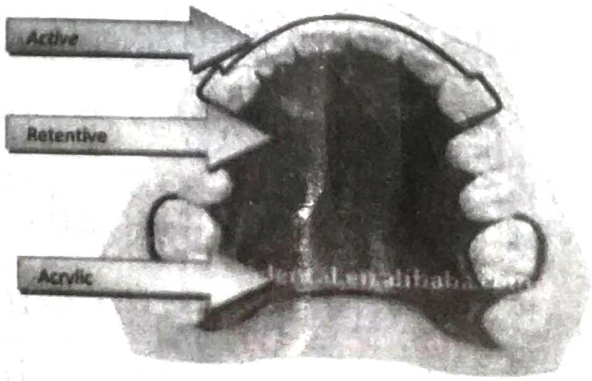
Space Maintainer

COMPONENT PARTS OF REMOVABLE APPLIANCES :

1) Active Component

2) Retentive Component

3) Acrylic Base Plate



24/06/21

STAINLESS STEEL

Stainless steel is the major alloy used in orthodontics. It is most widely accepted material. In 1950's stainless steel began to replace gold as an orthodontic wire.

'Steel' is iron based alloy that usually contain less than 2% carbon. When it contains 12 to 18% Chromium ; then the alloy becomes 'Stainless steel'.

In 1920s Harry Brealy of sheffield, FM Bracket of USA & Benno Strauss and Edward Maurs of Germany shared the honour for the development of the material.

- **History →**

i) It was first accidentally developed by a person Harry Brearely in sheffield, England.

ii) Stainless steel entered in dentistry in 1919 introduced at Krupe's Dental Polyclinic in Germany by F. Haupt meyer.

iii) In 1930s, Angle used it to make ligature wire

iv) By 1937, value of stainless steel as an orthodontic wire was confirmed.

v) Stainless steel was introduced for fabrication of orthodontic appliances in Ireland by Friel (1939)

vi) By 1950s stainless steel alloy was commonly preferred as an orthodontic wire.

- Manufacturing →

Steel is iron based alloy. The different classes of steel depend upon three possible lattice arrangements of iron.

i) Pure iron at room temperature has BCC (body centered cubic) lattice. This is referred as Ferrite.

ii) Ferritic stage is stable till temperature as high as 912°C due to low solubility of carbon 0.02%

iii) When ferrite is cooled down slowly from high temperature; the excess carbon that is not soluble in ferrite forms iron carbide (Fe_3C).

iv) At higher temperature between 912°C & 1394°C the stable form of iron is FCC (face centered Cubic) called Austenite.

v) Carbon has maximum solubility in Austenite - 2.1% by weight.

vi) When austenite is cooled down slowly the excess carbon that is not soluble in ferrite forms iron carbide. This hard, brittle phase adds strength to ferritic & austenitic forms of iron.

vii) If austenite is cooled rapidly (Quenched) it will undergo spontaneous (deformation) diffusion-less transformation to BCC lattice.

viii) Tetragonal structure called martensite is very strained & highly distorted, resulting in hard strong lattice alloy.

ix) Formation of martensite is important strengthening mechanism for carbon steels. This decompose into ferrite & carbide.

x) This process can be accelerated by heat treatment to reduce hardness. This is counter balanced by increasing toughness.

- Types of Stainless steel →

1) Ferrite.
2) Martensite.
3) Austenite.
4) Duplex.
5) Precipitation Hardening.

1) Ferritic Stainless steel →

i) AISI no. - 400 (AISI - American Iron & Steel Institute)

ii) Ferrite is the pure iron at room temperature having BCC lattice which is stable upto 912°C.

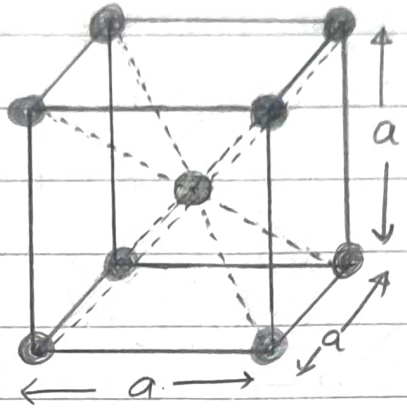
iii) Structure - lattice of Iron in ferrite is BCC i.e. Body Centered Cubic lattice.

iv) Properties →

a) Ferritic alloys provide good corrosion resistance at room temperature

b) They can't be hardened by heat treatment or readily work hardened.
c) They have less strength & hardness.
d) Ferrite is second most common form of stainless steel.

v) BCC lattice →



● → Iron atoms in BCC lattice.

vi) Composition →

Carbon (C) - 0.20% by weight.
Chromium (Cr) - 11.5 - 27% by weight.
Nickel (Ni) - 0%

vii) Ferrite has very less applications in Dentistry.

2) Austenitic Stainless Steel →

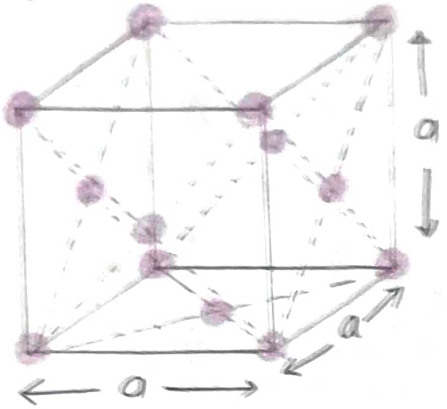
i) AISI no. - 302 to 304 series, 316
ii) At temperature between 912°C to 1394°C iron has (austenitic alloy form) FCC lattice ie. face centered cubic lattice.
iii) Composition →
a) AISI 302 stainless steel is basic type with composition -
① Carbon (C) - 0.15% by weight.

Fe - main constituent
C - Hardness
Cr - Corrosion resistance
Ni - Tarnish & Corrosion Resistance
Ti - Inhibit ppt. of Chromium Carbide

② Chromium - 18% by weight
③ Nickel - 8% by weight.

b) Type 304 stainless steel has almost simil
-r content with difference of extremely low
Carbon content → 0.08%.

iv) FCC lattice →



● → Iron (Fe) atoms in FCC lattice

v) Properties → Austenite is most corrosion resista
-nt of all three types of stainless steel alloy
which are most commonly used.

vi) Sensitization -

The austenite stainless steel may loose its corrosion resistance if it is heated between 400 to 900°c.

1. At this high temperature; there is precipita
-tion of Chromium carbide at grain boundri

2. The small rapidly diffusing carbon atoms migra
-te to grain boundries from all parts of the crystal to combine with large slowly diffusing Chromium atoms at periphery of grain.

Passivate = Process of Protecting a material from corrosion by specific alloying, a surface coating / Heat Tlt.

3. When chromium combines with carbon in this manner; its passivating effect is lost & corrosion resistance is lost.
4. Prevention - Use low fusing fluse & less time.

2) Stabilization → Includes methods to minimize sensitization.

① Keeping out of sensitization temperature
② Controlling the carbon content -
By stabilization, some element is introduced which precipitate as carbide in preferance to to chromium i.e. controlling carbon content by introducing Titanium.
- Titanium has 6 times more efficiency to inhibit the precipitation of Chromium carbide at soldering temperature than Carbon content.

) Greater ductility & ability to undergo more cold work without fracture.
Substantial strengthening during cold working (some transformation to martensite).
) Greater ease of welding.
Ability to overcome sensitization i.e Stabilization.
Less critical grain growth.
Comparative ease of forming.

These are the advantages of Austenite over other types & hence austenite is preferred over ferrite.

vi) Austenite is commonly preferred by orthodontists & Pedodontists in the form of Bands & wires.

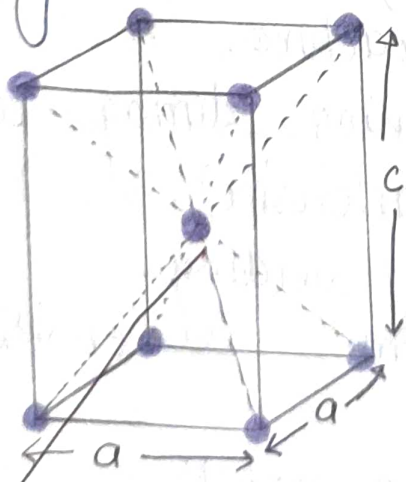
vii) Also used for production of dental instrument e.g. Scalpal blades & forceps, orthodontic wires, denture bases, Partial denture clasps endodontic posts & as stainless steel crowns for treatment of severely decayed primary molars.

3) Martensitic Stainless Steel →

i) AISI no: 400 series.

ii) When austenite is quenched at temperature very low, slowly it undergoes diffusionless transformation to BCT lattice

iii) BCT - Body Centered Tetragonal lattice.



● → Iron (Fe) atoms in BCT lattice

iv) Composition →

Carbon (C) - 0.15 to 1.20% by weight
Chromium C(r) - 11.5 to 17% by weight
Nickel (Ni) - 0 - 2.5% by weight.

v) Properties →

a) Martensite can be heat treated in same manner as plain carbon steel with similar result.

b) Corrosion resistance of martensite is less than other types & is reduced further following a hardening heat treatment.

c) When strength & hardness increases ductility decreases. It can decrease upto 2% elongation for high carbon martensite stainless steel alloy.

vi) Uses →

Due to high strength & hardness of martensite it is used to manufacture surgical instruments, cutting instruments & Bur shanks.

4) Duplex →

These steels have a microstructure which is approximately 50% ferritic and 50% austenitic. This gives them a higher strength than either of ferritic or austinitic steels.

i) They are resistant to stress corrosion cracking.

ii) They are weldable but need care in selection of welding consumables and heat input.

iii) They have moderate formability. They are magnetic but not so much as the ferritic, martensitic.

iv) Use - for manufacturing one piece brackets.

5) Precipitation Hardening → (PH)

i) These steels can develop very high steength by adding elements such as copper, Niobium & Aluminium to steels.

ii) With a suitable "aging" heat treatment, very fine particles form in the matrix of the steel which imparts steength.

iii) These steels can be machined to quite intical shapes requiring good tolerances.

iv) Corrosion resistance is comparable to standa d austenitic steels.

- Mechanical Properties of Stainless Steel →

1) Stress - Internal resistance of body to the external force is called stress.
Stress is the force per unit area within a structure subjected to a force or pressure

$$\text{Stress} = \frac{\text{Force}}{\text{Area.}}$$

i) Shear stress - Ratio of shear force to the original cross sectional area parallel to the direction of applied force.

ii) Compressive stress - Ratio of compressive force per unit area perpendicular to the direction of applied forces

iii) Tensile stress - Ratio of tensile force to original cross sectional area perpendicular to the direction of applied force.

2) Strain - Change in dimension per unit initial dimension. When stress produced inside the wire is not sufficient to withstand the external force (load) the body undergoes deformation (change in shape).

$$\text{Strain} = \frac{\Delta l}{l} = \frac{\text{Change in length}}{\text{original length.}}$$

3) Poison's ratio - within elastic range, the ratio of lateral strain to axial strain is called poison's ratio.

4) Proportional stress - The greatest stress that can be produced in material such that stress is directly proportional to strain.

5) Elastic limit - Maximum stress a material can withstand without undergoing deformation.

6) Yield strength - The stress at which a material exhibits a specified limiting deviation from proportionality of stress to strain.

7) Modulus of elasticity - Young's modulus
It represents relative stiffness or rigidity of the material within elastic range.

Young's modulus = $\frac{\text{Stress}}{\text{Strain}} = \frac{F/A}{\Delta L/L} = \frac{FL}{A\Delta L}$

F = Force A = Area of cross section

ΔL = Change in dimension L = original dimension

8) Flexibility → The maximum flexibility is defined as strain that occurs when the material is stressed to its proportional limits.

Maximum flexibility = $\frac{\text{Proportional limit}}{\text{Elasticity modulus}} = \frac{P}{E}$

9) Elastic strain - It is reversible strain. When force applied on the body is removed it recovers its original shape.

10) Plastic strain - Represents Permanent Deformation of material that doesn't decrease when force is removed.

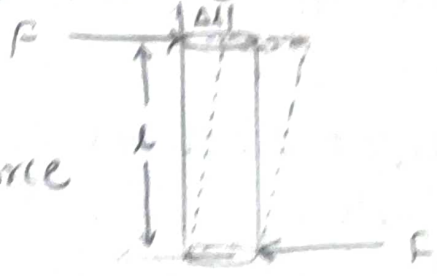
1) Tensile Stress

F = Tensile force

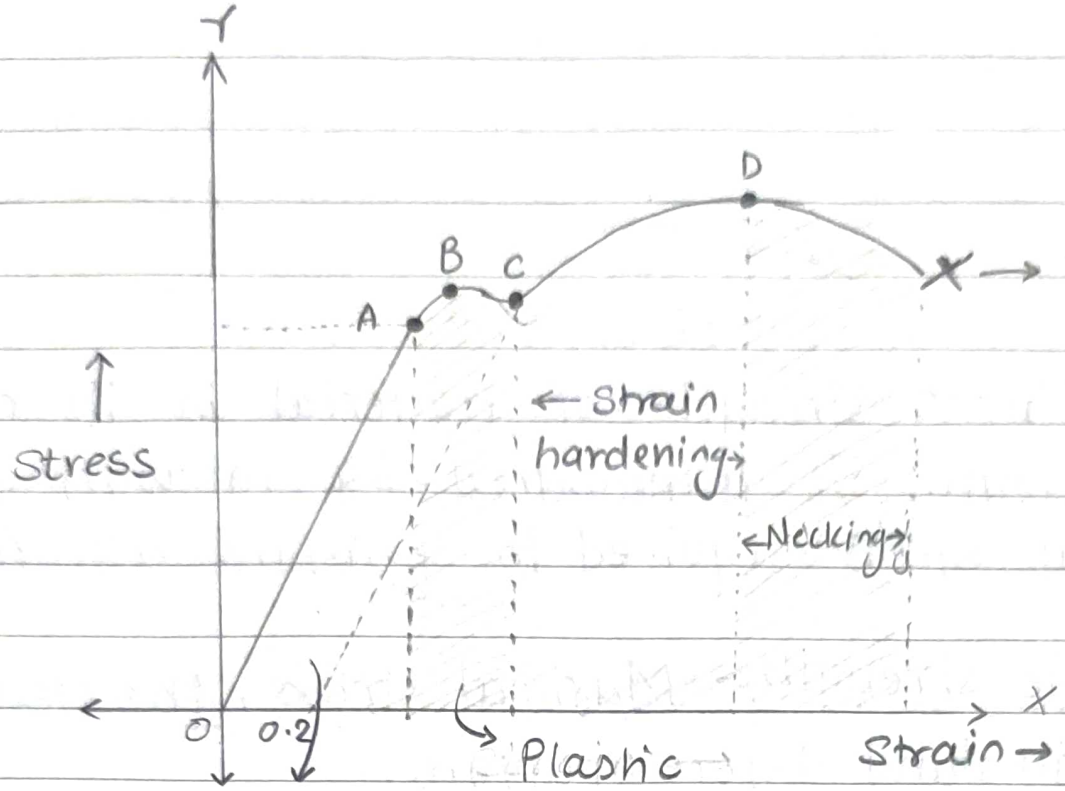
2) Compressive Stress

F = Compressive force

3) Shear Stress



F = Shear force



[ ] = Elastic Region

A = Proportional limit

B = Elastic limit

C = Yield strength

D = Ultimate tensile strength.

OA = Elastic behaviour.

CD = Plastic behaviour.

Stress-strain Plot for orthodontic stainless steel wire subjected to tension.

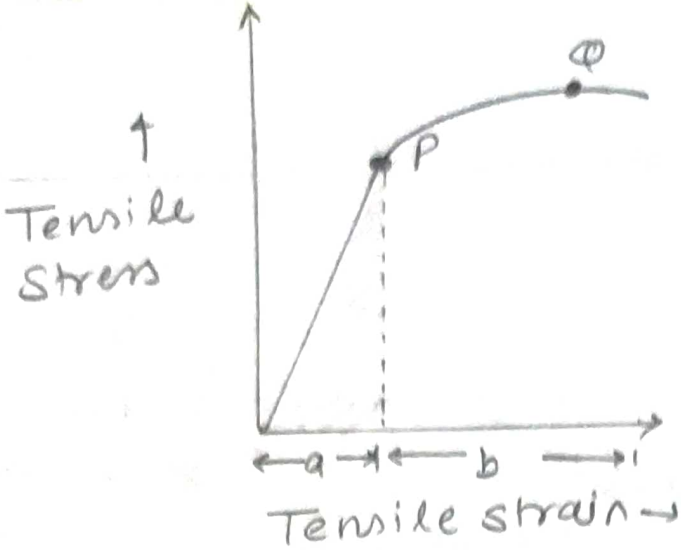
Proportional limit = 1020 MPa.

Yield strength at 0.2 % offset = 1536 MPa.

Ultimate tensile steength = 1625 MPa.

Elasticity modulus = 192,000 MPa.

ii) Resilience – Resilience is associated with 'springi-ness'. Defined as amount of energy absorbed by a structure when it is stressed not to exceed its proportional limits. It is measured as area under straight line portion of stress strain curve



P = proportional limit

Q = Ultimate tensile Strength

a = Elastic Strain

b = Plastic strain

▨ = Resilience

12) Strength → Strength of material is its resistance to fracture. It is measured by measuring the maximal stress required to fracture a structure.

i) Tensile strength - Maximal stress, the structure will withstand before rupture.

ii) Compressive strength - is determined by subjecting the cylindrical specimen to a compressive load.

iii) Shear strength - maximum stress a material can withstand before failure in a shear mode of loading.

iv) Transverse or flexural strength is obtained by three types of Tests - ① Threepoint flexural test ② four point flexural test ③ Biaxial flexural test

13) Ductility - ability of material to sustain a large permanent deformation under tensile load upto the point of fracture. Ability of material to be drawn into long thin wires

14) Malleability - Ability of material to sustain considerable permanent deformation without rupture under compression, as hammering or rolling into sheet.

Of the metals of interest in dentistry

Ductility - Gold > Silver > Platinum.
Malleability - Gold > Silver > Copper.

15) Hardness - Except for comparing one material to other the term hardness is difficult to define. The most commonly accepted concept is "Resistance to indentation".

- Cold working (strain hardening or work hardening) when most metal alloys have been stressed beyond their proportional limit, their hardness & strength increase at area of deformation, but; ductility decreases. As dislocations move & pile up along grain boundries; further plastic deformation in these areas become more difficult.
As a result, repeated plastic deformation of metal, as occurs during the bending of orthodontic wire or adjustment of clasp arm on removable dental prosthesis can lead to embrittlement of the deformed area of the wire.

- Physical Properties →

> Thermalconductivity - It is property of materials which represents that how easily heat can be conducted through material. Denoted by kappa 'k'.
Unit = watts per meter.

2) Density — Density is defined as mass per unit volume. unit = kg/m^3.

3) Electeical Conductivity - It is property of materia-s which represent that how easily the electei-ty can be conducted by material. Denoted by 'σ' (mho). Unit is mho/meter or siemen/meter

4) Thermal expansion - It is the term used to describe the change in dimensions that occur with most of materials as the temperature is raised or decreased.

5) Specific heat Capacity - Amount of energy neede-d to raise the temperature of unit mass by 1°C.

6) Viscocity - Ability to flow.

7) Colos - It is complex phenomenon that is a psychological response to a physical stimulus. Physical stimulus is light.

Property ↓ Alloy →	Stainless steel	Co. Cr, Ni	Ni, Ti	Beta-Ti
1) Elasticity modulus	179	184	41	72
2) Yield strength	1·6	1·6	0·43	0·93
3) Ultimate tensile strength	2·1	1·7	1·5	1·3
4) No. of 90° cold bend without fract-ure.	5	8	2	4

Property / Alloy	Density	Thermal Conductivity	Specific heat Capacity	Electrical Conductivity
	(kg/m³)	(watts/meter)		(Sieman/meter)
1) 304 Stainless steel	8000 kg/m³	8.09	0.120	1.37
2) 430 stainless steel	7750 kg/m³	8.11	0.110	1.28

- Chemical Properties → Electrochemical Properties:

1) Corrosion Resistance →

a) 'Corrosion' is the process by which deterioration of a material is caused by its reaction with external environment.

b) Iron based alloys containing 10.5% Cr produce a protective clear oxide layer which remain intact with surface of material regardless of the fabrication method.

c) Corrosion is either chemical or an electrochemical method, in each of which the first step is loss of electron → Oxidation

d) Austenite is most corrosion resistant type.

2) Galvanism → when two or more dissimilar metals are in direct physical contact; in presence of electrolytic medium they show sudden short circuit & can cause a sharp pain (in case of Restorations) known as Galvanic Shock.

3) Tarnish : Surface discoloration in case of metal or a slight loss of alteration in luster.

- Heat Treatment of Stainless steel →

Austenite cannot be hardened like carbon steel by Quenching & similar heat treatment. The only way to harden them is cold working. ① 'Softening heat treatment' → 'Annealing' ② 'Hardening Heat Treatment' → Tempering

1) Annealing of Austenitic steel → Includes 3 stages
① Recovery ② Recrystallization ③ Graingrowth

i) Stainless steel requires a higher temperature for annealing (1800°F to 2000°F) than carbon steel.

ii) At this high temperature all the effects of cold working are lost & alloy returns back to its most softened stage / workable stage.

iii) The process of annealing is very rapid & is very important for the corrosion control.

2) Stress Relief of stainless steel →

i) Stress Relieving is very important process for orthodontic steel performed at relatively low temperature.

ii) During work hardening, the atoms are stressed at intergranular level though; wire as piece is not under steers. But; when wire

Bands - stainless steel strip surrounding the crown
Tubes - allows the wire to slide through it. Square/Round

with such interval stresses is bent to produce spring action ; the previously stressed areas can't perform this action.

iii) Action of this wire is weakened by internal stress.

iv) 'Stress Relief' eliminates such kind of stress areas & puts it into most workable state.

v) This goes on usually at Room temperature.

vii) Stress relieving primarily depends upon temperature & time. In general low temperature treatment (400°F to 700°F) over long time period is desirable. But; arch formed in chair patient cannot be treated for several hours. Hence, most of the benefits of heat treatment can be produced in few minutes at low temperature 900°F.

i) Oven is the most reliable method for heat treatment because of relatively uniform temperature.

Clinical Applications of Stainless Steel Arch Wire

most important use of stainless steel in orthodontics is in form of arch wires.

Used for making orthodontic removable appliances like Clasps, springs, Bows, Retainers, etc.

Orthodontic Bands & tubes can also be made from stainless steel.

iv) Steel is standard material for many years to be used for orthodontic Brackets. Recently, Titanium brackets are introduced.

v) Australian arch wire is used in deep over bite correction as it doesnot undergo permanent deformation.

- Advantages →

i) Stainless steel arch wires are of lower cost
ii) Proven biocompatibility through extensive clini-cal used.
iii) Can be soldered / welded although welded joints may require solder reinforcement.
iv) Esthetics, Good strength & Formability.

- Disadvantages →

i) High force delivery
ii) Comparatively low springback than NiTi & Co-Cr alloys.
iii) Can be susceptible to intergranular corrosion after heating to temperature required for joining.
iv) Nickle Sensitivity →

① Nickle is most commonly used metal in stainless steel alloys.
② Ni causes - contact dermatitis.
③ NiTi wires (contain excess of 50% Ni) & stainless steel wires consist of higher content of Ni.

ℊ Nickle is most common metal to cause contact dermatitis in orthodontics due to allergic Reactions. Hence,

- Recent Advances →

Recently, New kind of stainless steel ie. nearly Nickle free austenitic stainless steel has been introduced to market.

⇒ Stainless steel is alloyed with -

Cr - 15-18%. (Chromium)
Mb - 3-4%. (Molybdenum)
Mn - 10-14%. (Manganese)
N - 0.9%. (Nitrogen)

to compensate for Nickle.

⇒ low Ni concentration causes less allergic potential.

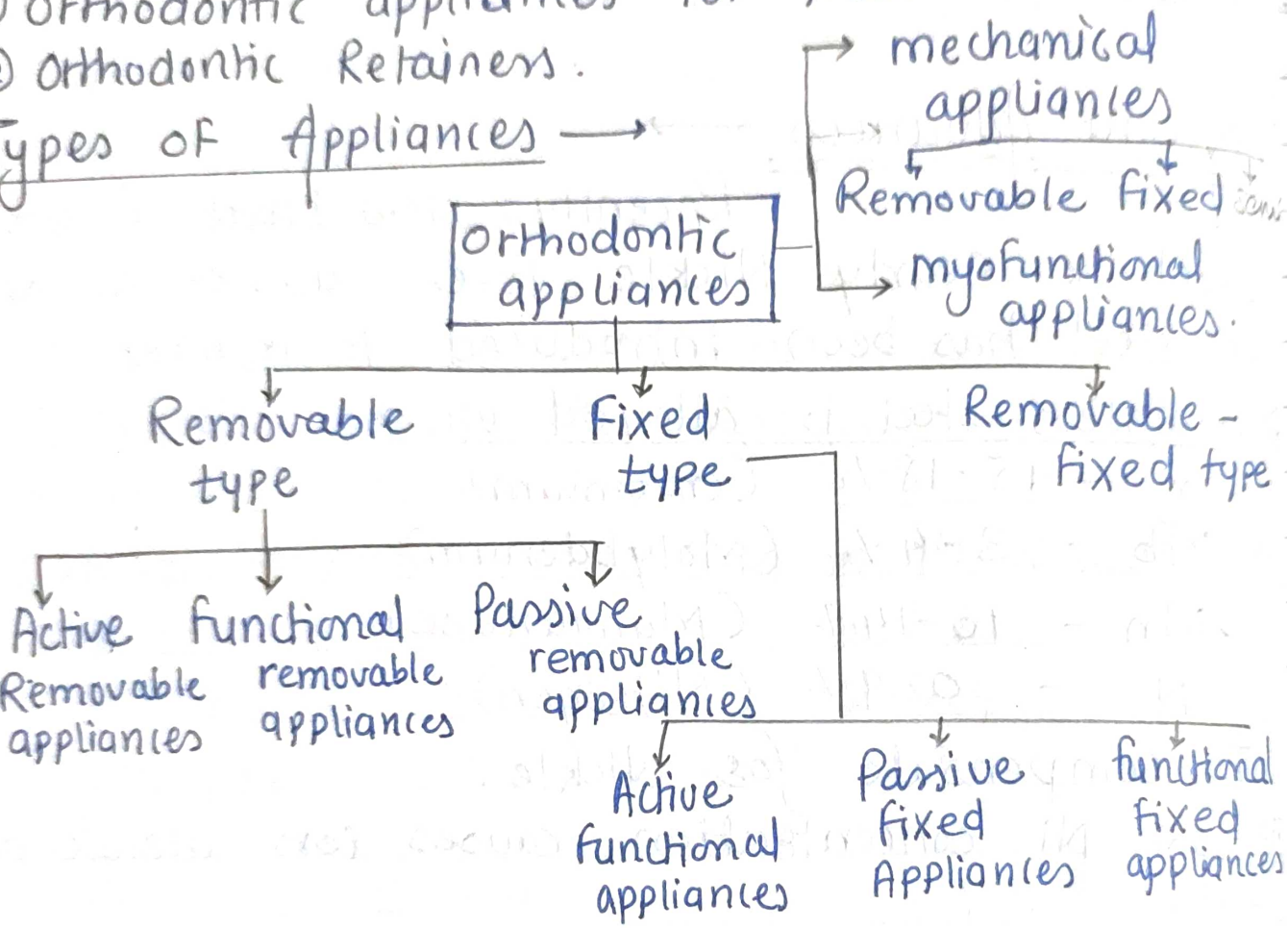
⇒ Orthodontic wires under names Manzanium or Noninium are already in market; unfortunately the melting ℊ formability of this steel is very costly.

REMOVABLE APPLIANCES in orthodontics

Basically orthodontic appliances can be classified into two; based on function -

① Orthodontic appliances for treatment.
② Orthodontic Retainers.

Types of Appliances →



- Removable orthodontic Appliances →

1) Definition →

The appliances which can be removed or inserted by patients in mouth at their own will. In other words, Removable appliances are those which are not fixed to teeth, but; can be removed by patient.

2) History of Orthodontic Removable Appliances →

Development of fixed appliances was preceeded by removable appliances.

i) Pierre Fouchard - Father of modern Dentistry entitled : 'The surgeon dentist : Treatise on teeth' published in 1728 described an expansion arch consisting horseshoe shaped strip of precious metal to which tooth was ligated.

fixed & sectional fixed.

ii) A german dentist - F.C. Kniesel was the first to use plaster model to record malocclusion in 1836. He used 'Chin strap' for his prognathic patients → First removable appliance.

iii) Vulcanite Plates - discovered by Charles goodyear in 1839 significantly reduced cost & weight of plates & dental appliances.
Goodyear accidentally discovered Sulphur crosslinking & rubber became functional (component) material.

iv) Discovery of PMMA - Polymethyl methacrylate & its use in dentistry substituted vulcanite plates with acrylic for orthodontic appliances.

v) Labial bow - First introduced by Charles Hawley in 1919.

vi) Victor Hugo Jackson - early 20th Century used vulcanite bases & precious metals

vii) Adam's A. Clasp - modification of original Jackson's clasp (1906) is Adam's Arrowhead Clasp.

viii) Adam's clasp which was known as Adam's Arrowhead clasp was introduced by Adams in 1950.

3) Indications of Removable Orthodontic Appliances

Due to inherent mechanical properties of removable appliances, they are most effective against simple tipping teeth.

1. Removable appliances are most effective in correcting:
   ① Cross bite
   ② Ectopic tooth position
   ③ Anterior spacing & overjet
   ④ Deep bite.
   ⑤ As an adjuant to more complex treatment with fixed appliances.
2. Growth modifications during mixed dentition
3. Limited rotation, tipping required
4. Arch expansion
5. Retension after fixed treatment.
6. However they are less efficient in treating
   1) Crowding movement
   2) Rotations
   3) Intraarch tooth
   4) Correction of molar relationship
   - ps:

4) Components of Removable Appliances →

3 basic Components: 1) Retentitive component
2) Active component
3) Baseplate

1. Retentive Component →

a) Help in keeping the appliance in place & resist displacement of appliance

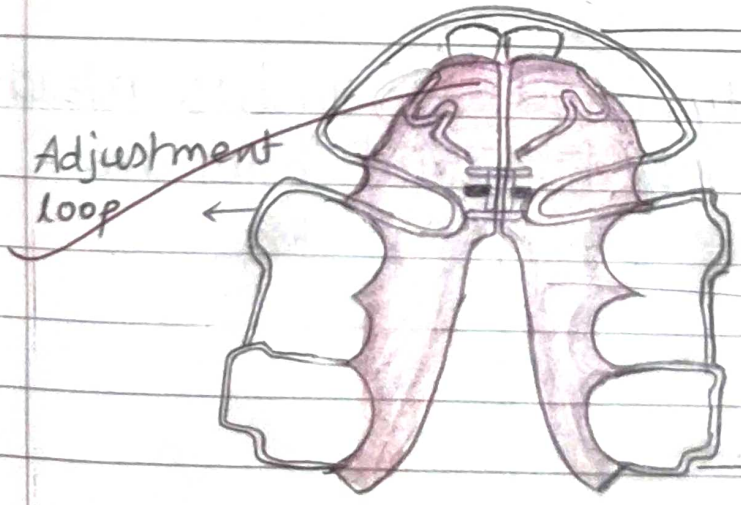
b) Retention of appliance in place & resistance displacement of appliance is achieved by incorporating certain wires components that engage undercuts of teeth.

c) These wire appliances which aid in retention are called as 'Clasps'

d) Hence, Examples of & Retentive components - various types of Clasps -

① Circumferential Clasps / 'C' clasp.
② Jackson's Clasp / Full clasp / 'U' clasp
③ Adams Clasp / Liverpool clasp / Universal Clasp
④ Southend Clasp.
⑤ Triangular Clasp.
⑥ Ball-end Clasp.
⑦ Schwarz Clasp / Single arrowhead clasp.
⑧ Crozat Clasp.

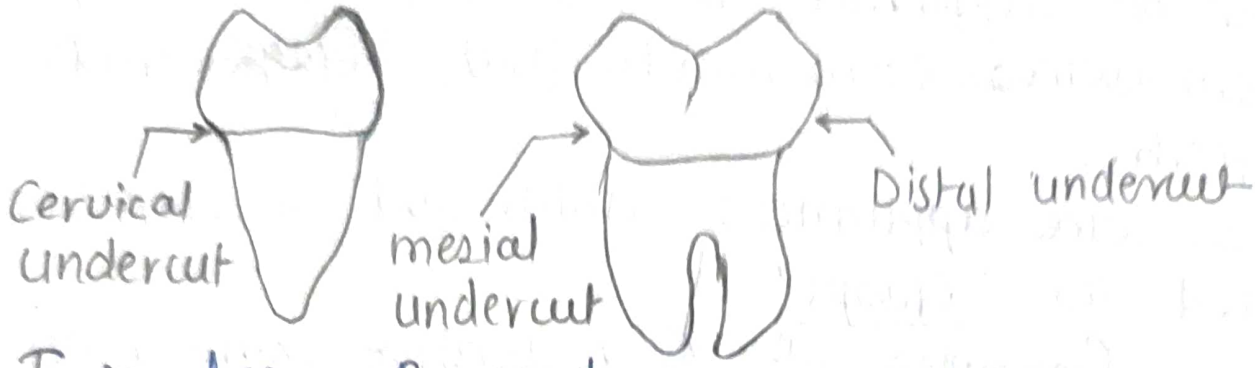
e) Components →



1) Active Components
   a) Labial bow
   b) Spring
   c) Retractor
   d) Elastics
2) Baseplate
3) Retentive Component.
   ↳ Clasp

f) mode of action of clasp → Clasps acts by engaging the constricted areas of teeth such

as undercuts.
When clasps are fabricated they are engage in the undercuts to prevent displacements



Two types of undercuts →

① Buccal & lingual Cervical undercuts.
② Mesial & distal proximal undercuts.

2) Active components →

These are the components of appliances that exert forces to bring about the necessary tooth movement. It includes -

i) Bows.
ii) Springs.
iii) Screws.
iv) Elastics.

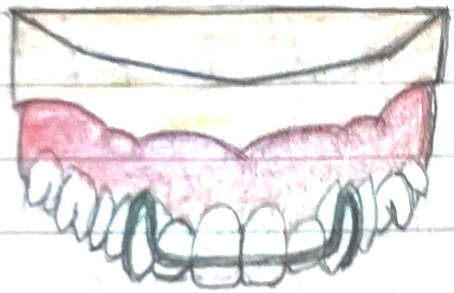
i) Bows - They are mostly used for incisor retraction. Some commonly used labial bows are -

a) Short labial bow.
b) Long labial bow.
c) Split labial bow.
d) Reverse labial bow.
e) Fitted labial bow.
f) Robert's Retractor.
g) Mill's retractor / Extended labial bow
h) High labial bow with apronsprings.

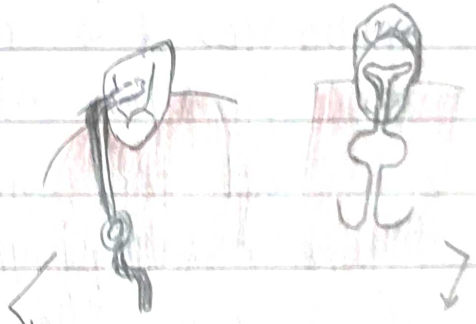
ii) Springs → Springs are active components of ROA that are used to affect various tooth movements. They are of various types -

① Finger spring / Single Cantilever spring
② Cranked single cantilever spring
③ Z spring / Double Cantilever spring.
④ T spring
⑤ Coffin spring
⑥ Canine Retractors – ⓐ U loop canine retractor
ⓑ Helical Canine retractor
ⓒ Buccal Canine retractor
ⓓ Palatal Canine retractor

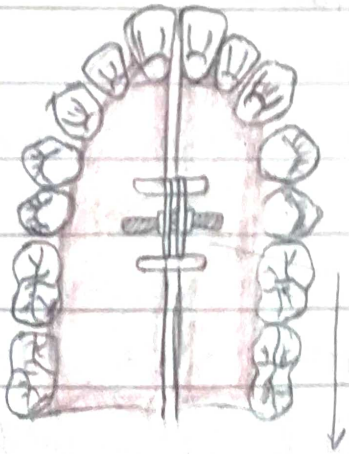
• active Components →



a) Short labial bow



b) Finger spring c) 'T' spring.



d) Screw of Removable appliances

e) elastics used in active components.

8 iii) Screws - They are active components used to bring about many types of tooth movements. Broadly the Removable appliances that make use of sp screws can be of bringing three types of tooth movements.

① Expansion of arch.
② Movement of one or a group of teeth in buccal & labial direction
③ Movement of one or more teeth in a distal or mesial direction.

iv) Elastics → They are active components used in conjunction with fixed appliances

4) Baseplate → The bulk of the removable appliances is made of acrylic baseplate.
- Prime function of Base plate is to incorporate all the components (active & Retentive) together into single functional unit.
- Use - i) Base plate helps in retention & anchorage in appliance.
ii) Units all components into one single unit.
iii) Helps in anchoring of appliance.
iv) Provides support for wire components.
v) Helps in distributing all the forces over large area.

- Cold cure acrylic resin is more likely to be used for as it is less time consuming
- Baseplate of 1.5 - 2mm thickness offer adequate strength.

5) Advantages of Removable appliances →

i) Removable nature of appliance make it possible for the patient to maintain good oral hygine during orthodontic therapy
ii) Many tooth movements like tipping, overbite reduction can be undertaken.
iii) These appliances take less chairside time.
iv) Fabrication of these appliances is less inventory
v) They are relatively less expensive than fixed appliances, ability to maintain oral Hygiene.
vi) Damaged appliances that offer undesirable forces can be removed by patient.
vii) Removable appliances are less conspicuous than multibanded fixed appliances.
viii) Most malocclusion require tipping type of tooth movement can be readily carried out using removable appliances.

6) Disadvantages →

i) As appliances can be removed by patient, Patient's cooperation is vitally required for the success of treatment. - main disadv.
ii) ROA are only capable of tipping tooth movements; this is major limitation of appliances.
iii) Multiple rotations are difficult to treat by removable appliances.

iv) In cases of requiring extractions: It is very difficult to close residual space by forward movement of Posterior teeth.

v) As the appliances are removable, there is greater chance of damaging or misplacing by patient.

vi) Patient should exhibit enough skill to remove and replace appliances without distorting them

vii) They cannot be used to treat severe cases of class II & class III malocclusions with unfavourable growth pattern.

7) Clinical Management of Removable Orthodontic Appliances →

• Delivery of appliances →

i) The tissue surface of appliances should not have any sharp points or nodules.

ii) Base plate may need some trimming for easy insertion & removal of it from mouth.

iii) Clasp should be examined for proper retention

iv) The active components should rest at desired locations. They should not impinge on gingiva.

v) The components can be activated after few days once patient gets use to with appliance.

• Instructions to patient →

i) Patient should be instructed about number of hours to wear.

ii) Appliances & teeth should be cleaned after every meal.

- Patient is asked to clean appliance with detergent & brush. Also to be cleaned before going to sleep.
- In case of appliances having springs & screws; patient & parents should have given clear instructions about there activation.
- Patient is instructed to visit immediately to clinic in case of domage to appliances.

- Problems encountered in the removable appliance therapy →

1) Oral hygine maintainance.
2) Soft tissue irritation.
3) Caries
4) Pain
5) Tooth mobility.

- Recent Advances in Removable appliances →

Transperant aligners - first introduced in US in 1999.

They have esthetic edge over visible fixed appliances as invisible braces due to their transperent color & lack of metal components.

Clasps

Name clasp is derived from french word UYPTAN mean to embrace.

Components of ROA

- Active Component
  - 1) Bows
  - 2) Screws
  - 3) Elastics
  - 4) Springs
- Retentive Component → CLASPS
- Baseplate

Definition :-

Adequate retention to removable appliance is achieved by incorporating certain wire components that engage under cuts of teeth. These wire components that aids in the retention of the removable appliances are called Clasps.

There are various types of Clasps :-

1) Circumferential clasp / C clasp / three quarter clasp.
2) 'U' clasp / Jackson's clasp / full clasp.
3) Adam's clasp / Liverpool clasp / Universal clasp / modified arrowhead clasp.
4) Southend clasp.
5) Triangular clasp.
6) Schwarz clasp.
7) Crozat clasp
8) Ball end clasp.

- **Mode of action of Clasps :-**

Clasps act by engaging the constricted areas of teeth that are known as undercuts. There are two types of undercuts:

1) Buccal & lingual undercuts.
2) Proximal (mesial & distal undercuts)

1) **Buccal & lingual undercuts** : Cervical undercuts present on buccal & lingual surfaces of tooth

1. Can be seen from mesial aspect of tooth
2. Examples of clasps engaging into the Cervical undercuts - Circumferential Clasp.
   Jackson's clasp.

2) **Mesial & distal Proximal undercuts :-**

The molars are widest teeth mesiodistally at the contact point & gradually taper towards cervical margin.

1. These surfaces sloping from mesial & distal contact areas towards the neck of the teeth are called mesial & Distal proximal undercuts.
2. Can be seen from buccal aspect of molar
3. Proximal undercuts are more pronounced than buccal / lingual cervical undercuts hence provide more retention.
4. Examples : Adams Clasp.
   Crozat Clasp.

• Ideal requirements of Clasp:

1) Should provide adequate retention.
2) Clasp should not impinge into soft tissue
3) It should provide adequate retention even in partially errupted teeth
4) Also should permit usage ~~in~~ even in presence of shallow undercuts.
5) They should not apply/ exert any active force on the tooth to cause movement.
6) Should be easy to fabricate.
7) Should not interfere with normal occlusion

• Uses -

1) To secure appliance in position.
2) To prevent rolling of appliance.
3) To resist forces of displacement.
4) To provide retention & anchorage.
5) For engaging elastics.

⊙ Clasp that engage into the mesial & distal cervical undercuts is more useful & more efficient than clasp engaging into buccal & lingual undercuts. Because -

1. Proximal undercuts begin below the contact point.
2. They are accessible ~~only when~~ very soon after the tooth has errupted.

3. Buccal & lingual cervical undercuts are less extensive & are accesible only when the tooth is partially fully errupted.

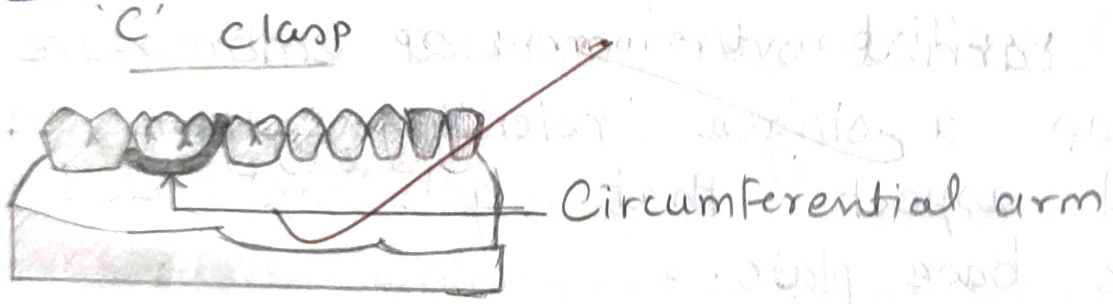
Circumferential Clasp

1. Also known as 'C' clasp or three quadrant clasp
2. It is simple clasp to engage into cervical undercut.
3. Fabrication:
1) wire is engaged from one proximal undercut along cervical margin.
2) Then carried over occlusal embrassure to end up a single retentive arm on the lingual aspect that gets embedded in acrylic base plate.
4. Parts:
1) Circumferential arm.
2) Retentive arm.
3) Interocclusal arm.
5. Advantages:
1) Simple design & easy to fabricate.
2) Prevent mesial migration of tooth.
3) Better undercut rest.
4) No gingival impingement.
5) less cost.
6. Uses:
To offer adequate retention to removable appliances in premolar & molar region.

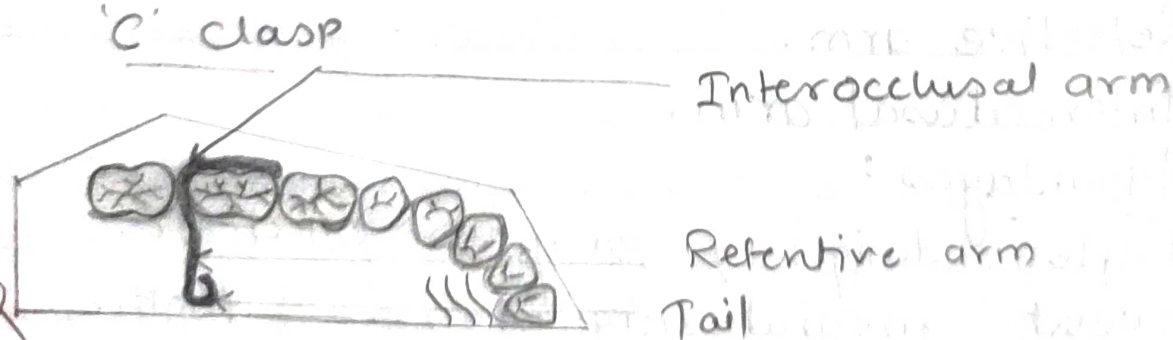
7. Disadvantages:

1) Can't be used in partially errupted teeth.
2) Inadequate retention in primary teeth.
3) Used only in premolars & molars can't be used in anteriors.
4) It is difficult to adjust & easily set ow
5) It tends to creat space between teeth due to wedging action as made from thicker gauge wire.
6) If it breaks; it can't be repaired.

Parts of 'C' clasp:



Buccal view



Occlusal view

Full Clasp / U Clasp

1. Also known as Jackson's clasp as it was invent-ed by V.H. Jackson in year 1906.

2. mode of action - U clasp gets engaged into bucco-cervical undercut and also mesial as well as distal proximal undercut.

3. fabrication -

① Armamentarium :- 1) 0.8 mm stainless steel wire
2) Universal plier
3) Marking pencil
4) Wire & Cutter.

② Procedure :-

1. Jakson's clasp is used on premolars & molars
2. Begins to form the clasp from buccal aspect
3. Take a piece of wire of about 5 inches & start working from its center, adapting the wire on to the buccal surface of tooth. to lie below maximum bulge area & above gingival margin.
4. Continue to adapt the wire across the buccoproximal line angles into the proximal embrasure crossing the contact point and the occlusal embrasure on lingual surface.
5. As it reaches the gingival crest raise it slightly & adapt it over the lingual or palatal surface leaving some space for the flow of acrylic resin.

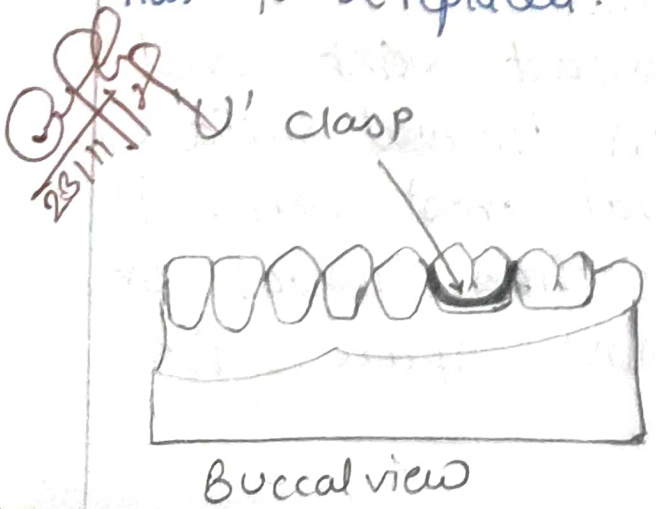
6. A small bend is given at the end of retentive arm for retention of clasp in acrylic resin

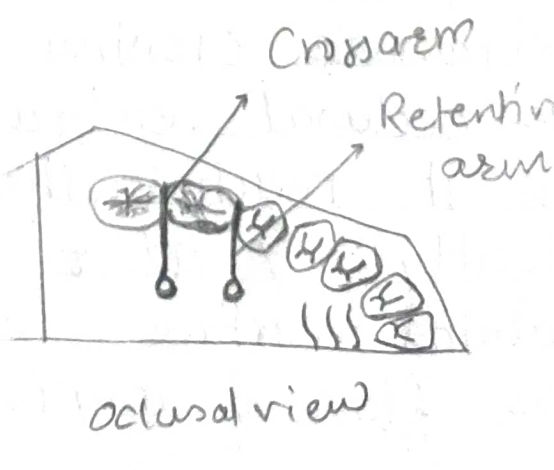
7. Adjustment: Adjusted by bending the clasp towards the tooth by holding it at contact point.

8. Indication: To provide retention to removable appliances in premolar & molar region.

9. Advantages:
1) Simple to construct.
2) Adequate retention.

10. Disadvantage:
i) Can't be used in anterior region
ii) Inadequate retention in partially erupted teeth.
iii) Can't be used in deciduous teeth as there is no infrabulge area.
iv) As fabricated from thicker gauge wire; it can't be adjusted easily
v) If it breaks, its can't be repaired. Whole clasp has to be replaced.





Adams Clasp

1. Adams clasp was first described by profes-sor Phillip Adams.
2. It is also known as -
   ① Liverpool Clasp
   ② Universal Clasp
   ③ Modified arrowhead clasp.
3. Indications - Adams clasp is used when
   i) Growth modification during mixed dentition
   ii) Limited tooth movements, desired arch expan-sion
   iii) Retention to Removable orthodontic appliances in orthodontic Treatment.
4. iv) Contraindication - Can't be used in severely crowded teeth, In severe rotations, Severe skeletal discrepency.
5. Parts of Adams Clasp : ① Arrowheads.
   ② Bridge.
   ③ Retentive arms.

① Arrowheads - get engaged into buccoproximal undercuts & Are connected through bridge.

② Bridge - Connects two arrowheads & is at 45° angulation to long axis of tooth.

③ Retentive arm - Rests on palatal or lingual surface of tooth.

6. Fabrication of Adams clasp :-

I] Armamentarium : ① 0.7 mm SS wire
② Adams Plier
③ Wire cutter
④ Glass marking Pencil.

II] Steps :

1) Step - 1

The mesial & distal undercuts are marked on the cast (molar tooth). The distance between these two marks would form the length of bridge of Adams.

2) Step - 2 :

22 Gauge (0.7 mm) wire is used. One 90° bend is given.

3) Step - 3 :

The wire is placed on model & distance between mesial & distal undercuts is marked on the wire.

4) Step - 4 :

The other 90° bend is given thus forming the bridge of Adams clasp

5) Step - 5 :

Round beak of the universal plier is placed on the outer side close to the bridge of the Adams.

6) Step - 6 :

Wire is bent around to form the U. thus forming arrowhead.

7) Step - 7:
The arrowhead is squeezed between the two beaks of plier to make it as narrow and pointed as possible. Same is done on othe side.

8) Step - 8
Arrowhead is given 45° bend so that the arrowhead is at 45° to bridge. ~~to~~ same done on other side.

9) Step - 9
The outer arm of arrowhead is given 90° bend at height that is half the arrowhead.

10) Step - 10
Adams is placed on tooth so that arm rests in the embrassuee. Same is done on the othe -r side.

11) Step - 11
Both arms are adapted on occlusal embrassures

12) Step - 12
Place a mark beyond the palatal side of contact area

13) Step - 13
The palatal tag is bent down & is slightly kinked to form a step over the margin of ginging. The palatal wire is adapted to be paralle

-- l to the plaster.

14) Step - 14 :
The end is cut off & is bent to rest on palatal surface.

15) Step - 15 :
When viewed from occlusal aspect bridge must be at 45° angle to buccal surface. & long axis of tooth.

16) Step - 16 :
When viewed from buccal aspect ; bridge should be parallel to occlusal plane.

7. Advantages of Adams Clasp :

i) Adams clasp is rigid & offers adequate reten -tion to ROA.
ii) It can be fabricated on Deciduous as well as permanent teeth.
iii) It can be fabricated in partially or fully errupted teeth.
iv) Can be fabricated on incisors, premolars & molars.
v) No specialized instrument is required to fabricate the clasp. Young's universal plier can be routinely used
vi) It is small & occupies less space
vii) If fractured it can be repaired by soldering
viii) Clasp can be modified in number of ways

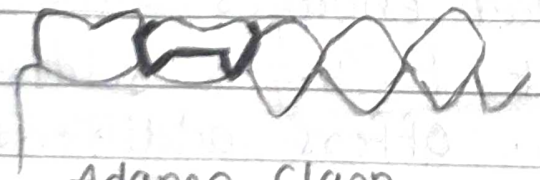
ix) In case of short clinical crown; the gingival papillae is carved out on the cast to expose undercuts.

x) If required clasp can be preadapted by trimming the buccoproximal undercuts.

8. Modifications of Adams clasp:

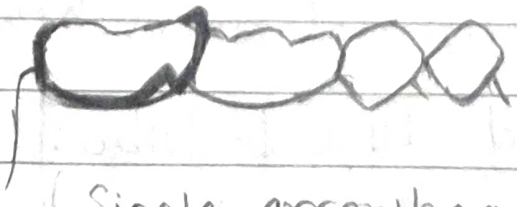
1) Adams with Single arrowhead.

- Indicated in partially erupted teeth (molars)
- Single arrowhead is made to engage into mesio-proximal undercut of last erupted molar.
- The bridge is modified to encircle the tooth distally and ends on the palatal aspect as retentive arm.



Adams Clasp
(Buccal view)

Adams Clasp
(occlusal view)



Single arrowhead Adams clasp
(Buccal view)

2] Adams with 'J' Hook :

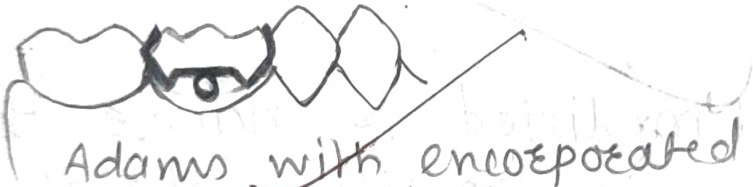
J hook can be soldered on to the bridge of Adams clasp. The hook is useful in engag-ng the elastics.

[2]

Adams with modified 'J' Hook.
(Buccal view)

3] Adams with incorporated Helix :

Helix can be incorporated into the bridge of Adams. This also helps in engaging helix.



Adams with encorporated Helix
(Buccal view)

4] Adams with additional arrowhead:

Additional arrowhead canbe encorporated into Adams. Additional arrowhead engages bucco-proximal undercut of adjacent tooth & is soldered on to the bridge of Adams. Offers additional retention.

Adams with additional arrowhead

5] Adams with Soldered buccal tube:

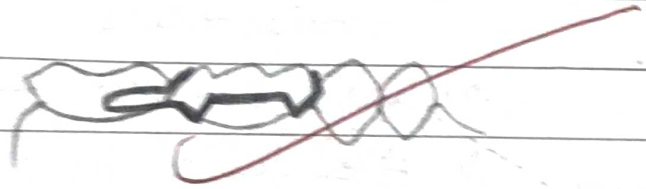
- A buccal tube can be soldered on to the bridge of the Adams clasp.
- The modifications of adams clasp permit the

use of extraoral anchorage using face bow head gear assembly.

Adams with soldered buccal tube

6] Adams with distal Extension –

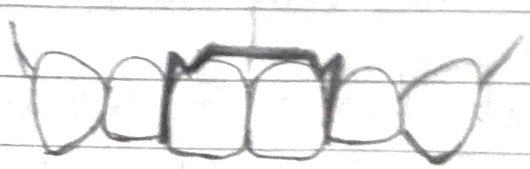
- Distal arrowhead has a small extension incorporated distally.
- This distal extension helps in engaging elastics



Adams with distal extension
(Buccal view)

7] Adams on incisors & Premolars –

- When retention in incisors & premolars aregion is required; Adams can be fabricated in this area also.
- They can be constructed to span a single tooth or two teeth.



Adams clasp on incisors (Buccal view)

Labial bow

Definition:

Labial bow is that component of removable appliance, which help in retracting and retaining anterior teeth and also contributes for the retention of appliance.

1. Bows are active components of removable orthodontic appliances.
2. **Types of Labial Bows:**

1) Short labial bow.
2) Long labial bow.
3) Split labial bow.
4) High labial bow
5) Soldered labial bow
6) Reverse loop labial bow.
7) Roberts retractor.
8) Mills retractor.
9) Labial bow with self straightening
10) Labial bow with elastics
11) Fitted labial bow.
12) Ricketts retention bow
13) Begg retention bow
14) Miscellaneous.

3. **Three parts of labial bow:-**
   1) Horizontal bow portion.
   2) Vertical loops.
   3) Retentive arms.

4. **Uses:**
   1) It is used for retraction of anterior teeth
   2) It is used for retention of teeth after active orthodontic treatment is completed.
   3) Used for reinforcement.
   4) It can be used for attachment of auxillary springs
   5) It can also be used for carrying Soldered attachments.

5. Selection of labial bow:

Labial bows are mainly used for retraction & retention of teeth, (after active orthodontic treatment).

There are many designs of labial bows. Type of selection of labows depends upon following factors:

1) number of teeth to be moved.
2) Severeity of protrusion of teeth.
3) Purpose of labial bow.
4) Location of spacing of teeth.
5) Preference of clinician.

6. Construction of labial bow:

- Armamentarium: wire, wire cutter, plier.

1) Dispence the wire from the spool.
2) Measure the wire from one molar accross to the other molar area along the labial or buccal surfaces of teeth and cut it with wire plier cutter.

1. Stainless steel wire of 0.6 mm → Retraction.
2. Stainless steel wire of 0.7 mm → Retention.
3. Stainless steel wire of 0.8 to 1mm → Reinforcement.

3) Adapt this piece of wire on labial surfaces of teeth with help of fingers at junction of incisal & middle third of tooth.
4) Place two marks on bow ~~Correcting~~ corresponding

to contact points between the lateral incisos and Canine on either side. Place two right angled bends on the bow at the points marked. Bend should be towards gingival margin.

5) Make mark on the vertical arm at about 2mm beyond the free gingival margin on either side form the loops at the marked points using round beak of young's loop bending plier.

6) The loops should be formed above the gingi-val margin and should be short of the sulcus to prevent irritation to soft tissues.

7) Care should be taken to keep it away from frenal & muscle attachments

8) The distal arm of the vertical loop is adapted on to the palatal & lingual surfaces of cast to form tagum as in the case of clasp construction

9) Care is taken to see that the labial bow remains at junction of the middle & incisal thirds of anterios teeth while adapting the tagum or retentive arm.

- Construction of short labial bow for retention:

Construction is similar to construction of short labial bow for retraction only modification

is the
1. Horizontal bow portion is at middle third of teeth.
2. Vertical bend or right angle bend, to form a loop, is given at ther mesial one third of canine.

• Contraindication - labial bow is :-

1. Contraindicated in case of severe proclination of anterior incisors because the horizontal bow portion has a tendancy to slip gingivally when activated, due to inclined plane effected of teeth.

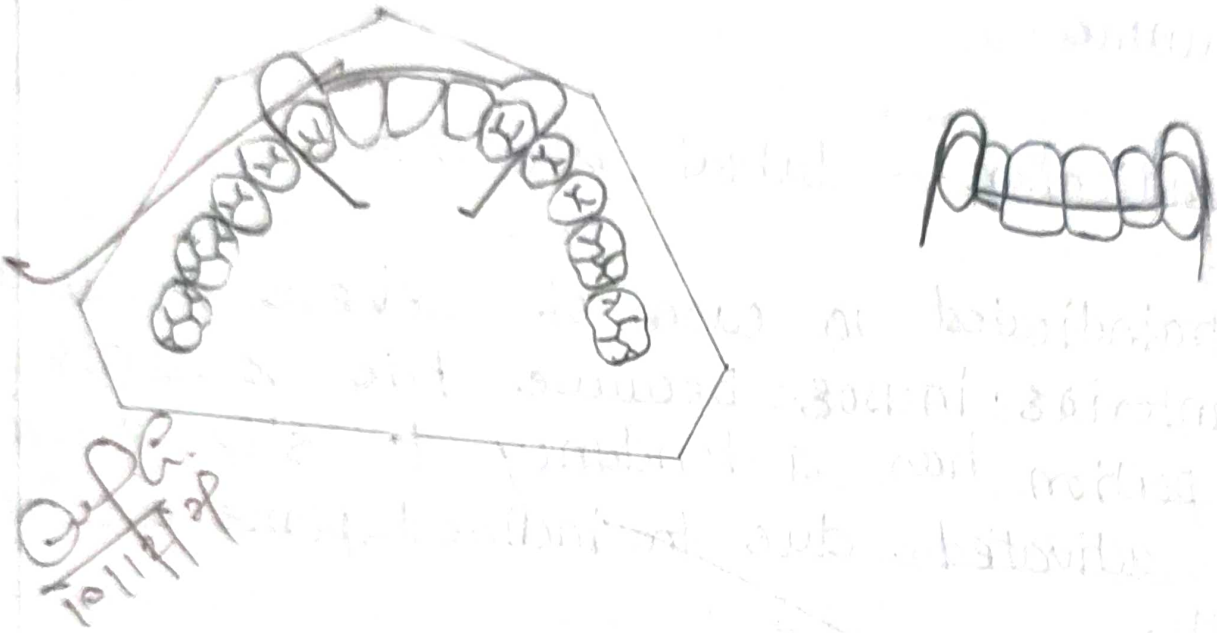
2. This slippage results in insuffient activation as the point of action can't be maintained

• Advantages of short labial bow :—

- It is easy to fabricate
- Useful for correcting the minor discrepancy in the overjet.
- Used to reinforce anchorage.
- Used for retention.
- Useful for attachment of whip spring (for correction of single tooth rotation.
- Hooks can be soldered, which are useful in attachment of elastics or for engaging 'J'

Hooks for extraoral traction.

7. Easy to adjust
8. Offsets can be placed on the horizontal arm for correction of minor regularities of anterior teeth.



Long Labial bow

1. Long labial bow is similar to short labial bow except that it extends from one first premolar to the opposite first premolar.
2. Parts of long labial bow - ① Horizontal bow portion
   ② Vertical 'U' loops
   ③ Retentive arms
3. The distal arms of the 'U' loops are adapted over the occlusal embrasures between the two premolars to get embedded in acrylic plate.

4. Indications →

1. Minor anterior space closure.
2. Minor overjet reduction.
3. Closure of space distal to canine
4. Guidance of canine during canine retraction using palatal retractor.
5. As a retaining device at the end of fixed orthodontic treatment.

5. Construction of Long labial bow →

- Armamentarium →

1. Stainless steel wire of
   0.6 mm - Retraction.
   0.7 mm - Retention.
2. Young's loop bending plier.
3. Marking pencil.
4. Wire cutter.

- Construction steps →

Dispense the wire from spool by measuring the wire on the cast from the last erupted tooth of left side to right side along the labial or buccal surfaces of the teeth & cut it with wire cutter.

2. Using fingers, form a bow adapting it on to the labial surfaces of the incisors & canines at about the junction of middle & incisal third of the teeth.

iii) Place two marks on the bow corresponding to the contact points between canines & first premo-lars on either side.

iv) Place two right angle bends on the bow, at the point marked.

v) The bends should be towards gingival margin

vi) Make mark on the vertical arm at about 2mm beyond the free gingival margin on either side, form the loops at a marked points using round beak of young loop bendi-ng plier.

vii) The loops should be formed above the gingiva margin and should be short of the sulcus to prevent irritation to the soft tissue.

viii) Care should be taken to keep it away from the gingival attachments.

ix) The distal arm of vertical loop is adapted like the retentive arms of any other clasp on the palatal or lingual surface of the cast.

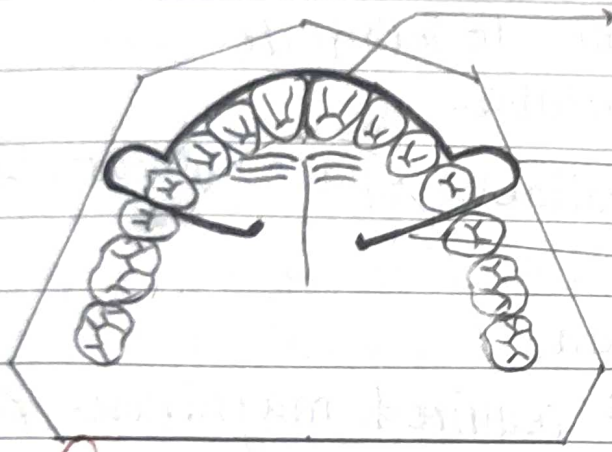
- Activation → activated by compressing the 'U' loops.

  Activation should be such that a labial bow is displaced palatally by 1mm

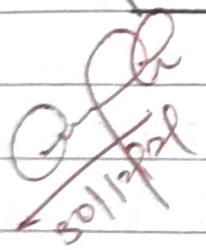
- A modified form of long labial bow can be made by soldering the distal arm of 'U' loops on to the bridge of the Adams clasp

• Advantages →

i) Can be used to close the space between canine & premolar.
ii) Labial bow (long) can control the canine rotation / movement.
iii) Used for retention purpose.



Occlusal view



Springs

Single Cantilever Spring

Spring: Spring is an active component of removable appliance which brings about the desired tooth movement.

Classification -

1] Based on the presence or absence of helix springs can be classified as -
① Simple - without helix ② Compound - with helix.

2] Based on the presence of loops or helix -
① Helical springs ② Looped springs

5. Based on the nature of stability of the spring they can be classified as -

① Self supported spring - usually made of thicker gauge wire. Can support themselves

② Guided springs - made of thinner gauge wire and the lack of adequate stability.

③ Auxillary springs - made of very thinner wire 0.35 mm e.g. high labial bow with apron spring

III] Ideal requirements of springs →

1) The spring should be simple to fabricate.
2) It should be easily adjustable.
3) It should fit into the available space without discomfort to the patient.
4) It should be easy to clean.
5) It should apply force of required magnitude & direction.
6) It should not slip or dislodge when placed over a sloping tooth surface.
7) It should be robust.
8) It should remain active over a long period of time.

- Factors to beconsidered in designing a spring:

1. Diameter of wire → The flexibility of the spring to a large extent depends upon the diameter of wire used. Thus the force generated is -

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

F = Force D = Diameter of wire L = length of wire.

Thicker wire when used decreases the flexibility of the spring and apply a greater force on the tooth.

By doubling the diameter, force increases by almost 16 times. Thus by decreasing the diameter the force applied is lesser and therefore the spring remains more flexible and active over a longer period of time.

2. Length of wire - Force can be decreased by increasing the length of wire. Thus springs that are longer are more flexible and remain active for longer time. Helices & loops can be incorporated into springs to make them more active. By doubling the length the force cane be reduced by 8 times.

3. Force to be applied - The force that should be generated by springs is calculated based on the number of teeth to be moved, root surface area and patient comfort. On an average, forces of about 20gm/cm² of root area is recommended for most tooth movement.

4. Patient comfort - Spring should not offer any patient discomfort by way of its design, size or the force it generates. The patient should be able to insert the appliance with the spring in the proper position so as to bring about the desired tooth movement.

5. Direction of tooth movement - The direction of tooth movement is an important consideration in designing spring. The direction of tooth movement is determined by the point of contact between the spring & the tooth. Palatally placed springs are used for the labial & mesiodistal tooth movement. Buccally placed springs are used when the tooth is to be moved palatally & in mesio-distal direction.

Single helix Cantilever Spring:

i) One end is fixed in acrylic & the other end is free.

ii) It is constructed using 0.5 mm or 0.6 mm hard round stainless steel wire.

iii) Indication - ① The finger spring/ single helix cantilever spring is used for palatal/ Buccolingual movement of teeth. ② Buccal movement of tooth/ slight rotation - I movement can be achieved by single cantilever spring.

iv) Parts of single helix cantilever spring -

1] Active arm
2] Retentive arm
3] Helix

v) Construction -

- Armamentarium - stainless steel wire of 0.5mm
- Young's loop wire bending plier
- Marking pencil
- wire cutter
- modelling wax
- wax knife
- Lacron carver.

vi) Fabrication steps -

- make a coil of diameter 3mm & carrying both arms parallel to each other.
- Arm which lies below the coil forms activearm while other arm forms retentive arm.
- Cut the length of active arm equal to mesial width of tooth / teeth tobe moved.
- At about centre of retentive arm, place right angled bend & adapt it to take contour of palate.

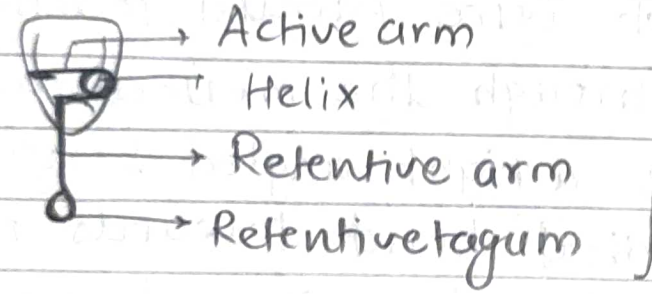
Place a vertical bend, towards the palate, OE retentive tag, such a way, spring is held at right angled to cingulum of teeth.

Place retentive tag at the end.

- Activation :

To activate the spring open the coil by about 2-3mm

- Types of Cantilever springs.
  1) Single cantilever spring.
  2) Double cantilever spring.
  3) Cranked cantilever spring.



Double helix Cantilever Spring / 'Z' spring.

1. Double helix cantilever spring when activated looks like 'Z' shape hence Also known as 'Z' spring.
2. Parts -
   1] Active arm - in contact with lingual surface of tooth
   2] Two coils / Helices -
   3] Retentive arm.

- Active arm lies in contact with lingual/Palatal surface of tooth.
- Helix - 'Z' spring constitutes two helices / coils
- Spring Constitutes 10-12 mm length.

It gets embedded into acrylic.

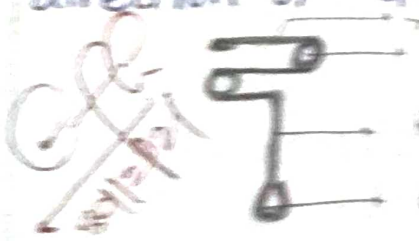
Fabrication - 0.5 mm wire.

Armamentarium -

1) 0.5 mm stainless steel wire
2) Wire cutter 3) Wire knife 4) Lacron carver
5) Adam's plier 6) Universal plier.

Steps -

- Adapt 0.5 mm wire on palatal / lingual surface of tooth to be moved labially & place a coil at one end.
- Adapt the wire parallel to active arm & place another coil at the far end of the first coil within the limits of tooth / teeth to be moved labially.
- From second coil adapt wire parallel to active arm & at a point halfway through the mesiodistal width of spring place a right angled bend and then place a vertical bend towards the palatal side so that spring is positioned perpendicular to palatal surface / cingulum of tooth and continue to adapt retentive arm to form tagum.
- Boxing of spring is done.
- Activation - to activate the spring, open coil by about 2 to 3mm. In the case of double cantilever spring 1'2' spring, open palatal limb alone adjust free end so that, it is perpendicular to the direction of the tooth movement.



Double helix cantilever spring

FingerSpring

Fingerspring can also be called single cantilever spring as one end of the spring is fixed in acrylic & other end is free.

Use - fingerspring is used for the mesio distal movement of teeth.

- It can be used only in those teeth which are located correctly in the buccolingual direction i.e teeth should be within the line of arch.

- Parts - ① Active arm — [Buccal active arm / Palatal active arm.
  ② Helix / coil.
  ③ Retentive arm
- Active arm = 12-15 mm length → Towards the tissu
- Helix = 3 mm diameter
- Retentive arm of 4-5 mm length. is kept away from the tissues & ends as small retentive tagum.
- Fabrication →

Armamentarium —

i) Stainless steel wire of 0.5mm for incisors
ii) 0.6 mm for canine & Premolars
ii) Young's loop wire bending plier.
iii) Adam's plier
iv) Marking pencil.
v) Wire cutter
vi) modelling wax
vii) Wax knief
viii) Lacron's carver

Fabrication: Steps -

1. make a coil of one & quarter turns having an internal diameter of 3mm
2. The arm which brings about the tooth movement is called active arm & is placed towards the tissues
3. Coil is positioned midway b/w the initial & final position of tooth.
4. Coil should be on opposite side of direction of tooth movements. Retentive arm is adapted on the palate.
5. Active arm should contact only on proximal side & is adapted on to labial side away from tooth surface
6. finger spring consist of an active arm of 12-16 mm length, a helix of 3mm internal diameter of 4-5 mm length that is kept away from the tissue ends in a small retentive tagum.

Use →

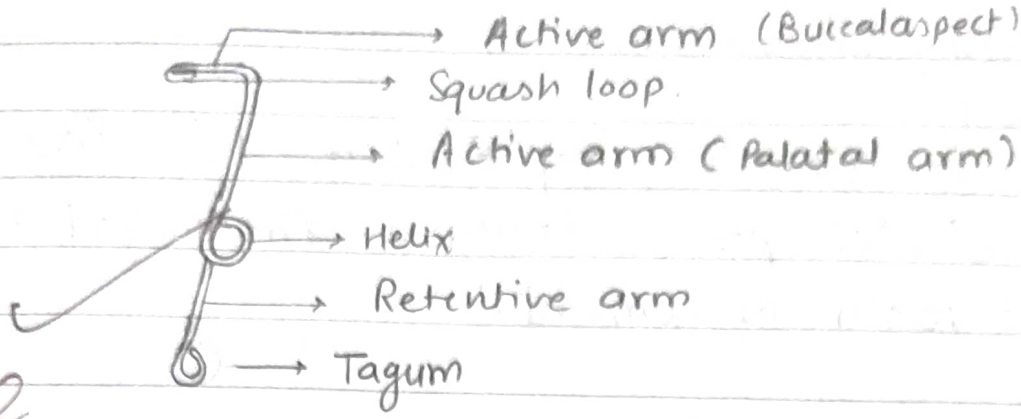
1. Used for the mesiodistal movement of teeth
2. Used on those that are located correctly in bucco-lingual direction.

Activation → fingerspring is activated by moving the active arm towards the teeth intended to move.

- Activation is done as close to coil as possible
- Activation of upto 3mm is considered ideal when 0.5 mm wire is used for its fabrication, wherever 0.6 mm wire has been used the activation should be half of that.

Modification → 1. A modification of the fingerspring is double finger spring.

2. In this spring, a retentive arms of two finger springs are joined together



T springs

T springs having 'T' shaped active arm can be used to effect the buccal movement of premolars & sometimes that of canine.

Parts of T springs -

1) T shaped active arm that contacts the tooth to be moved 2) Loops incorporated in arms
3) Retentive arms which gets embedded in acrylic
4) Retentive tagum

Construction :

> Spring should be perpendicular to palatal surface of tooth to be moved.
> Head of 'T' spring is slightly curved to follow the palatal contour of the tooth.
> As tooth moves buccally, the head, the 'T' can still be made to remain in contact with crown by opening up the loops incorporated in the arms.

Uses :

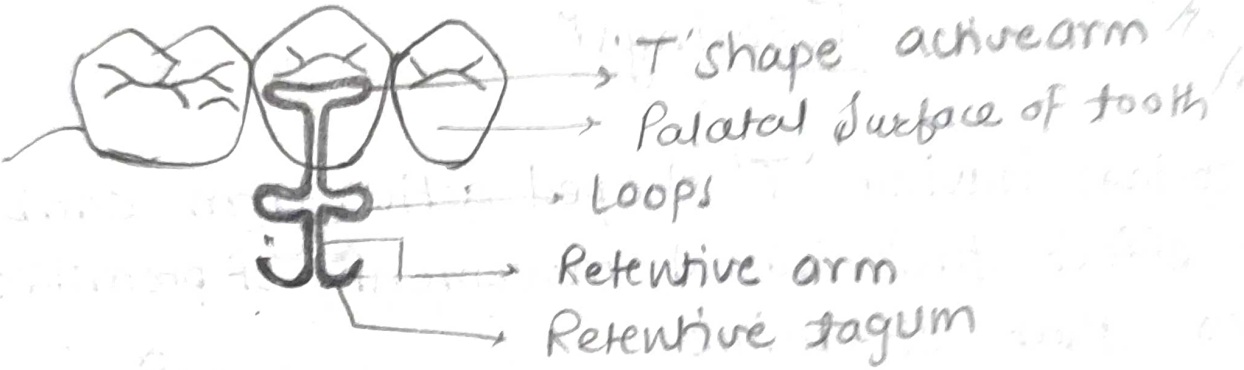
> 'T' spring is used for the buccal movement

of the premolar

2) It can be used in some cases for the buccal movements of canine.

Activation -

Spring is activated by Pulling the free end of the 'T" of spring toward the intended direction of tooth movement.

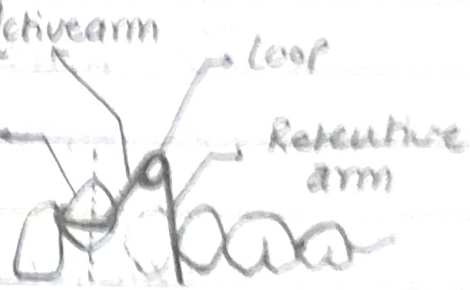


24/3/22

Canine Retractors

Though canine is anterior tooth it can't be retracted with (canine retractor should be used) labial bow as it has to be moved distally more than lingual direction.
Also canine have long root firmly anchored in bone & hence rightly called as corner tooth of arch.
Hence following the extraction the canines are retracted distally using one of the 4 different types of canine retractors.

1) Reverse loop canine retractor.
2) Buccal Canine retractor.
3) Palatal canine retractor.
4) 'U' loop canine retractor.



Buccal view of Buccal canine R.

1) Buccal canine retractor / self supporting canine retractor →

1. Buccal Canine retractor is also called as self supporting canine retractor.
2. This type can be given only on maxillary arch.

• Indication -

1. Indicated where canine is placed labially or high in the sulcus which requires the movement of the canine both distaley & palatally
2. When canine overlaps the lateral incisor is not accesible from lingual side of arch

- Contraindication -

This type of canine retractor is not indicated in the lower arch due to presence of shallow sulcus.

- Armamentarium -

i) Stainless steel wire of 0.7 mm for self supporting type.
ii) 0.5mm for supported type.
iii) marking pencil.
iv) wire cutter.

- Construction of Buccal Canine Retractor -

i) To fabricate self supporting canine retractor use 0.7 mm wire to make coil of about 0.4 internal diameter using loop bending plier.
ii) Coil is placed midway between initial & final position of canine in buccal sulcus
iii) The mesial arm of coil which forms the active arm should be away from the tissue surface and should run parallel to the long axis of canine
iv) At about middle third of canine a right angle bend is given to the active arm and it is adapted to the mesial side of canine.
v) The distal arm of canine retractor coil which is towards tissue surface is adapted to t

mesial aspect of 2nd Premolar.

i) The supported type of retractor can be formed with 0.5 or 0.6 mm of stainless steel wire.

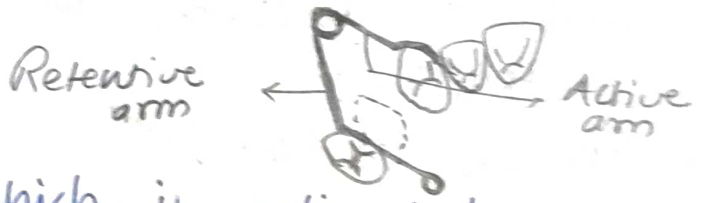
ii) The retentive arm should be reinforced with a stainless steel sleeve before it is adapted on to the mesial side of 2nd premolar above imaginary contact or to palatal side to form retentive arm tags.

Activation:

i) To bring about distal movement the free end is cut short by about 1mm & is readapted to engage the mesial side of canine.

ii) To bring about palatal movement, the active arm is bent at a point where it emerges out from the coil.

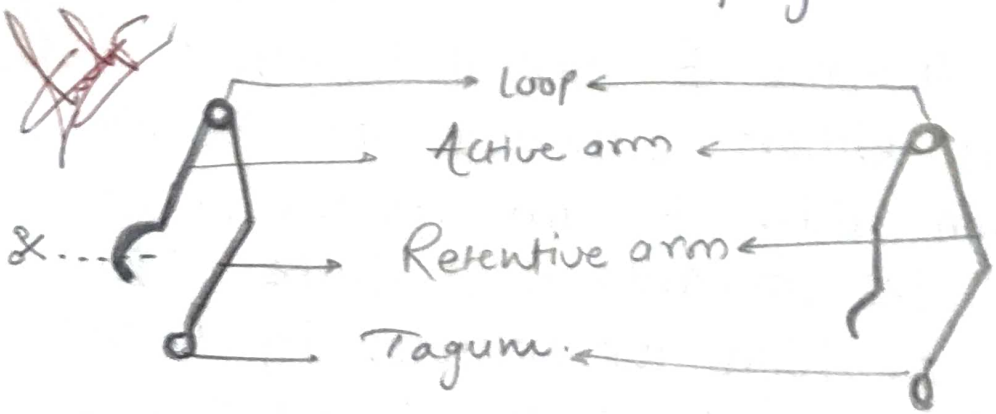
Occlusal view of Buccal Canine R.



Salient Features:

1. This is only spring which is activated by closing the coil.

2. The coil of spring lies towards the tissue & the active arm placed away from gingival tissue & the active arm should not impinge tissue.



Activation of Buccal canine Retractor

Reverse loop Canine Retractor

1. Helical canine retractor - most commonly used type of canine retractor.
2. Parts: ① Active arm
② Helix
③ Retentive arm

- Active arm includes: a distal arm is bent at right angles to form the arm
- Active arm engages the canine.

2. Helix - Diameter should be 3 mm. Placed 3 to 4 mm below gingival margin.

- Indication:

⇒ Indicated when canine is placed within arch & has to be just distalized.

- Construction:

I. Armamentarium:
Wire used: 23 gauge wire
Adam's plier.
Universal plier.
Wire cutter.
marking pencil.

1. A coil about 4 mm of internal diameter should be constructed either clockwise / anticlockwise depending upon side of arch to see that internal arm lies towards the tissue distally.
2. Coil is placed as high as possible in sulcus but short of functional depth in relation to

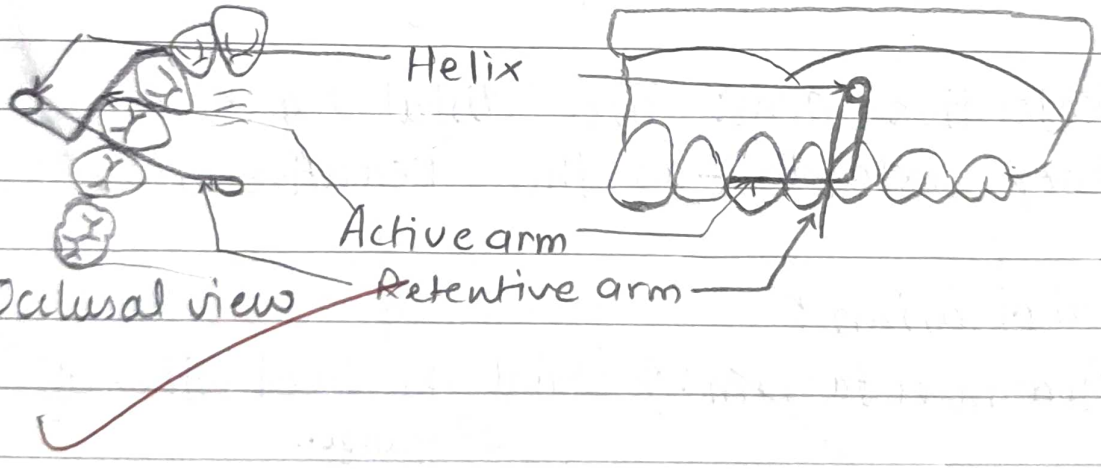
space to which canine has to be moved.

3. The mesial arm of coil in which form the retentive arm, lies mesial to second premolar.

ii) The distal arm, which is towards the tissue surface forms the active arm.

iv) A retentive arm is adapted mesially to the second premolar by carrying the wire above imaginary contact point, on to the palatal surface.

vi) Place a right angled bend to active arm at about cervical third margin of teeth & adapt it onto the mesial side of canine.

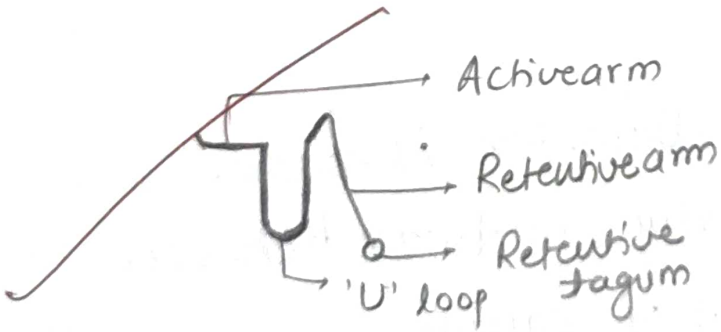


- Activation: A coil is opened for activation & about 5mm of free end of active arm is cut and readapted on to mesial side of canine.

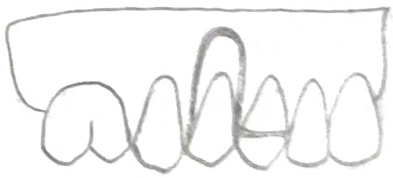
'U' loop Canine Retractor

- Parts of 'U' loop canine retractor:
  1) Active arm
  2) 'U' loop
  3) Retentive arm
  4) Retentive tagum
- Active arm includes: Active arm is bent at right angles from mesial leg of loop
- Active arm is adapted around canine
  U loop - Base of 'U' is placed 2-3 mm below cervical margin.
- 'U' loop consist of 2 legs → mesial leg, → Distal leg.
- Retentive arm: The distal leg of the loop extends as the retentive arm.
- fabrication:
  Armamentarium: 1) Stainless steel wire of 23 gauge.
  2) Adams plier.
  3) Universal plier.
  4) Wire cutter.
- A 'U' loop of approximately equal to width of a premolar is made of using plier
- mesial arm forms active arm

- At about cervical margin of canine a right angled bend is given & placed on active arm to engage mesial side of canine.
- The distal arm is adapted to the mesial side of second premolar to form retentive arm.
- Activation: The free end is cut by 1mm & it is readapted on to the mesial side.
- Advantage: It can be used in presence of shallow sulcus.
- Drawback: This spring requires frequent adjustments.
- Indication: Indicated when minimal canine retraction of 1 to 2 mm is required.



Design of 'U' loop canine Retractor



Buccal view of 'U' loop canine Retractor

Palatal Canine Retractor

- Parts: 1) Active arm 2) Helix 3) Guide arm/Retentive arm

1) Active arm: Placed mesial to canine.
2) Helix: 3 mm internal diameter
3) Helix is placed along the long axis of premolar
4) Retentive arm is placed on palate

5) Indication:

This type of canine retractor is indicated for retraction of Palatally Positioned canine

6) Fabrication:

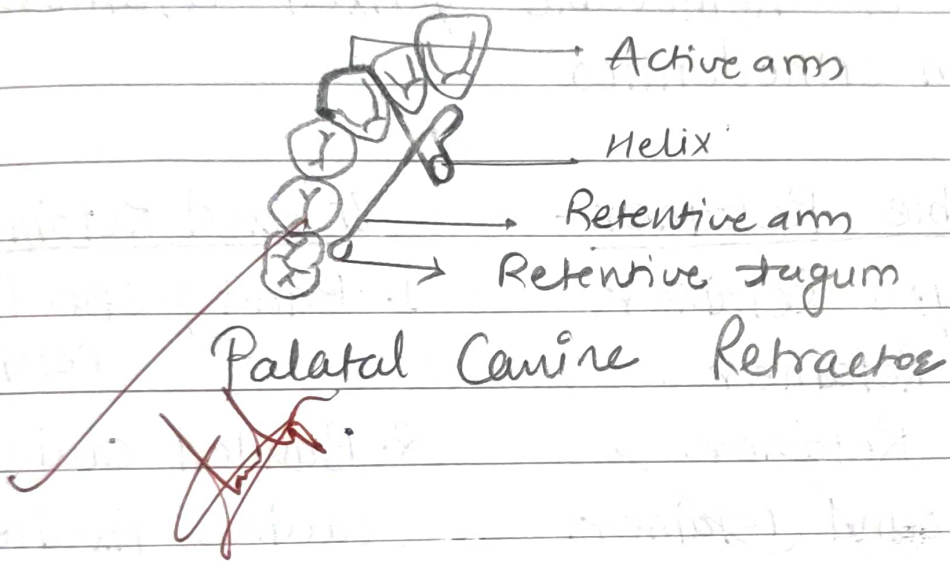
- Armamentarium: 23 gauge wire.
  Adam's plier.
  Universal Plier.
  wire cutter
  marking pencil.

- Construction:

i) Coil of 3 mm internal diameter is made
ii) He Coil is placed palatally midway between the initial & final position of canine
iii) The distal arm forms the active arm & can be made to come into contact with the mesial side of canine.
iv) The retentive arm of canine is bent at right angle & extends upto mesial aspect of first molar where a retentive tagum is placed
v) Boxing of Retractor is done.

2) Activation:

Coil is opened for activation by about 2-3 mm at a point where active arm emerges out of coil.



Hawley's appliance

Retainer is defined as passive orthodon appliance that helps in maintaining & stabili -ng the position of suppoeting structures after the active phase of orthodontic therap

- Number of Removable & fixed retainers are used in orthodontics

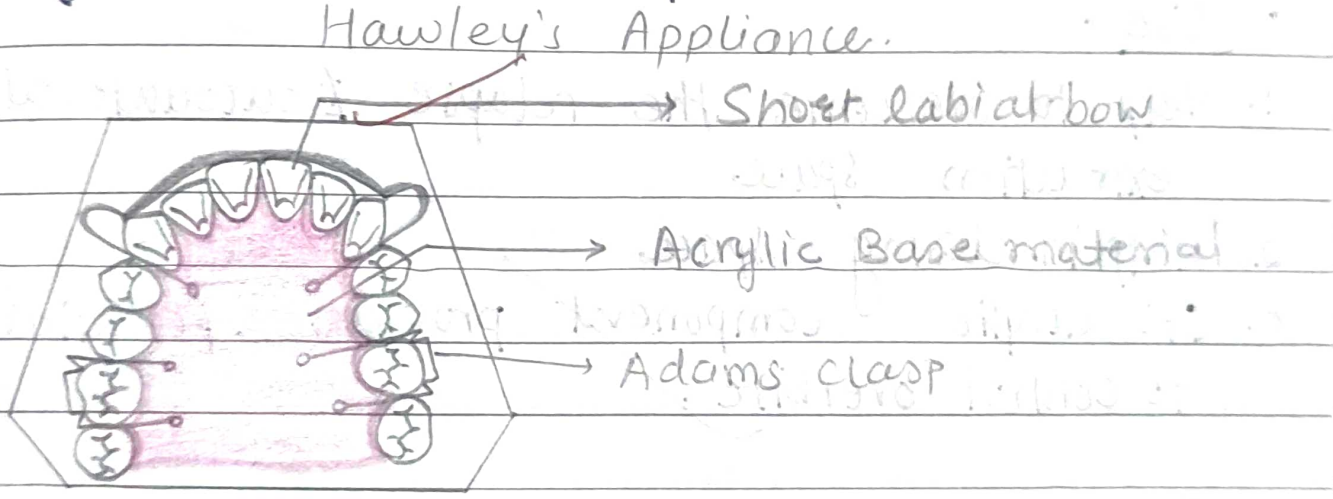
# Removable Retainer -	# fixed Retainer -
1. Hawley's Retainer.	1. Band & spur fixed retainer
2. Begg's Retainer.	2. Banded canine to canine fixed retainer
3. Clip on Retainer.	3. Bonded canine to canine fixed retainer
4. Wrap around retainer.	
5. Kesling's tooth positioner	
6. Invisible retainer.	

Hawley's Retainer -

1. Designed by Charles Hawley in 1920
2. One of most routinely used removable retainer
   - Simple design
   - Accepts number of modifications to suit various clinical needs.
   - Although generally used as a passive retainer can bring about minor tooth movement when desired by activating the labial bow.

Design: Consist of retentive clasp on molar teeth & a charcteristics labial bow with adjustments 'U' loop, Spacing from canine to canine.

1) Wire Component:
   i) Clasp: Adam's clasp → assure Retantion of appliance.
   ii) Bow: labial bow → Provides anterior stabili-zation control position of injuries incisors that aren't meant to move.
2) Acrylic Component: Acrylic base material.



Advantage:
1. Easy to fabricate due to simple design
2. Offers good patient compliance due to its reduced bulk.
3. A Hawley's retainer can be used for maxillary & mandibular arches.
4. Its acrylic component provides a potential bite plane to control overbite.
5. Oral Hygiene is not issue
6. Can be modified.

Disadvantage -

1. It is susceptible to fracture or loss
2. Hawley's appliance fabricated on mandibular arch is sometimes fragile & may be difficult to insert because ; of undercut in premolar & molar region.
3. Requires pt's compliance
4. Visible labial bow.
5. Interproximal wire can cause opening of spaces
6. High incidence of breakage & loss.

- Use -

1. Help to overcome the relapse encountered by extraction space
2. Help in closing space
3. It's acrylic component provide a potential plane to control overbite.

Retention:

1) Adams Clasps - 2 made with 23 gauge stainless steel wire.

2) Short labial bow - 1 short labial bow extending from canine to canine
fitted labial bow provides adequate retention
- The designs prevents the gap opening in canine & premolar Region.

3) Baseplate:

- Prime function of Base plate is to incorporate all components together.
- Base plate helps in retention of application & for anchorage.
- Base plate uses -

1) The base plate unites all the components into one unit.
2) Helps in anchoring appliance in place.
3) Provides support for wire component.
4) Helps in distributing forces along long axis.
5) Base plate should be of minimum thickness to help in adaptation & pt acceptance.
6) Base plate of 1.25 to 2 mm thickness offers adequate strengths & tolerated well by patient

7) Base plate is made of: ① Cold Cure acrylic resin
② Heat Cure acrylic resin

Retraction: 23 gauge wire is used for retraction as it is thin & flexible it allows the tooth move-ment

- Retraction plate should be 2-3 mm away from palatal aspect teeth to aid tooth movement.

Modifications of Hawley's Appliances →

1) Hawley's Retainer with long labial bow:

- labial bow has 'U' loop on premolar, distal to canine. Allows closure of spaces distal to canine
- Helps to keep the extraction space closed in Premolar extraction case.

Hawley's Retainer with 'C' clasp-
indicated in tight occlusal contact.
Occlusal arms of clasp may cause occlusa interference.
Retention may be less than conventional appliance

> Hawley's Retainer with contoured labial bow-
Labial bow is contoured to anterior teeth at cervical region. Better control over anteriors.

> Hawley's retainer with 'Z' spring-
- In case of anterior single tooth crossbite 'Z' springs incorporated into Hawley's with poste -r bite planes can open the bite sufficiently to allow the incisor to advance without occlusal interference.

5> Hawley's Retainer with light elastics:
instead of labial bow - light elastics is steetched in anterior teeth region.

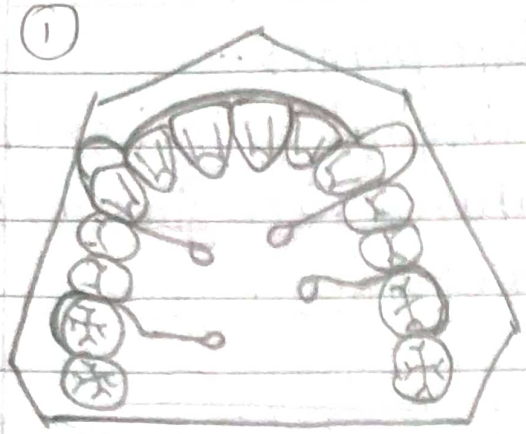
6> Hawley's Retainer solderd labial bow to bridge of Adam's Clasp-
Terminal ends of labial bow are soldered to the bridge of adam's clasp instead of terminating as retentitive arm in acrylic baseplat This allows closure of space in anterior segmen as well as any residual space in premolar extrac site.

7) Hawley's Retainer - with bite planes -
- Biteplane is incorporated lingual to incisors in upper arch while rest features are similar to standard design Hawley's Retainer.
- Deep bite cases.
- Anterior bite planes aid in establishment & maintainance of normal overbite by encourag -ing supraeruption of posterior teeth.

8) Hawley's Retainer with lingual extension clasp on molar (instead of 'C' clasp & adam's clasp)
- Retentive capacity of lingual extension clasp is comparatively less when compared to that of Adam's clasp.
- Indicated when tight occlusal contacts.

9) Hawley's retainer with occlusal rest -
- Occlusal rest on molar instead of 'C' clasp / Adamp
- This type of Retainer is indicated whene there is tight occlusal contact & occlusal arms of clasp might cause occlusal interfere -nce.

(1)

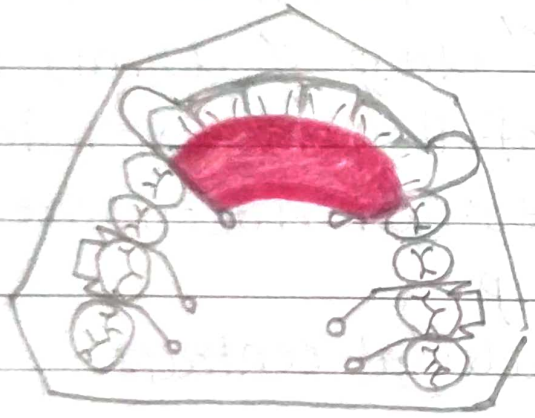


Hawley's Retainer with 'c' clasp on molar

(2)

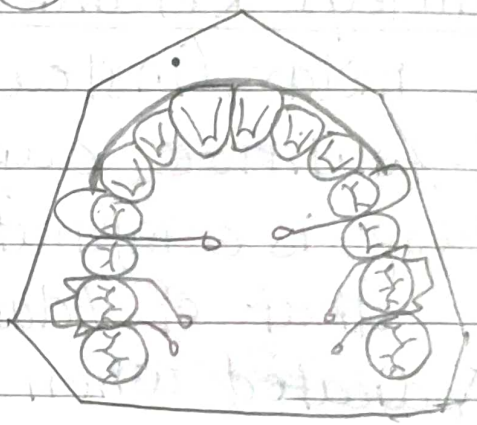
Hawley's Retainer with Light elastics

(3)



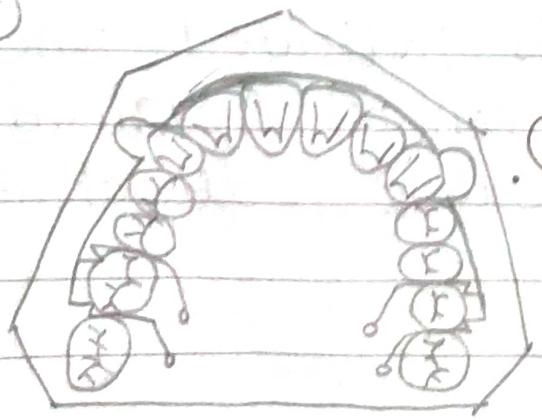
Hawley's Retainer with anterior bite plane

(4)



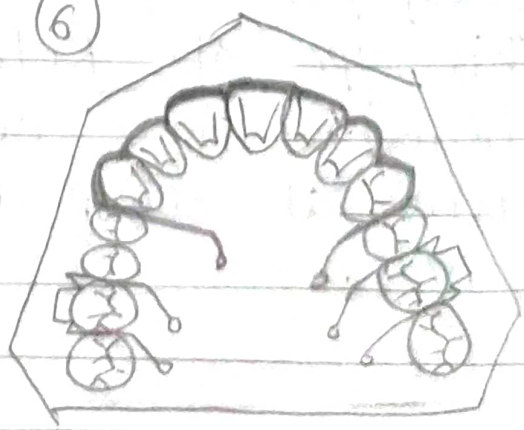
Hawley's Retainer with long labial bow

(5)



Hawley's Retainer with soldered labial bow to adams clasp.

(6)



Hawley's Retainer with Contoured labial bow

Oral Screen

myofunctional appliances - Introduced by Newell 1912

· Principle:

Vestibular screen can be used either to apply the forces of circumoral musculature to certain teeth or to relieve those forces from the teeth thereby allowing them to move due to forces exerted by the tongue.

- Thus the vestibular screen works on the principles of both force application as well as force elimination.

Indication:

1) Pts with habit of mouth breathing, tongue thrusting, thumb sucking, lip biting & cheek biting.

2) mild distoocclusion

3) Interception of muscular anomalies.

4) Used to perform muscle exercise to help in correction of hypotonic lip & cheek muscle.

5) The vestibular screen is given in pts with mild anterior proclination.

Fabrication:

1. Impressions of both upper & lower arches are made

working models ... should reproduce depth of vestibular sulcus.

- The upper & lower casts are occluded in normal intercuspation & the models sealed together using plaster.
- In case appliance is being used for correction of disto occlusion, a construction bite should be taken to advance the mandible.
- The vestibular screen should be extended into sulcus to point where the mucosal tissue reflects outwards. Care should be taken not to impinge on frenum & muscle attachment.
5) Posteriorly appliance should extend upto distal margin of last erupted molar.
6) The models are covered with 2-3 mm of wax over labial surface of teeth & alveolar process. In case of proclined teeth which used to be retracted the wax relief is removed to expose the incisal one-third of teeth.
7) The appliance is fabricated using either self cure or heat cure acrylic resin.
8) The appliance is smoothened using sand paper & polished.

management of Appliance: Pt should be asked to wear the appliance at night & 2-3 hrs during day times.

1. Pt is instructed to maintain lipseal.
3. During first few days pts may show certain areas of irritation in sulcular & frenal area. Such areas

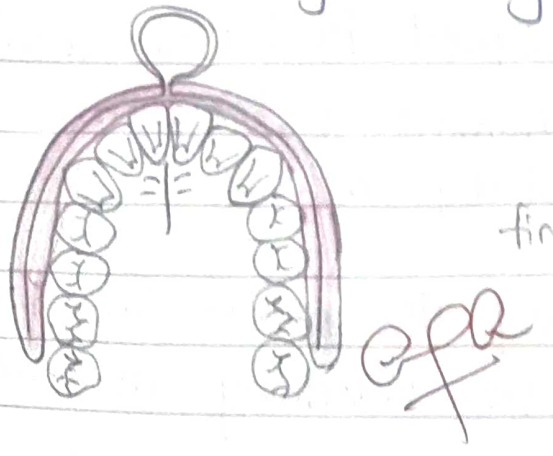
should be trimmed carefully to avoid irritation.

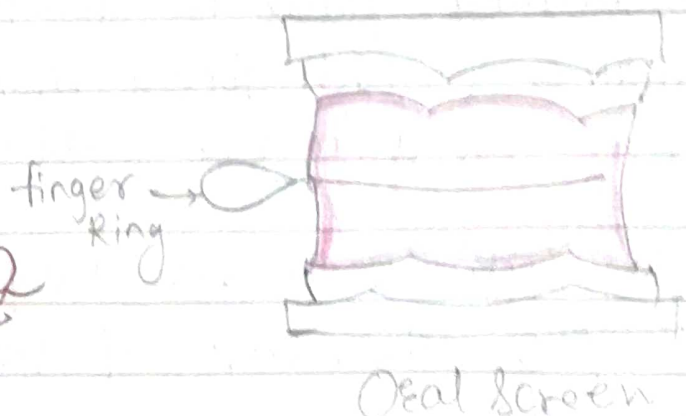
modifications of vestibular screen:

1) Hotz modification:
Oral screen can be fabricated with metal ring projecting b/w upper & lower lip
This ring can be used to carry out the various muscle exercises.

2) In pts with tongue thrusting habit additional screen is placed on lingual aspect of teeth
3) This screen is attached to vestibular screen by means of thick wire that runs through the bite in lateral incisor region.
4) In case of mouth breather the vestibular screen should be fabricated with number of holes that are gradually closed in the phased manner.

Diameter of Ring = equal to pts finger
Gauge → 19 gauge → Thicker gauge wire must be used for finger rings. frenal Relief.





Oral screen

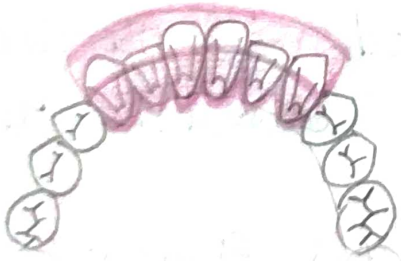
Inclined Planes - 1. Catlan's

- Bite planes are myofunctional appliances which are usually incorporated into the design of a removable orthodontics appliances as an extension or modification of the acrylic base framework.

- It is type of myofunctional appliance which harnesses the natural forces & transmits it to teeth & alveolar bone in predetermined direction.

Inclined plane used on lower anteriors is used to treat maxillary teeth in crossbite

- Inclined planes can be made of acrylic or cast metal & can be designed to treat single tooth in cross bite or segment of upper arch in crossbite



Anterior inclined plane / Catlan's appliance

(Side view)

The inclined plane is designed to have a 45° angulation, which forces maxillary teeth in crossbite to a more labial portion.

It is inclined when adequate space exist in arch for alignment of the maxillary arch teeth in crossbite.

fabrication –

1. Acrylic resin or crometal is used to fabricate Catlan's appliance. The lower anterior inclined plane is designed in such a way that, it is at 45° angle to maxillary occlusal plane.

2. Catlan's can be fabricated on the single lower anterior tooth for crossbite correction of whole anterior segment.

Indication:

1. Sufficient space available in arch for alignment of maxillary anteriors
2. Anterior crossbite due to palatally placed maxillary incisors
3. Deep bite 4.

Contraindication:

1. Crossbite due to true mandibular anterior prognathism
2. Lack of overbite.

Disadvantage –

1. Patient encounters the problem in speech during therapy
2. Can't be constructed if mandibular incisors are crowded

3. Periodontal problem of mandibular teeth associated with prolonged use of appliance may cause PDL ligament problem.

4. Occurence of anterior open bite is reported in patients with ~~prologe~~ prolonged useage of this appliance due to supraeruption of teeth.

5. Contraindicated in pts with periodontally compr-mised mandibular anterior teeth.

6. Pt have to follow dietary restrictions during TH

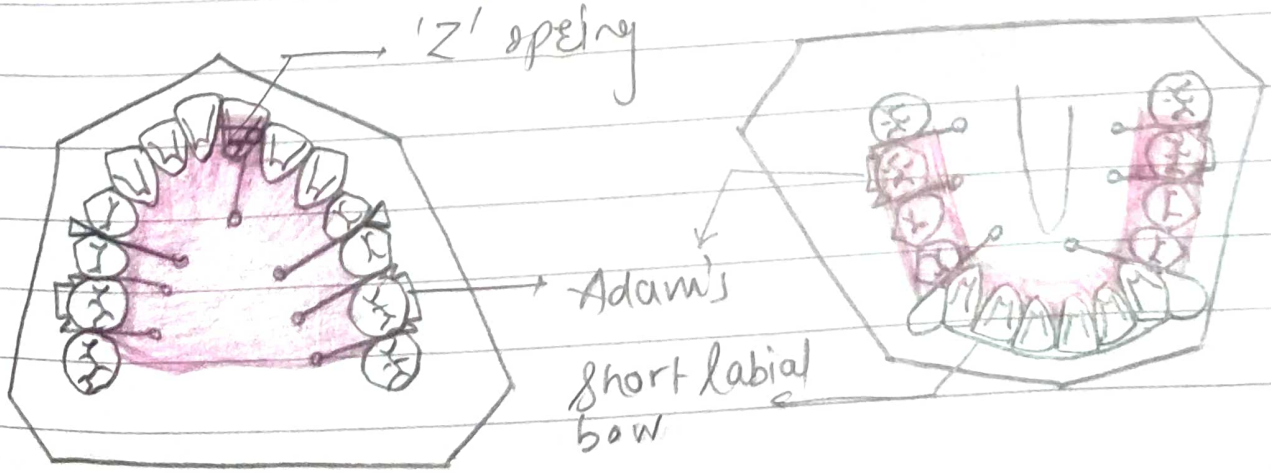
Posterior Bite plane

Bite planes → modified base plates.
1. Anterior bite plane
2. Sved bite plane
3. mandibular anterior inclined
4. Posterior bite plane for upper & lower arch
5. Sidlow's hollow bite plane.

- Bite planes are myofunctional appliances which are usually incorporated into the design of a removable orthodontic appliance as an extension or modification of the acrylic base framework.

1. Posterior bite plane - extension of acrylic base plate over the occlusal surface of the posterior teeth.

2. Indication:
1. To give occlusal clearance for the correction of cross bite of the either anterior or posterior teeth
2. for dignosis of occlusal prematurities.
3. Cases with TMJ pain dysfunction.



Construction:

- It can be incorporated into the design of either upper or lower appliance.

1. It should cover the occlusal surface of posterior teeth, extending anteriorly from first premolar to the last erupted tooth posteriorly.

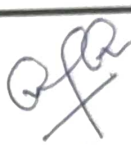
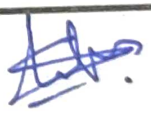
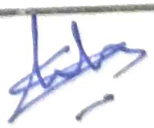
2. The thickness of bite planes should be kept minimum as much as possible.

3. It is constructed as an extension of the acrylic base while acrylising the base plate similar to that of other bite planes.

Clinical management:

- When appliance is delivered, care is taken to see that bite plane should contact the buccal & lingual cusp of the posteriors of opposing arch uniformly on both sides.
- The bite plane should be sufficiently thick to Relieve the occlusal interferences.

MODEL ANALYSIS SUBMITTED

SR NO	DATE	EXERCISES	SIGN
1	12/10/22	MODEL ANALYSIS NO. 1	
2	13/10/22	MODEL ANALYSIS NO. 2	
3	17/10/22	MODEL ANALYSIS NO. 3	
4	19/10/22	MODEL ANALYSIS NO. 4	
5	27/10/22	MODEL ANALYSIS NO. 5	
6	30/10/22	MODEL ANALYSIS NO. 6	
7	25/01/23	MODEL ANALYSIS NO. 7	
8	25/01/23	MODEL ANALYSIS NO. 8	
9	25/01/23	MODEL ANALYSIS NO. 9	
10	25/01/23	MODEL ANALYSIS NO. 10	

MODEL ANALYSIS

Diagrammatic presentation and detailed analysis, treatment planning, treatment modalities and type of retention.

1) **PONTS ANALYSIS**

2) **ASHILEY HOWES ANALYSIS**

3) **NANCE & CAREYS ANALYSIS**

4) **BOLTON ANALYSIS**

5) **SPACE ANALYSIS**

6) **DIAGNOSIS AND TREATMENT PLANNING.**

7) **RETENTION**

Model Analysis - 1

1) Teeth Present:

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

2) Teeth measurement:

1] maxillary arch: →

6	5	4	3	2	1		1	2	3	4	5	6
11	7	7	9	8	10		10	7	7	6	7	11
12	7	7	7	6	6		5	6	7	8	7	12
6	5	4	3	2	1		1	2	3	4	5	6

mandibular arch ↗

3) Total tooth material:

	maxillary	mandibular
Actual	103.0 mm	90 mm
Normal	91.7 mm	84 mm
Difference	11.3 mm	6 mm
Inference	Total tooth material is excess by 11.3 mm	Total teeth material is Excess by 6 mm

4) Sum of incisors:

	maxillary	mandibular
Actual	35 mm	23 mm
Normal	31.3 mm	23 mm
Difference	3.7 mm	0 mm
inference	Sum of incisors is excess by 3.7 mm	-

3) Proclination : by direct method.

	maxillary	mandibular
Actual	4 mm	2 mm
Normal	2 mm	0 mm
Difference	2 mm	2 mm
inference	maxillary incisors are proclined by 2 mm	mandibular incisors are proclined by 2 mm

4) Depth of Palate (maxillary arch):

Actual	Normal	Difference	Inference
24.5mm	17.5mm	7 mm	Deep palate

5) Curve of spee (mandibular arch):

Actual	Normal	Difference	Inferenc.
2mm	1.5mm	0.5 mm	Deep curve of spee

6) Spacing & Crowding:

	maxi spacing	Crowding
Upper arch	-	7mm
lower arch	-	7 mm

7) Pont's index:

i) Premolar region = $\frac{\text{Sum of incisors}}{80} \times 100$

$= \frac{35}{80} \times 100 = 43.75$ mm

ii) Molar region = $\frac{\text{Sum of incisors}}{64} \times 100$

$= \frac{35}{64} \times 100 = 54.6$ mm

Region	measured	Calculated	Difference	Inference
Premolar	34 mm	43.75mm	9.75	need for Expansion
molar	43.6mm	54.6mm	11	

8) Ashley Howey's index = $\frac{\text{Canine fossa width}}{\text{Total tooth material}} \times 100$

$= \frac{40}{105} \times 100 = 38\%$

9) Nance & Carey's index -

Calculated L.D = L.A + 2X ⇒ L.A - sum of lower incisors

= 23 + (2 x 22)

= 23 + 44 = 67

measured L.D	Calculated L.D	Difference	Inference
77	67	10	Extraction of first Premolar required.

if Calculated LD > measured LD
then only inference is applicable.

10) models in occlusion -

Anteroposterior molar region	Right side	left side
Overjet = 5mm	Endon clan relation	Class II relation. Overbite = 2 mm.

11) Bolton's Ratio:

Sum of mandi 12 =	90 mm	Sum of mandi 6 =	37 mm
Sum of maxi 12 =	103 mm	Sum of maxi 6 =	51 mm

Overall ratio = $\frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$

$= \frac{90}{103} \times 100 = 87.37\%$

$\because < 91.3\%$ — maxillary tooth material Excess

$\therefore$ maxillary excess = maxillary 12 − $\frac{\text{mandi 12}}{91.3} \times 100$

$= 103 - \frac{90 \times 100}{91.3} = 103 - 90 \times 1.09$

$= 103 - 98.10$

$= 4.90$

Anterior ratio = $\frac{\text{Sum of mandi 6} \times 100}{\text{Sum of maxi 6}}$

$= \frac{37}{51} \times 100 = 0.72 \times 100 = 72\%$

$\because < 77.25 \rightarrow$ maxi. Ant. excess

$\therefore$ maxillary Anterior excess

$= \text{maxi 6} - \frac{\text{mandi 6} \times 100}{77.2}$

$= 51 + \frac{37 \times 100}{77.2} = 51 - 37 \times 1.29$

$= 51 - 47.73 = 3.27$

maxillary Anterior excess is 3.27.

# Space Problem:	maxillary	mandibular
1) Space required for	2 x 2 = 4mm	2 x 2 = 4mm
1) To correct proclination	3 mm	3 mm
2) To correct rotation	+	
3) To correct curve of spee	−	0.5 x 2 = 1mm
4) To correct crowding	7 mm	6 mm
Total space required	14 mm	14 mm

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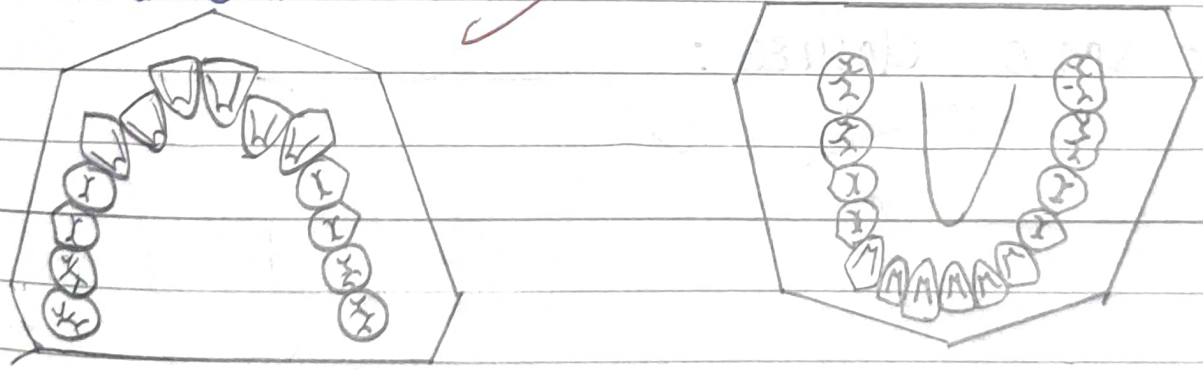
Total space required	14 mm	14mm

Space available:

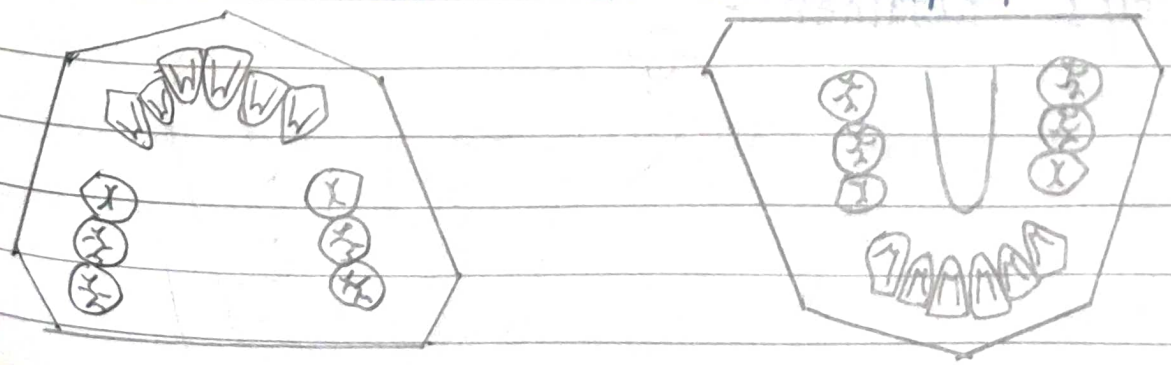
	maxillary	mandibula
1) Interdental spacing	-	
2) Expansion	-	
3) Distallization	-	
4) Interproximal stripping	-	
5) Derotation of posterior	-	
6) Uprighting of posterior	-	
7) Extraction after anchorage loss	13 mm	14 13 mm
8) Proclination of anterior	1 mm (12,22)	1 mm (32)
9) Total space available	14 mm	14 mm

· Treatment Plan:

1) Pretreatment:

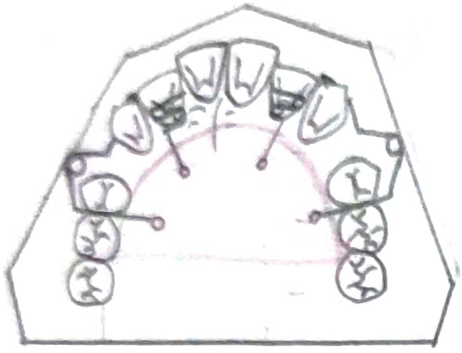


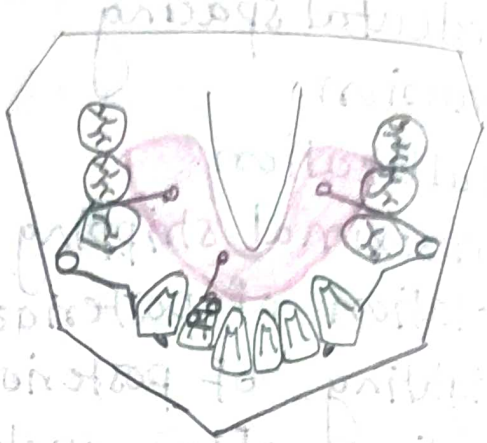
2) Extraction: all 4 extractions $\frac{4}{4}\frac{4}{4}$



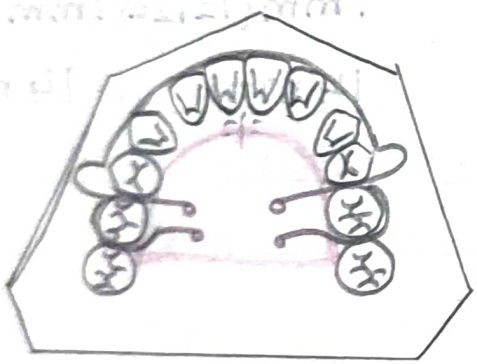
3) i) Proclination of $\frac{2|2}{2}$ with double cantile spring / Z' spring

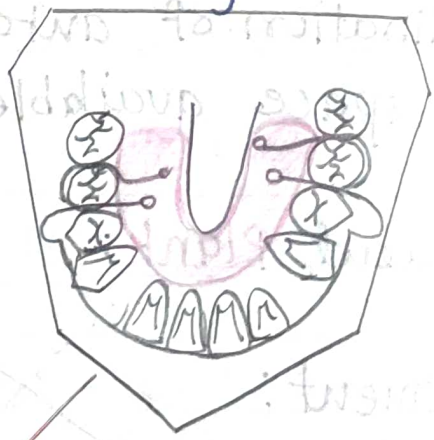
ii) Canine Retraction by Buccal canine retractor / self supported canine retractor



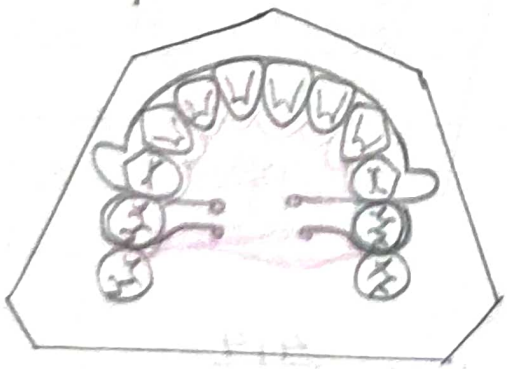


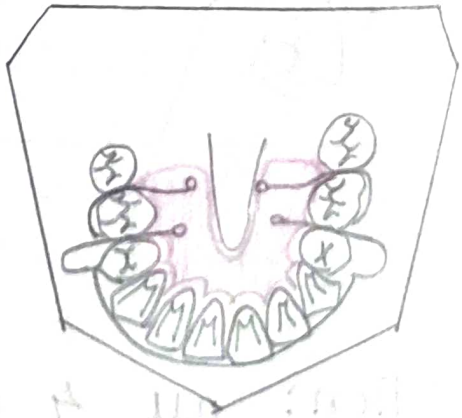
4) Retraction of incisors with long labial bow:



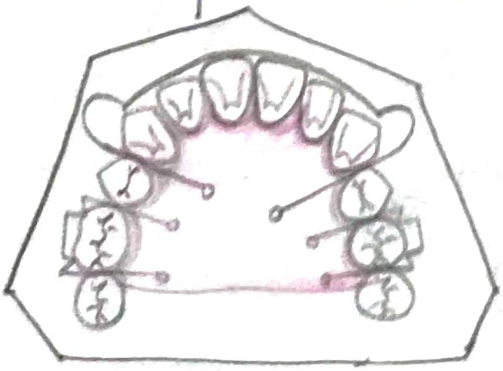


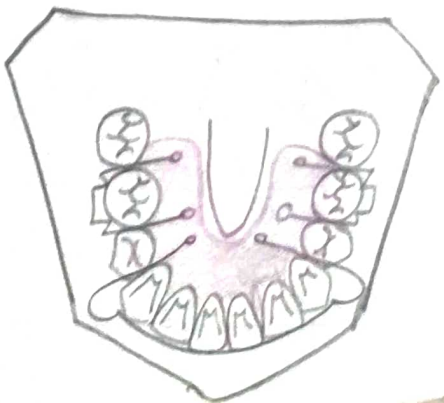
5) Post space closure :





6) Hawley's Retainer -





Model Analysis - 2

1) Teeth present -

7 6 5 4 3 2 1	1 2 3 4 5 6 7
7 6 5 4 3 2 1	1 2 3 4 5 6 7

2) Teeth measurement:

① maxillary arch

② maudibular arch

6	5	4	3	2	1	1	2	3	4	5	6
10	7	7	8	7	7	7	6	7	8	7	11
11	7	7	6	5	5	5	5	6	7	7.5	11
6	5	4	3	2	1	1	2	3	4	5	6

3) Total tooth material:

	maxillary	mandibular
Actual	92 mm	82.5 mm
Normal	91.7 mm	84 mm
Difference	0.3 mm	1.5 mm
Inference	maxillary TTM excess by 0.3mm	mandibular TTM less by 1.5mm

4) Sum of incisoes:

	maxillary	mandibular
Actual	27 mm	20 mm
Normal	31.3 mm	23 mm
Difference	4.3 mm	3 mm
inference	SI less by 4.3mm	SI less by 3mm

5) Proclination (by direct method):

	maxillary	maudibular
Actual	4 mm	2 mm
Normal	2 mm	0 mm
Difference	2 mm	2 mm
Inference	Proclined maxillary arch	Proclined maudibular arch

6) Depth of Palate - maxillary arch

Actual	Normal	Difference	Inference
2 mm	1.5 mm	0.5 mm	Deep curve of spee

7) Spacing / Earving Crowding:

	Spacing	Crowding
Upper arch	-	-
lower arch	-	-

8) Pont's index →

i) Premolar region = $\frac{SI \times 100}{80}$

$= \frac{27 \times 100}{80} = 33.75$ mm

ii) molar region = $\frac{SI \times 100}{64}$

$= \frac{27 \times 100}{64} = 40.12$ mm

Region	measured	Calculated	difference	Inference
· Premolar	37 mm	33.75 mm	3.25 mm	Need for Expansion
· molar	44 mm	40.12 mm	3.8 mm	

9) Ashley' Howey's index :

Ashley'Howey's index = $\frac{\text{Canine fossa width}}{\text{Total teeth material}} \times 100$

$= \frac{40.1}{92} \times 100 = 0.43 \times 100 = 43\%$

10) Nance & Carry's index -

Calculated linear dimension = Length of arch + 2x

$= 20 + (2 \times 20)$

$= 20 + 40 = 60$ mm

measured L·D	Calculated L·D	Difference	Inference
67 mm	60 mm	7 mm	Extraction of 1st premolar required.

11) model in occlusion:

Rt ~~sig~~ Right side molar region — Class I molar region

left side Class I molar region.

Overjet = 5 mm Overbite = 4 mm

12) Bolton's Ratio =

Sum of mandi 12 = 82.5 mm

Sum of maxi 12 = 92 mm

Sum of mandi 6 = 32 mm

Sum of maxi 6 = 42 mm

· Overall ~~regi~~ Ratio = $\frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$

$= \frac{82.5}{92} \times 100 = 89.1\% \longrightarrow$ maxillary excess

· maxillary excess / ~~ma~~ =

maxi 12 - $\frac{\text{mandi 12} \times 100}{91.3}$

$= 92 - \frac{82.5 \times 100}{91.3} = \frac{149.6}{91.3} = 1.63\% \rightarrow$ maxi Excess

· Anterior Ratio - $\frac{\text{sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

$= \frac{32}{42} \times 100 = 75.2\% \rightarrow$ maxi Anterior Excess.

∴ maxillary Anterior ~~a~~excess = maxi 6 - $\frac{\text{mandi 6}}{77.2} \times 100$

$= 42 - \frac{32 \times 100}{77.2} = \frac{42.4}{77.2} = 0.54\%$

∴ maxi Ant. Excess = 0.54%.

Space problem ⟶

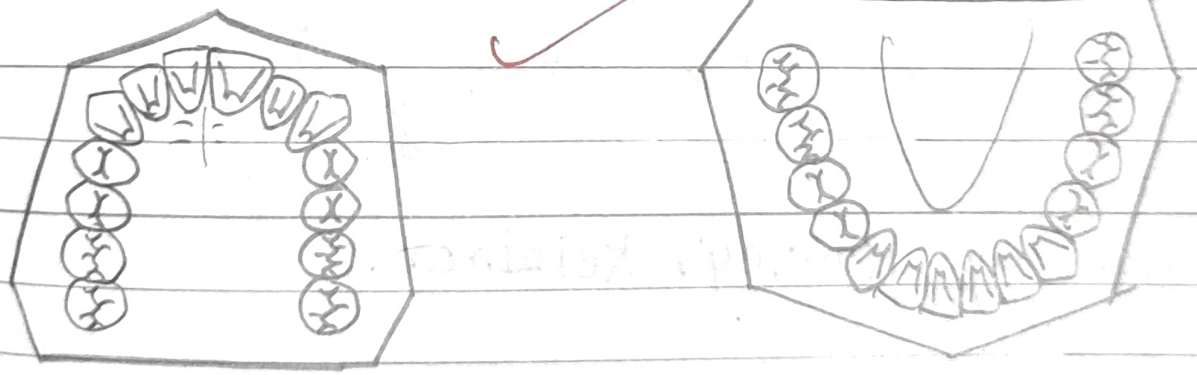
	maxillary	mandibular
⁾ Space Required for		
1) To correct proclination	2 x 2 = 4mm	2 x 2 mm = 4mm
2) To correct Rotation	-	-
3) To correct curve of spee	-	0.5 x 2 = 1mm
4) To correct crowding	-	-
Total space required	4mm	5mm

Space available:

Space available by	maxillary	mandibular
1) Interdeutal spacing	-	-
2) Expansion	1.5mm	2.5mm
3) Distallization	-	-
4) Interpeoximal stripping	2.5mm	2.5mm
5) Derotation of posterior	-	-
6) Uprighting of posterior	-	-
7) Extraction after anchorage loss.	-	-
8) Total space available	4mm	5mm

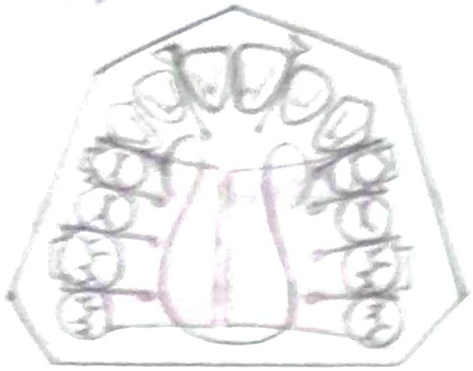
Treatment Plan:

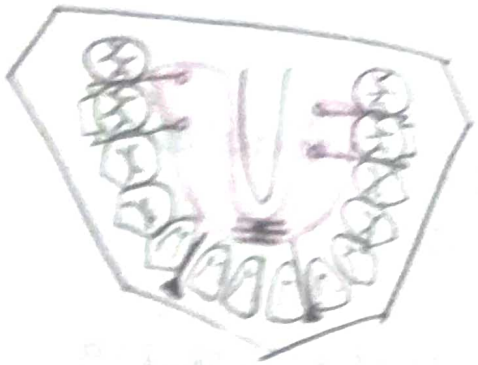
1) Pretreatment:



2) Interpeoximal stripping:

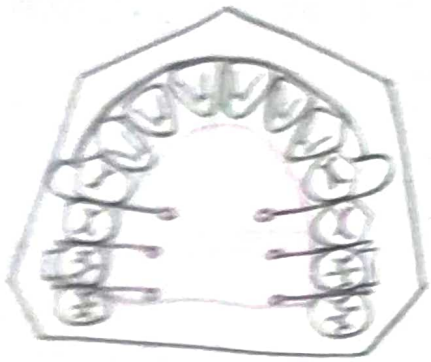
3) Expansion :

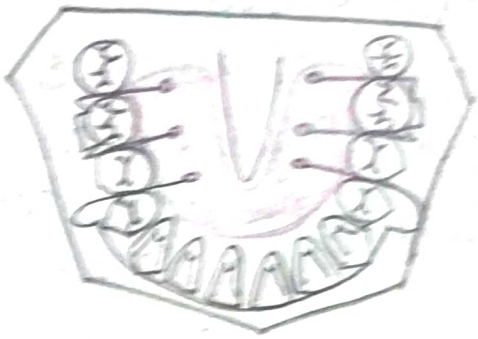




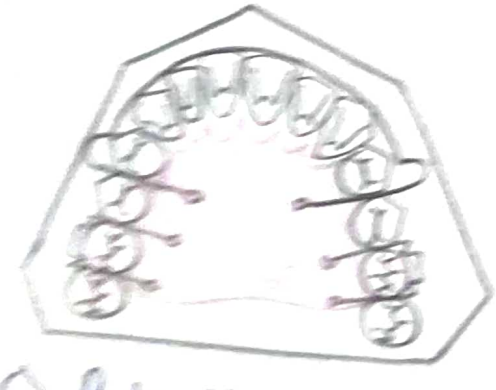
Coffin's Spring

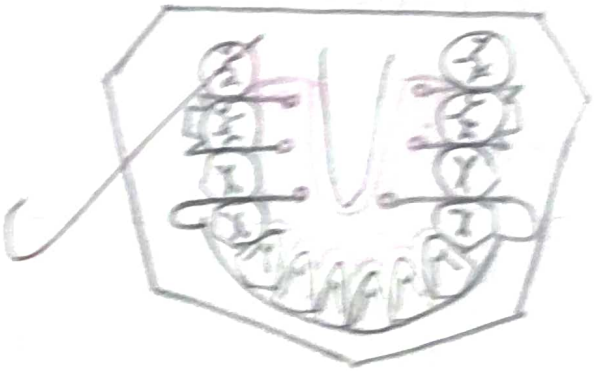
4) Retraction by long labial bow:



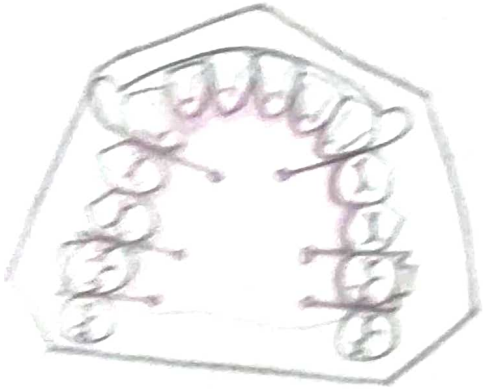


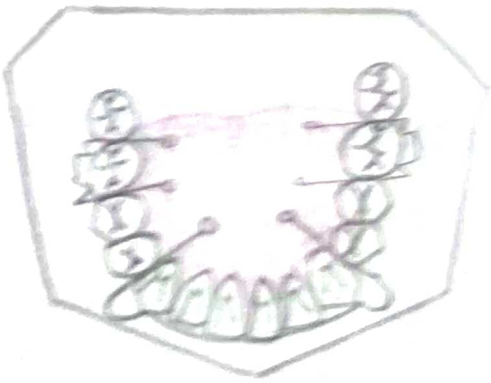
5) Post space closure:





6) Retention by Hawley's Retainer.





Model Analysis - 3

① Teeth present :

7	6	5	4	3	2	1	1	2	3	4	5	6	7
7	6	5	4	3	2	1	1	2	3	4	5	6	7

② Teeth measurement:

6	5	4	3	2	1	1	2	3	4	5	6
9	6	7	7	7	9	9	6	7	7	6	10
11	7	7	6	5	6	6	6	7	7	7	7
6	5	4	3	2	1	1	2	3	4	5	6

③ Total Teeth material -

	maxillary	mandibular
Actual	90 mm	82 mm
Normal	91.7 mm	84 mm
Difference	1.7 mm	2 mm
Inference	TTM excess by 1.7 mm	TTM excess by 2 mm

④ Sum of incisors -

	maxillary	mandibular
Actual	31 mm	23 mm
Normal	31.3 mm	23 mm
Difference	0.3 mm	0 mm
Inference	SI less by 0.3mm	SI -

⑤ Depth of Palate -

Actual	Normal	Difference	Inference
14.5 mm	17.5 mm	2 mm	Deep palate

6) Proclination -

	maxillary	mandibular
Actual	4mm	2mm
Normal	2mm	0mm
Difference	2mm	2mm
Inference	Proclined maxillary arch Teeth by 2mm	Proclined lower anterior by 2mm

7) Curve of spee -

Actual	Normal	Difference	Inference
2mm	1.5mm	0.5mm	Deep curve of spee

8) Spacing & Crowding -

	spacing	crowding
upper arch	2mm	-
lower arch	-	-

9) Pont's index -

Premolar region = $\frac{\text{Sum of incisors}}{80} \times 100$

$= \frac{31 \times 100}{80} = 31 \times 1.25 = 38.75$

Molor Region: = $\frac{\text{Sum of incisor}}{64} \times 100$

$= \frac{31 \times 100}{64} = 31 \times 1.56 = 48.36$

Region	measured	calculated	Diff	Inf.
Premolar	37 mm	38.75 mm	0.75 mm	Need for expansion
molar	45 mm	48.36 mm	2.64 mm	

Ashley Howey's index :

$$= \frac{\text{Canine fossa width}}{\text{Total teeth material}} \times 100$$

$$= \frac{38}{90} \times 100 = 4.22 \times 10 = 42.2\%.$$

Nance & Carey's index =

Calculated linear Dimension = length of arch + 2x

= 20 + (2 x 20) = 60

measured LD	Calculated L.D	Difference	Inference
55	60	5	Extraction of 2nd premolar required.

models in mal occlusion:

Anteroposterior molar Relation -

Right side - Class I molar relation.

Left side - Class I molar relation.

Overjet = 2 mm Overbite = 12 mm

Bolton's Ratio =

Sum of mandi 12 = 81 mm.

Sum of maxi 12 = 90 mm.

Sum of mandi 6 = 36 mm.

Sum of maxi 6 = 45 mm.

$$\text{Overall ratio} = \frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$$

<91.3 maxi excess.

$= \frac{81 \times 100}{90} = 90$

∴ maxillary Excess = $\text{maxi } 12 - \frac{\text{mandi } 12}{91.3} \times 100$

$= 90 - \frac{81}{91.3} \times 100 = 90 - 88.29$

$= 1.71$

· Anterior Ratio = $\frac{\text{Sum of mandi } 6}{\text{Sum of maxi } 6} \times 100$ < 77.5%.

$= \frac{364}{459} \times \frac{20}{100} = 80\%.$

maxi Ant. Excess

∴ maxillary excess = $\text{maxi } 6 - \frac{\text{mandi } 6}{77.2} \times 100$

$= 45 - \frac{36}{77.2} \times 100$

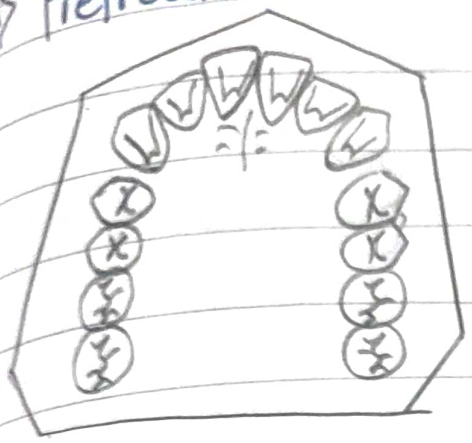
$= 45 - 36 \times 1.29 =$

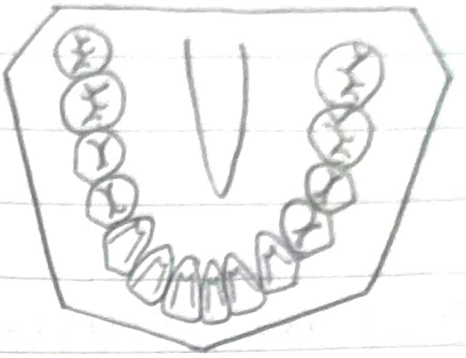
# Space (Relation) Problem:	maxillary	mandibular
1) To correct proclination	2 x 2 = 4mm	4mm
2) To correct Rotation		
3) To correct Curve of spee		0.5 x 2 = 1mm
4) To correct crowding		
5) Total space required.	4 mm	5 mm

# Space available:		
1) Interdental Spacing	2 mm	-
2) Expansion, Derot of Posterior		2 mm expansion
3) Distalization, Interproximal Uprighting, Stripping	2 mm (IPS)	2.5 mm (IPS)
4) Extraction after anchorage loss		
5) Total Space available	4mm	5mm

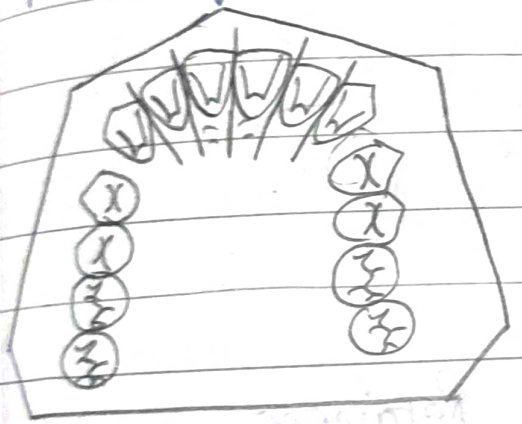
Treatment Plan:

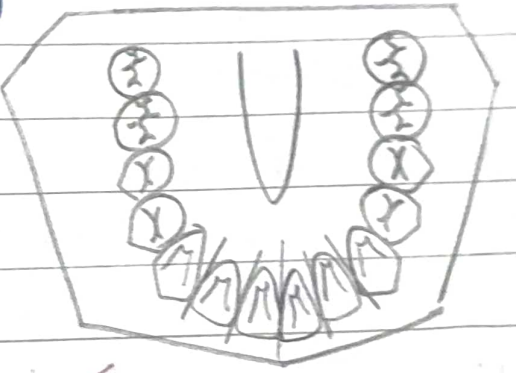
1) Pretreatment:



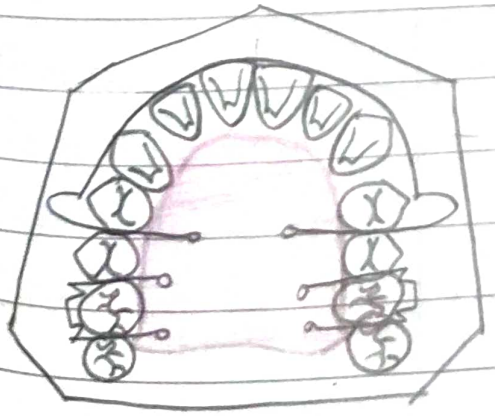


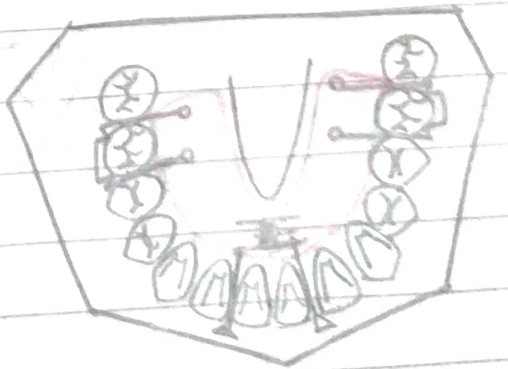
2) Interproximal Stripping:



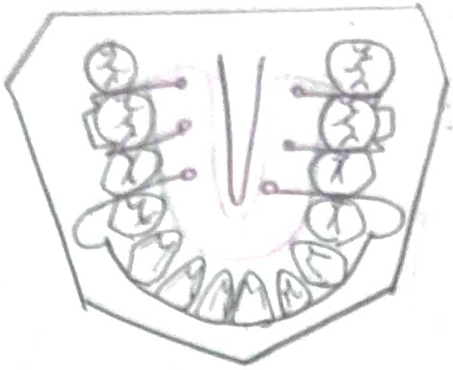


3) Retraction of incisors using long labial bow in maxillary arch & Expansion of mandibular arch.

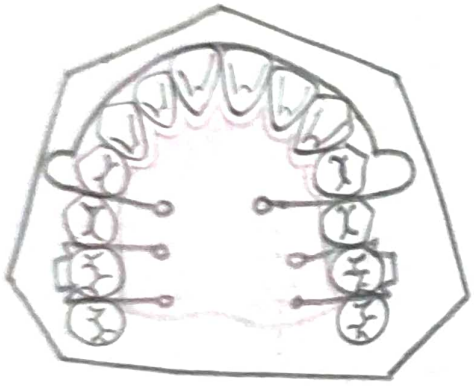


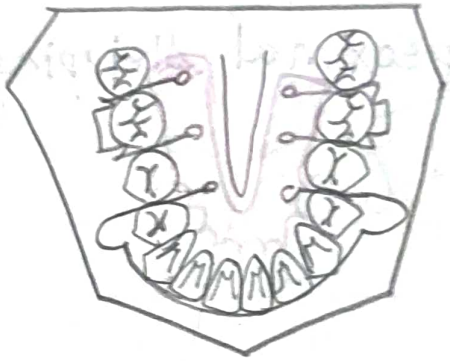


4) Retraction of mandibular incisors by long labial bow

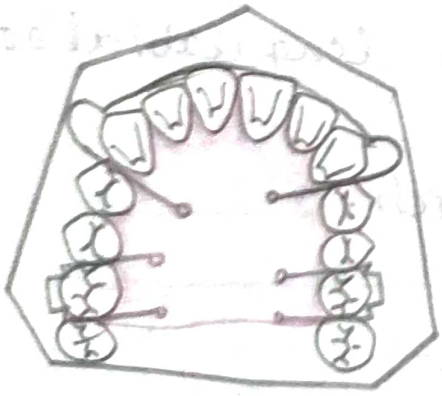


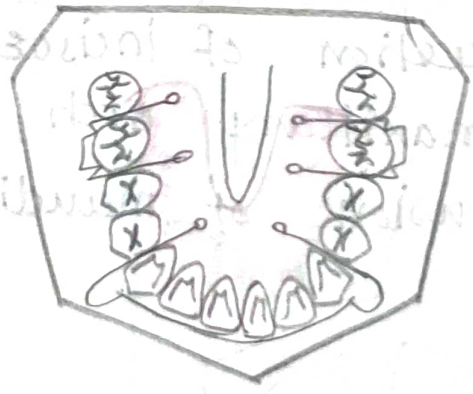
5) Post space closure -





6) Retention : with hawley's Retainer





Model Analysis - 4

1) Teeth present :

8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8

2) measurement of teeth :

6	5	4	3	2	1		1	2	3	4	5	6
10.5	6.5	7	9	7	9		9	7	8	7	6.5	10.5
11.5	6.5	7.5	7.5	5.5	5.5		6	5	7	7	7	11.5
6	5	4	3	2	1		1	2	3	4	5	6

3) Total teeth material :

	maxillary	mandibular
1) Actual	97 mm	87.5 mm
2) Normal	91.7 mm	84 mm
3) Difference	5.3 mm	3.5 mm
4) Inference	maxillary teeth material excess by 5.3 mm	Mandibular TTM excess by 3.5 mm

4) Sum of incisors :

	maxillary	mandibular
Actual	32 mm	22 mm
Normal	31.3	23 mm
Difference	0.7 mm	1 mm
Inference	SI excess by 0.7 mm	SI excess by 1 mm.

5) Depth of Palate :

Actual	Normal	Difference	Inference
25 mm	17.5 mm	7.5 mm	Deep palate.

6) Proclination:	maxillary	mandibular
i) Actual	3.5 mm	0 mm
ii) Normal	2mm	0 mm
iii) Difference	1.5 mm	-
iv) Inference	maxillary Anteriors proclined by 1.5 mm	-

7) Curve of spee:

Actual	Normal	difference	Inference
2mm	1.5mm	0.5mm	Deep curve of spee

8) Spacing & Crowding

	spacing	Crowding
upperarch	2 mm	-
lower arch	-	1.5 mm

Pont's index -

i) Premolar region = $\frac{\text{Sum of incisors}}{80} \times 100$

$= \frac{32}{80} \times 100 = 40$

ii) molar region = $\frac{\text{Sum of incisors}}{64} \times 100$

$= \frac{32}{64} \times 100 = 50$

Region	measured	Calculated	Difference	Inference
Premolar	38mm	41.5mm	3.5	Need for expansion
molar	45 mm	51.5mm	6.5	

Ashley Howey's index = $\frac{\text{Canine forsq width}}{\text{Total Tooth material}} \times 100$

$= \frac{45 \times 100}{97} = 47.7\%$

Nance & Carey's index -

Calculated L.D = L.D + 2X

= ~~18 28 + (2 x 21) = 64~~

= 28 + (2 x 18) = 28 + 36

= 64

measured L.D	Calculated L.D	Difference	Inference
69 mm	64 mm	5 mm	Extraction of 2nd Premolar required.

Occlusion: Anteroposterior molar Relation -

Right side } Class I molar relation on both side.
left side }

Overjet = 2.5 mm Overbite = 3 mm

Bolton's Ratio :

Sum of mandi 12 = 87.5 . Sum of maudi 6 = 36.5.

Sum of maxi 12 = 97 . Sum of maxi 6 = 49.

Overall ratio = $\frac{\text{Sum of maudi 12}}{\text{Sum of maxi 12}} \times 100$

$= \frac{87.5}{97} \times 100 = 90.2\%$ ∴ < 91.3% → maxillary excess

∴ maxillary Excess = maxi 12 - $\frac{\text{maudi 12}}{91.3} \times 100$

$= 97 - \frac{87.5}{91.3} \times 100 = 97 - 95.8$

$= 1.2\%$

Anterior Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

< 77.25% maxi excess

$= \frac{36.5}{49} \times 100 = 74.4\%$

∴ maxillary excess = maxi 6 − $\frac{\text{mandi 6}}{77.2} \times 100$

$= 49 - \frac{36.5}{77.2} \times 100 =$ ~~49x~~ $49 - 47.2 = 1.8$

Space Refroblem:

1) Space required for:	maxillary	mandibular
i) To correct proclination	1.5 x 2 = 3mm	-
ii) To correct Rotation	-	-
iii) To correct curve of spee	-	0.5 x 2 = 1mm
iv) To correct crowding	-	1.5mm
v) Total space required	3mm	2.5mm

2) Space available:

	maxillary	mandibular
1) Interdental spacing	2mm	-
2) Expansion	-	-
3) Distallization	-	-
4) Interproximal Stripping	1mm	2.5mm
5) Derotation of posterior	-	-
7) uprighting of posterior	-	-
7) Extraction after anchorage lor.	-	-
8) Total space available	3mm	2.5mm

$= 97 - \frac{87.5}{91.3} \times 100 = 97 - 95.8$

$= 1.2\%$

Anterior Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

$< 77.25\%$ maxi excess

$= \frac{36.5}{49} \times 100 = 74.4\%$

$\therefore$ maxillary excess = maxi 6 $- \frac{\text{mandi 6}}{77.2} \times 100$

$= 49 - \frac{36.5}{77.2} \times 100 =$ ~~49 X~~ $49 - 47.2 = 1.8$

Space Refroblem :

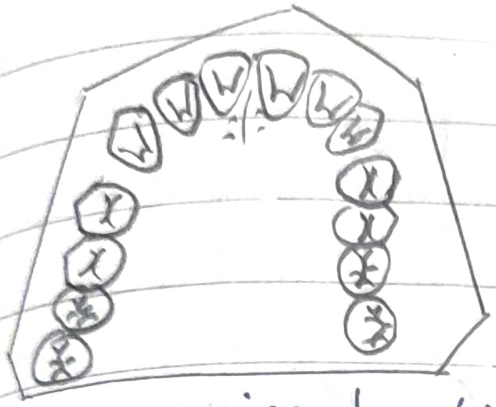
1) Space required for :	maxillary	mandibular
i) To correct proclination	$1.5 \times 2 = 3mm$	-
ii) To correct Rotation	-	-
iii) To correct curve of spee	-	$0.5 \times 2 = 1mm$
iv) To correct crowding	-	1.5mm
v) Total space required	3mm	2.5mm

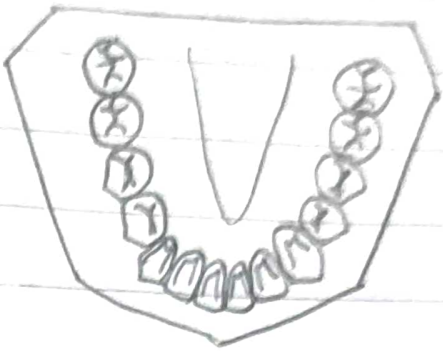
2) Space available :

	maxillary	mandibular
1) Interdental spacing	2mm	-
2) Expansion	-	-
3) Distallization	-	-
4) Inter proximal Stripping	1mm	2.5mm
5) Derotation of posterior	-	-
6) uprighting of posterior	-	-
7) Extraction after anchorage lor.	-	-
8) Total space available	3mm	2.5mm

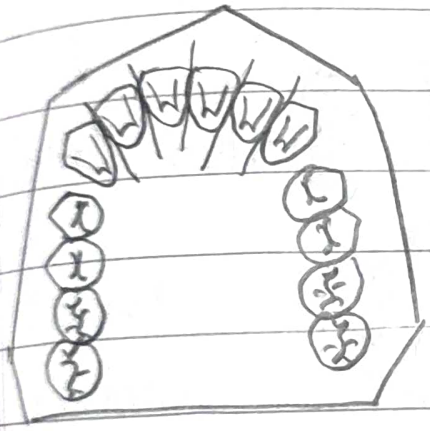
Treatment Plan:

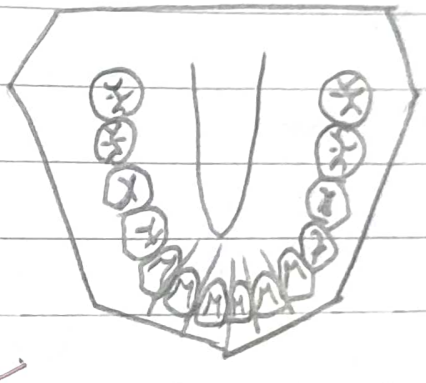
1) Pretreatment:



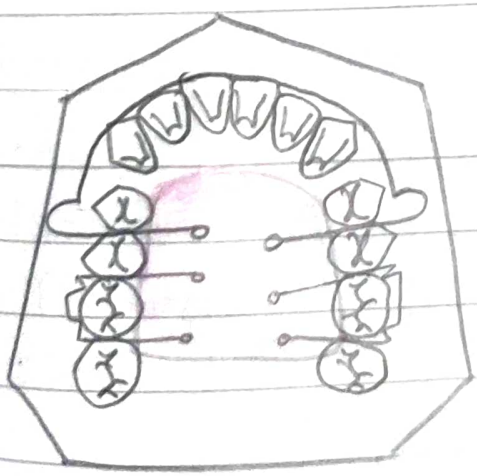


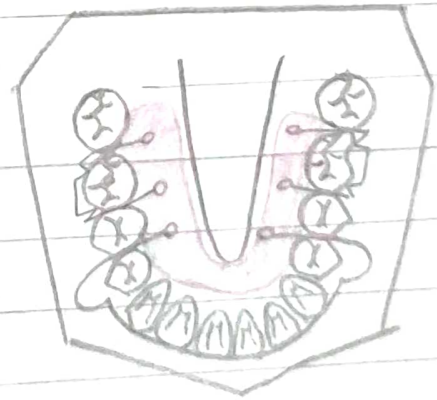
2) Interpeoximal stripping:



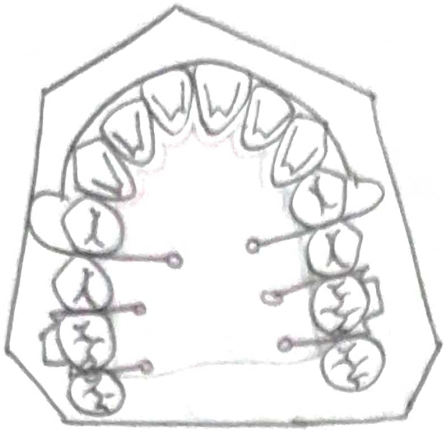


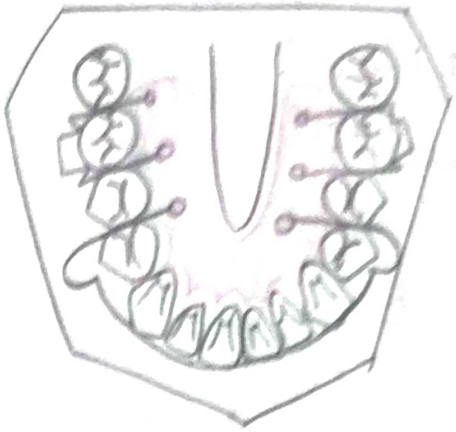
3) Retraction of incisors by long labial bow.



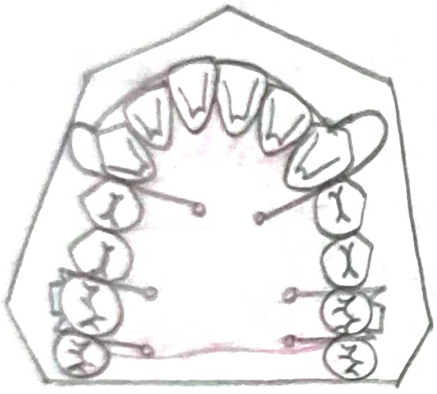


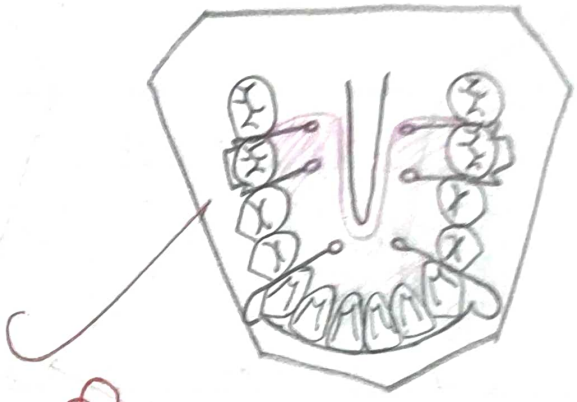
④ Post space closure





⑤ Retainer : Hawley's Retainer for Retention.





Model Analysis - 5

1. Teeth present

7	6	5	4	3	2	1	1	2	3	4	5	6	7
7	6	5	4	3	2	1	1	2	3	4	5	6	7

2. Teeth measurement:

6	5	4	3	2	1	1	2	3	4	5	6	
10	6	7	8	6.5	9	9	8	8	6.5	6	10.5	
11	6.5	6.5	7	6	6	6	6	6.4	6.4	6.5	11	
6	5	4	3	2	1	1	2	3	4	5	6	

3. Total Teeth material:

	maxillary	maxillary
Actual	92	85
Normal	91.7	84
Difference	0.3	1 mm
Inference	TTM excess by 0.3mm	TTM excess by 1 mm

4. Sum of Incisors:

	maxillary	mandibular
Actual	30.5 mm	24 mm
Normal	31.3 mm	33 mm
Difference	0.8 mm	1 mm
inference	SI less by 0.8 mm	SI more by 1mm

5. Depth of Palate:

Actual	Normal	Difference	Inference
24.5	17.5	7 mm	Deep Palate.

6) Proclination:	maxillary	mandibular
1) Actual	2mm	0
2) Normal	2mm	0
3) Difference	0	-
4) Inference	-	-

7) Curve of spee :

Actual	Normal	Difference	Inference
2 mm	1.5mm	0.5mm	Deep curve of spee

8) Spacing & Crowding :

	Spacing	Crowding
· upper arch	-	5 mm
· lower arch	-	4 mm

9) Pont's Index :

i) Premolar Region = $\frac{\text{Sum of Incisors}}{80} \times 100$

$= \frac{30.5}{80} \times 100 = 30.5 \times 1.25 = 38.12$

ii) Molar Region = $\frac{\text{sum of incisors}}{64} \times 100$

$= \frac{30.5}{64} \times 100 = 47.58$

Region	measured	Calculated	Difference	Inference
Premolar	34mm	43.75mm	9.75mm	Need for expansion
Molar	43.6mm	54.6mm	11mm	

10) Ashley Howe's index : $\frac{\text{Canine fossa width}}{\text{Total tooth material}} \times 100$

$= \frac{44}{92} \times 100 = 47.52\ \%$

11) Nance's Carey's index:

Calculated L·D = L·A + 2X

= 40 + (2 x 10) = 60 mm

measured L·D	Calculated L·D	Difference	Inference
68 mm	60mm	8 mm	Extraction of 1st premolar required.

12) Model in occlusion - Angle's classification:

Angle's Class I molar relation on both side.

overjet = 1mm Over bite = 1 mm.

13) Bolton's Ratio:

Sum of mandi 12 = 85. Sum of mandi 6 = 37.4.

Sum of maxi 12 = 92. Sum of maxi 6 = 36.5.

Overall ratio: $\frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$

$= \frac{85}{92} \times 100 = 82 \times 1.08 = 88.56$

maxillary excess = maxi 12 - $\frac{\text{mandi 12}}{91.3} \times 100$

$= 85 - \frac{92}{91.3} \times 100$

$= \frac{7760}{91.3} =$

Anterior Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

$= \frac{37.4}{46.6} \times 100 = 37.4 \times 2.14 = 80.03$

mandibular anterior TTM excess.

Mandibular excess = mandi 12 - $\frac{\text{maxi 12}}{77.2} \times 100$

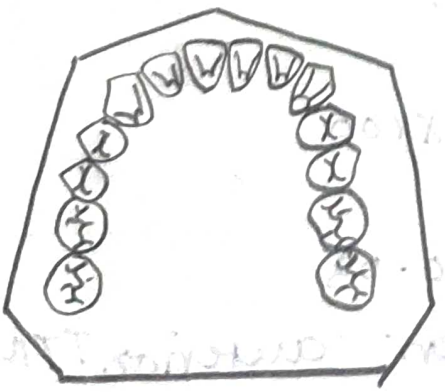
$= 37.4 - \frac{46.5 \times 100}{77.2}$ $= \frac{37.4 \times 77.2 - 46.5 \times 100}{77.2}$

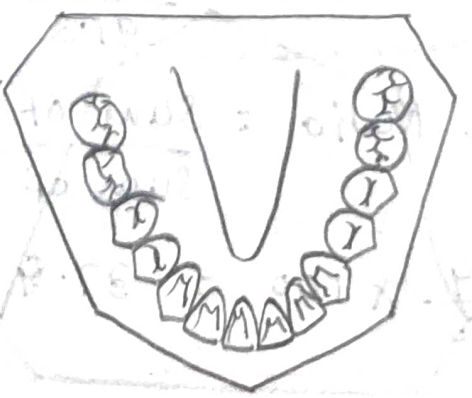
# Space Problem:	maxillary	mandibular
Space Required:		
1) To correct proclination		
2) To correct Rotation		
3) To correct Curveofspee		0.5x2 = 1mm
4) To correct Curve of spee (crowding)	5mm	4mm
Total Required:	5mm	5mm

# Space available	maxillary	mandibular
1) Interdental spacing	-	-
2) Expansion	2.5mm	2.5mm
3) Distalization	-	-
4) IPS	2.5mm	2.5mm
5) Derotation of Posterior	-	-
6) Uprighting of Posterior	-	-
7) Extraction after anchorage loss	-	-
Total Space available	5mm	5mm

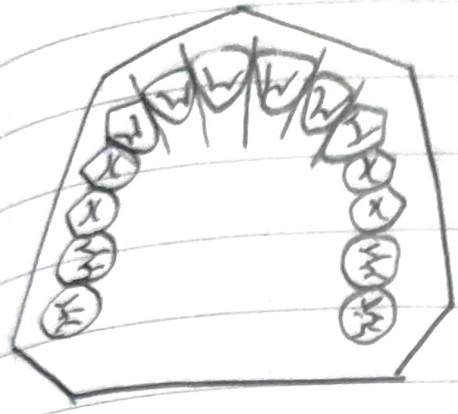
Treatment Plan:

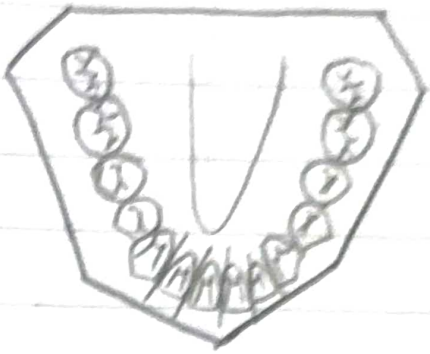
1) Pretreatment:



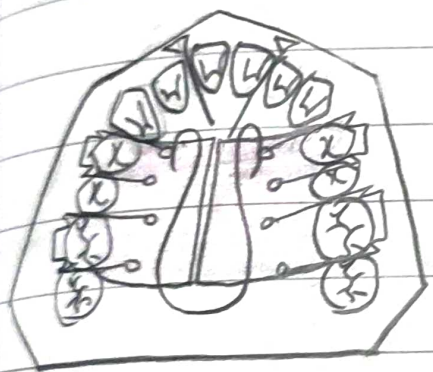


2) Interproximal Stripping:

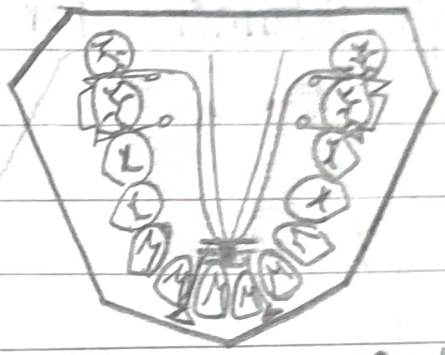




3) Expansion of arches:

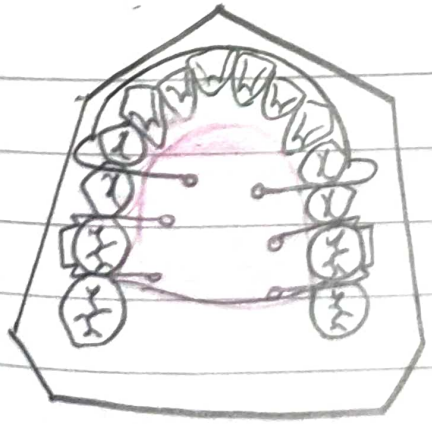


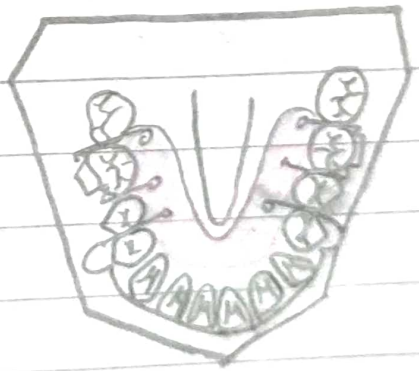
Expansion of upper arch by coffin speing



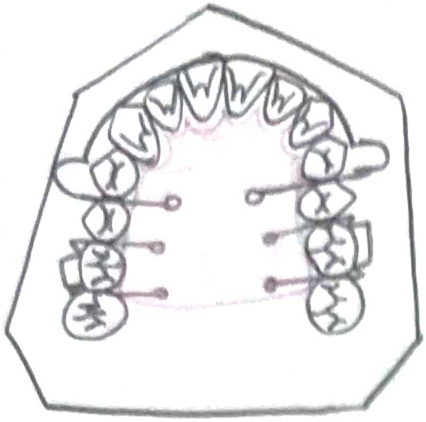
Expansion of lower arch by Schwartz appliance

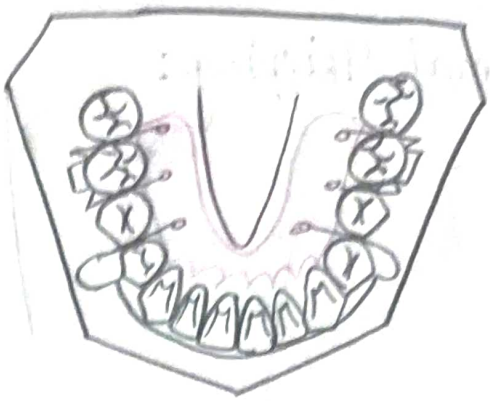
4) Retraction of incisors by long labial bow:



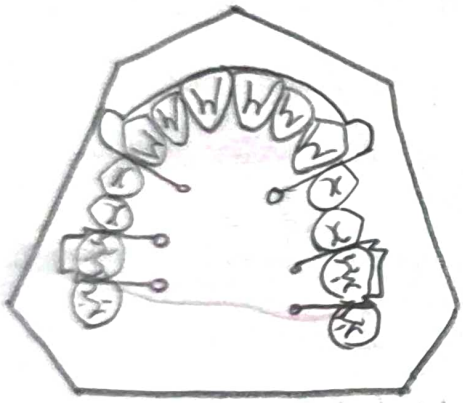


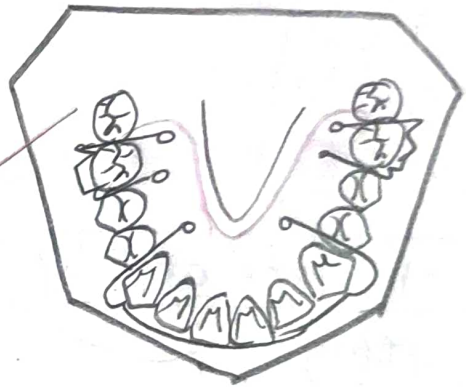
5) Post space Closure:





6) Hawley's retainer for retention:





Model Analysis - 6

Teeth present:

8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

measurements of Teeth:

6 5 4 3 2 1	1 2 3 4 5 6
10 6 6 8 6 9	9 6 8 5 5 10
11 7 6 6 6 5	5 5 6 6 6 11
6 5 4 3 2 1	1 2 3 4 5 6

Total Teeth material:

	maxillary	mandibular
Actual	88 mm	80 mm
Normal	91.7 mm	84 mm
Difference	3.7 mm	4 mm
Inference	maxillary TTM excess by 3.7mm	mandibular TTM excess by 4mm

Sum of incisors -

	maxillary	mandibular
Actual	30 mm	21 mm
Normal	31.3 mm	23 mm
Difference	1.3mm	2 mm
inference	SI excess by 1.3mm	SI mandi Inc less by 2 mm

5) Depth of Palate -

Actual	Normal	Difference	Inference
23 mm	17.5mm	5.5 mm	Deep palate

6) Proclination -

	maxillary	mandibular
Actual	5 mm	3mm
Normal	2mm	0 mm
Difference	3 mm	3 mm
inference	Proclined anteriors	mandi I procline

7) Curve of spee -

Actual	Normal	Difference	inference
3mm	1.5mm	1.5mm	Deep curve of spee

8) Pont's index :

$$\text{Premolar region} = \frac{\text{Sum of incisors}}{80} \times 100$$

$$= \frac{30}{80} \times 100 = 37.5$$

$$\text{molar region} = \frac{\text{Sum of incisors}}{64} \times 100$$

$$= \frac{30}{64} \times 100 = 46.8$$

9)

Region	Measured	Calculated	Diff.	Inf.
Premolar	36 mm	37.5mm	1.5mm	Needfo
molar	44mm	46.8mm	2.8mm	expan

1) Ashley Howey's Index = $\frac{\text{canine fossa width}}{\text{TTm}} \times 100$

$$= \frac{34}{88} \times 100 = 0.38 \times 100 = \frac{\text{TTm}}{88}$$

10) Nance & Carey's index -

Calculated L·D = L-Area + 2x

= 33 + 2(18) = 33 + 36

= 69 mm.

measured L·D	Calculated L·D	Diff.	Inf.
60 mm	69 mm	9 mm	Extraction of 1st Premol -ar Req.

Occlusion: Class I molar Rel° on both side.

Overjet = 1mm overbite = 2.5 mm.

Bolton's Ratio: Sum of mandi 12 = 80 mm maxi 12 = 88mm
mandi 6 = 33 mm maxi 6 = 46 mm

$\frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100 = \frac{80}{88} \times 100 = 90\%$

$\because$ < 91.3 → maxi Excess.

$\therefore$ maxi-Excess = maxi 12 - $\frac{\text{mandi 12} \times 100}{91.3}$

= 88 - $\frac{80 \times 100}{91.3}$ = 8034.4 - 8000 = 33.87.

Ant. Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

= $\frac{33}{46} \times 100$ = 0.71 × 100 = 71%

$\because$ < 77.25 → maxi Excess.

maxi Excess = maxi 12 - $\frac{\text{mandi 12} \times 100}{77.2}$

= 46 - $\frac{33}{77.2} \times 100$ = 46 - 39.6

= 6.4%

Space Problem:

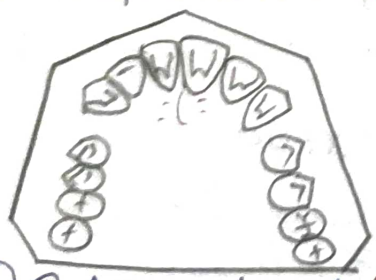
	maxillary	mandibular
1) To correct Proclination	3x 2 = 6mm	3x 2 = 6mm
2) To correct Rotation	-	-
3) To correct crowding	-	5 mm
4) To correct curve of spee	-	1.5 x 2 =
5) Total space Required	6mm	16mm

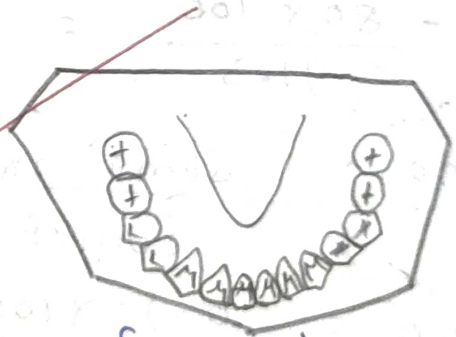
Space Available

	maxillary	mandibular
1) Interdental Spacing	2mm	-
2) Expansion	2mm	-
3) Distallization	2mm	-
4) Interproximal Stripping		-
5) Derotation of posterioz		-
6) Uprighting of posterioz		-
7) Anchorage / Extraction.		14mm
Total space gain	6mm	16mm

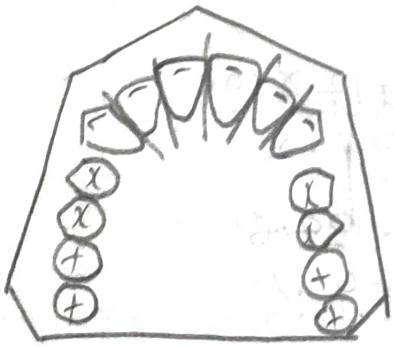
Treatment Plan:

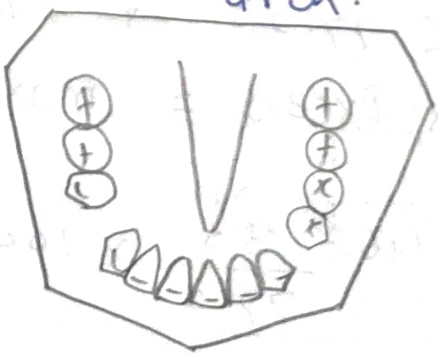
① Pretreatment



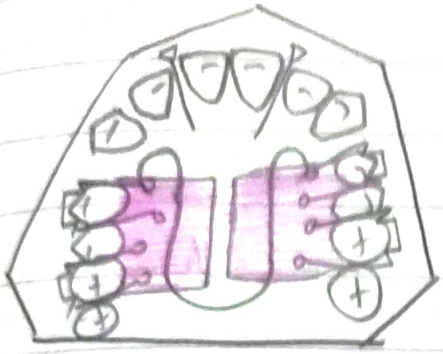


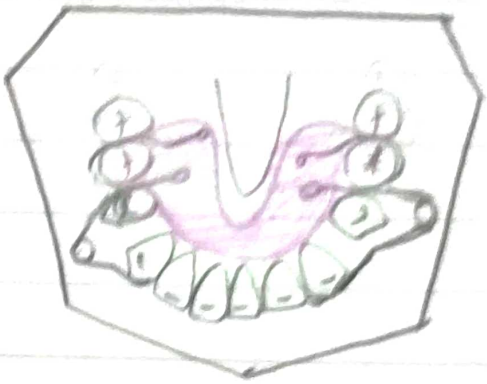
② Interproximal Stripping of maxillary arch.
Extraction ⊂ $\frac{4}{4}$ mandibular arch.



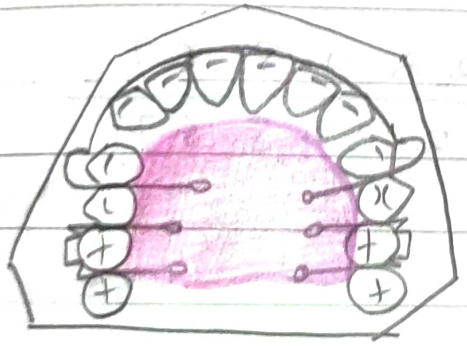


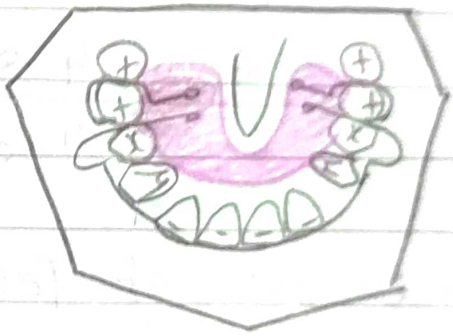
(3) Expansion of maxillary arch by coffin spring & Retraction of lower canine with Buccal canine Retractor.



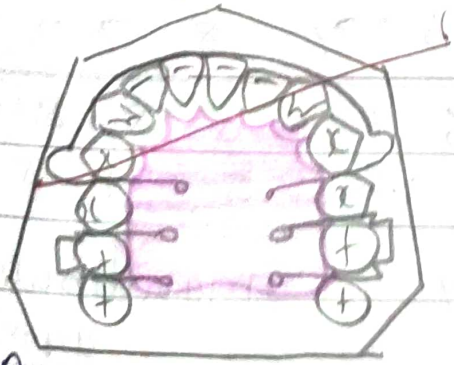


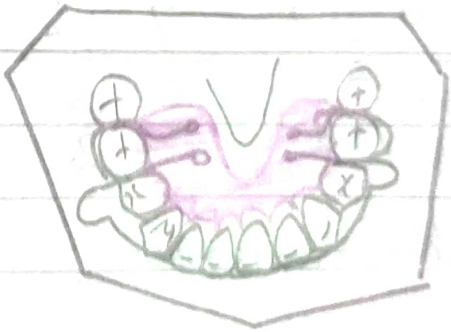
(4) Retraction of Both upper & lower anteriors by long Labial bow.



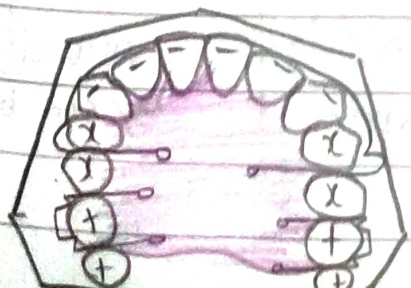


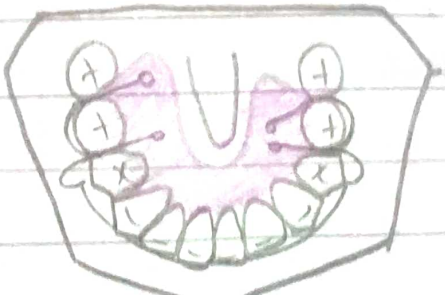
(5) Post space closure of both upper & lower arch.





(6) Retention with ~~lower~~ an Hawley's Retainer: (modified) (long labial bow + Adams)





model Analysis - 7

(manashri)

1) Teeth present :

7 6 5 4 3 2 1	1 2 3 4 5 6 7
7 6 5 4 3 2 1	1 2 3 4 5 6 7

2) measurement of Teeth :

6 5 4 3 2 1	1 2 3 4 5 6
10 7 7 8 6 10	10 7 8 7 7 10
11 8 8 8 6 6	6 6 8 8 8 11
6 5 4 3 2 1	1 2 3 4 5 6

# Total teeth material	maxillary	mandibular
Actual	97 mm	94 mm
Normal	91.7 mm	84 mm
Difference	5.3 mm	10 mm
inference	maxi Teeth material excess by 5.3 mm	mandi TTM excess by 10

Sum of Incisors :

	maxillary	mandibular
Actual	83 mm	24 mm
Normal	81.3 mm	23 mm
Difference	1.7 mm	1 mm
inference	SI excess by 1.7mm	SI excess by 1mm

Proclination -

	maxillary	mandibular
Actual	5mm	1 mm
Normal	2 mm	0 mm
Difference	3mm	1 mm
inference	maxi Ant. Proclined by 3mm	mandi Incisor Proclined by 1mm

Depth of Palate -

Actual	Normal	Difference	Inference
22.3mm	17.5mm	4.8 mm	Deep palate.

Curve of spee -

Actual	Normal	Difference	inference
2.5mm	1.5mm	0.5mm	Deep curve of spee

Spacing & Crowding

	Spacing	Crowding
Upperarch -	6mm	0 mm.
Lower arch -	2 mm	2mm.

Pont's index:

1) Premolar Region = $\frac{\text{Sum of incisors}}{80} \times 100$

$= \frac{33}{80} \times 100 = 41.2$.

2) molar Region = $\frac{\text{Sum of incisors}}{64} \times 100$

$\frac{33}{64} \times 100 = 51.48$.

Region	measured	calculated	Diff	Inference
Premolar	43 mm	41.2 mm	1.8 mm	Expansion of arches Req.
molar	52 mm	51.48 mm	0.52	

Ashley Howey's index = $\frac{\text{canine fossa width}}{TTM} \times 100$

$= \frac{39\text{mm}}{97} \times 100 = 40\%$.

Nance & carey's Index =

Calculated L.D = L.A + 2x = 36 + 40 = 76 mm.

measured L.D	Calculated L.D	Diff.	Inf.
75 mm	76 mm	1 mm	IPS. req.

Occlusion = Rt side - Class I molar Rel^n on both sides

Overjet = 4 mm Overbite = 4 mm.

Bolton's Ratio:

Sum of mandi 12 = 100 mm Sum of maxi 6 = 50

Sum of mandi 6 = 84 mm Sum of mandi 6 = 34 mm

Overall Ratio = $\frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$

$= \frac{100}{106} \times 100 = 94.3 \longrightarrow$ mandi Excess.

$\therefore$ mandi Excess = mandi 12 $- \frac{\text{maxi 12} \times 91.3}{100}$

$= 106 - \frac{100 \times 91.3}{100} = \frac{10600 - 9130}{100} \Rightarrow 16\%$

Anterior Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

$< 77.25 \rightarrow$ maxi Excess

$= \frac{34}{50} \times 100 \Rightarrow 68\%$ maxi Excess.

maxi/mandi Excess = mandi 12 $- \frac{\text{mandi 12} \times 100}{97.23}$

$= 100 - \frac{106}{77.2} \times 100 =$ 6 mm

Space problem :

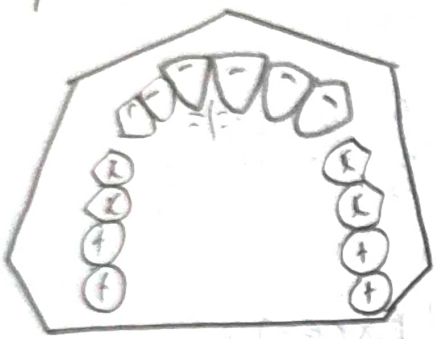
	maxillary	mandibular
1) To correct Rotation		–
2) To correct crowding		2mm
3) To correct proclination	3 x 2 = 6mm	1 mm
4) To correct Curve of Spee		0.5 x 2 = 1mm
5) Total Space Required	6 mm	4 mm

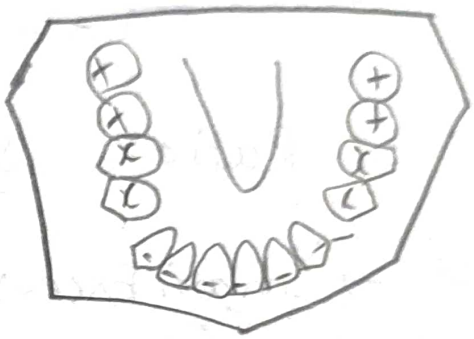
# Space available :	maxillary	mandibular
1) Interdental spacing	5mm	2mm
2) Expansion	–	–
3) Distalization.	–	–

4) Interproximal stripping	mm	2mm
5) Derotation of posterior	–	–
6) Uprighting of posterior	–	–
7) Extraction after anchorage loss	–	–
8) Total space available	6mm	4mm

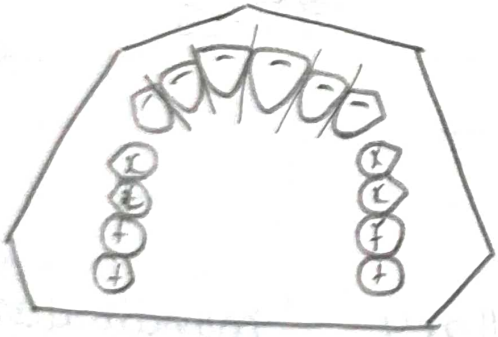
T/t Plan:

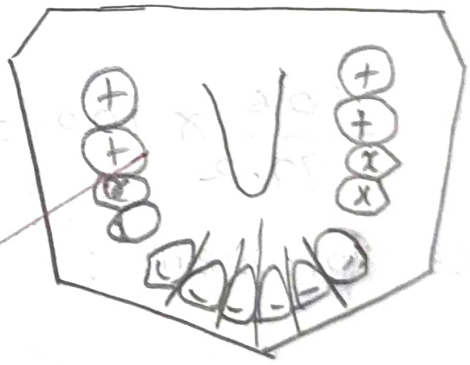
1) Pretreatment:



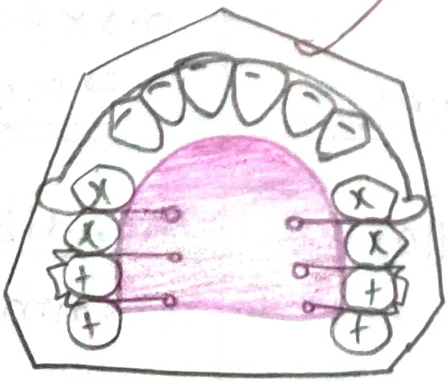


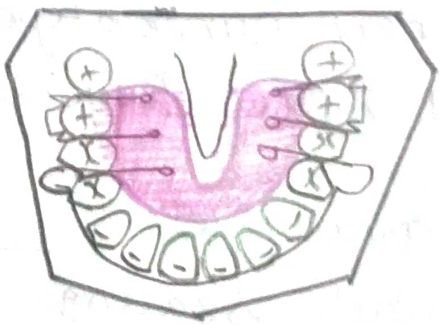
2) Interproximal stripping in mandibular arch.



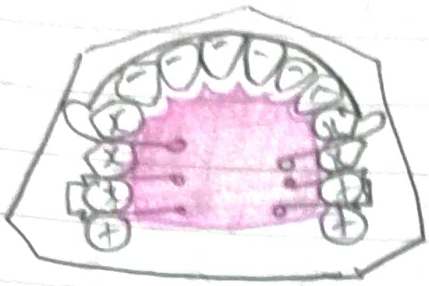


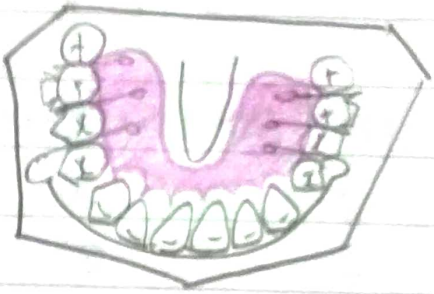
3) Retraction of Anteriors by long labial bow in both arches:



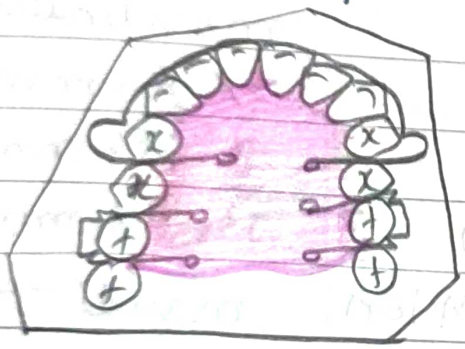


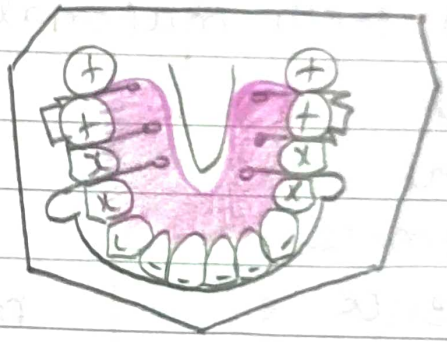
4) Post space closure:





5) Retention by: Hawley's Retainer:





model Analysis - 8

1) Teeth Present

8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

2) Teeth measurement:

6 5 4 3 2 1	1 2 3 4 5 6
10 6 7 8 7 8	8 6 8 6 6 10
11 7 8 7 6 5	5 5 5 7 7 11
6 5 4 3 2 1	1 2 3 4 5 6

3) Total teeth material:

	maxillary	mandibular
Actual	90 mm	84 mm
Normal	91.7 mm	84 mm
Difference	0.7 mm	0 mm.
inference	maxillary TTM lens by 0.7 mm	mandi TTM by 0mm

4) Sum of incisor

	maxillary	mandibular
Actual	29 mm	21 mm
Normal	31.3mm	23 mm
Difference	2.7 mm	2 mm
inference	-	

5) Depth of Palate:

Actual	Normal	Difference	inference
23mm	17.5mm	± 5.5 mm	Deep Palate

# Proclination:	maxillary	mandibular
1) Actual	4mm	0mm
2) Normal	2mm	0mm
3) Difference	2mm	-
4) Inference	maxillary anteriors proclined by 2mm	

Curve of Spee -

Actual	Normal	Difference	Inference
3 mm	1.5mm	1.5 mm	Deep curve of spee.

Spacing & Crowding -

	Spacing	Crowding
upper arch	2mm	
lower arch		2mm

Pont's index -

1) Premolar region = $\frac{\text{Sum of incisors}}{80} \times 100$

$= \frac{29}{80} \times 100 = 29 \times 1.25 = 36.25.$

2) Molar region = $\frac{\text{Sum of incisors}}{64} \times 100$

$= \frac{29}{64} \times 100 = 45.24$

Region	measured	Calculated	Difference	Inferen
Premolar	39mm	36.25mm	2.75mm	Expan
molar	48mm	45.24mm	2.76mm	on requir

Ashley Howey's index -

$$\frac{\text{Canine fossa width}}{\text{Total teeth material}} \times 100$$

$$= \frac{47}{90} \times 100 = 52.2$$

Nance and carey's analysis -

Calculated L·D = L·A + 2X

= 29 + 40 = 69

measured L·D	Calculated L·D	difference	Inference
73mm	69 mm	4mm	Extraction of 2nd Premolar

Occlusion = Class I molar relation on both side

Overjet = 3mm.

Overbite = 4mm.

Bolton's ratio -

Sum of maxi 12 - 90 mm

Sum of maudi 12 - 84 mm

Sumof maxi 6 - 45 mm

Sum of maudi 6 - 33 mm

$$\text{Overall ratio} = \frac{\text{Sum of maudi 12}}{\text{Sum of maxi 12}}$$

$$= \frac{84}{90} \times 100 = 93.3\%.$$

$$\text{maudi Exten} = \text{maudi 12} - \frac{\text{maxi 12}}{91.3} \times 100$$

$$= 90 - \frac{84}{91.3} \times 100 = -13\%.$$

Anterior ratio = $\frac{33}{45} \times 100 = 73\%$.

maxi excess = $33 - \frac{45}{77.2} \times 100$

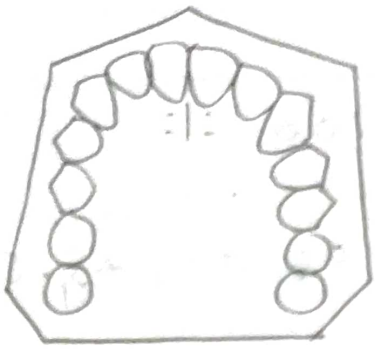
$= 83 - 58.05 = 25.5$

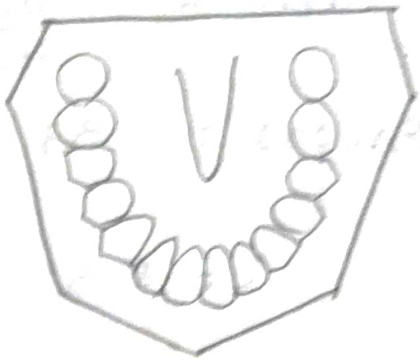
Space Required -	maxillary	mandibular
1) To correct proclination	2x 2 = 4mm	-
2) To correct crowding	-	2.5mm
3) To correct curve of spee	-	3mm
4) To correct rotation	-	-
Total space required	4mm	5.5mm

Space available	maxillary	mandibular
1) Interdental spacing	2mm	-
2) Expansion	-	3mm
3) Distallization	-	-
4) Interproximal stripping	2mm	2.5mm
5) Derotation of posterior	-	-
6) Uprighting of posterior	-	-
7) Extraction after anchorage loss	-	-
8) Total space available	4mm	5.5mm

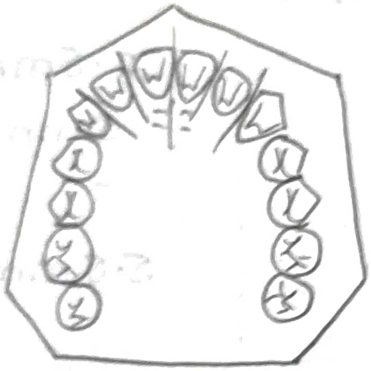
Treatment Plan

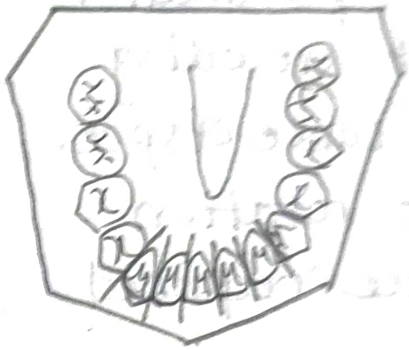
1> Pretreatment



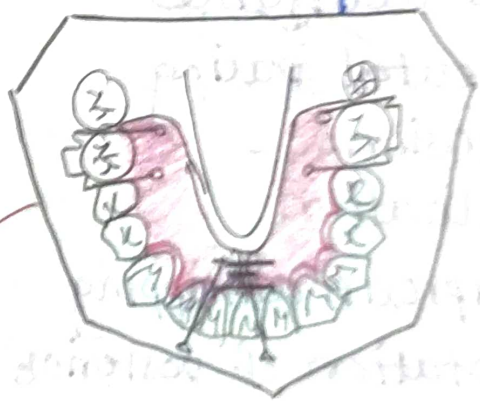


2> Interproximal Stripping -

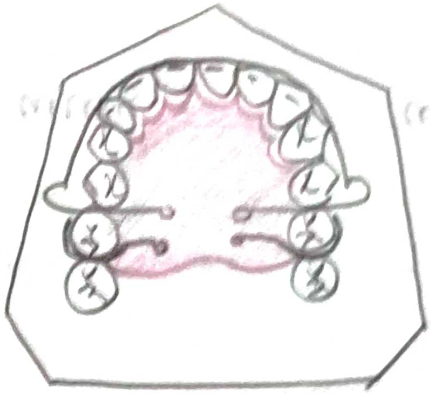


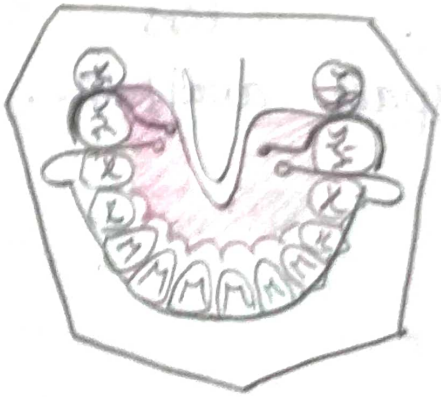


3> Expansion of mandibular arch - by Schwartz appli

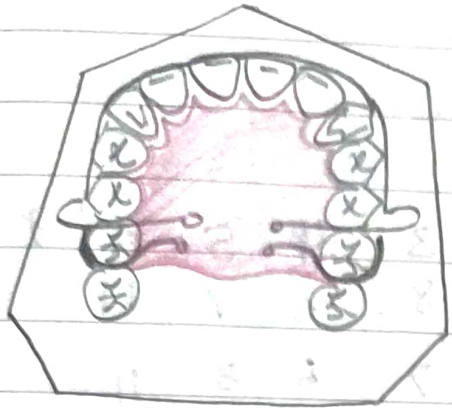


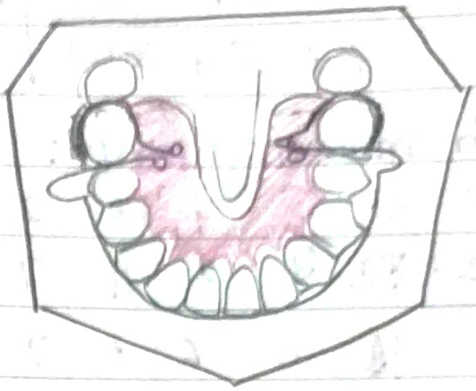
4> Retraction of anteriors by long labial bow



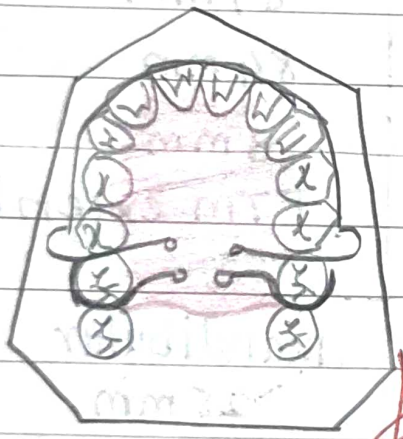


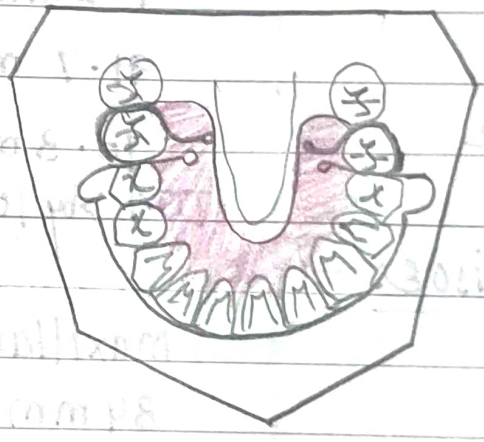
5) Post space closure :





6) Retention by Hawley's retainer :





model Analysis - 9

Teeth present :

7 6 5 4 3 2 1	1 2 3 4 5 6 7
7 6 5 4 3 2 1	1 2 3 4 5 6 7

Teeth measurement :

↗	6	5	4	3	2	1	1	2	3	4	5	6	7
↦	82	8	8	8	7	10	10	7	8	6	7	11	
	16	6	6	6	7	6	6	7	7	6	8	11	
↘	6	5	4	3	2	1	1	2	3	4	5	6	↘

Total Teeth material

	maxillary	mandibular
actual	102 mm	87 mm
Normal	91.7 mm	84 mm
Difference	10.3 mm	3 mm
inference	TTM >by 10.3 mm	TTM excess by 3mm

Sum of incisoes -

	maxillary	mandibular
Actual	34 mm	25 mm
Normal	31.3 mm	23 mm
Difference	2.7 mm	2 mm
Inference	maxi TTM excess by 2.7 mm	mandi TTM excess by 2mm

Depth of Palate :

Actual	Normal	Difference	Inference
23 mm	17.5 mm	5.5 mm	Deep palate.

6) Proclination:

i) Actual	Normal	Difference	Inference
maxi 6mm	2mm	4mm	Proclined by 4mm
mandi 4mm	0mm	4mm	

7) Curve of spee:

Actual	Normal	Difference	inference
1.5mm	1.5mm	0mm	flat curve spee

8) Spacing & Crowding

	upper arch	lower arch
1) Spacing	-	-
2) Crowding	6mm	5mm

9) Pont's index:

1) Premolar region = $\frac{\text{Sum of incisors}}{80} \times 100$

$34 \times \frac{100}{80} = 42.5$

2) molar region = $\frac{\text{Sum of incisor}}{64} \times 100$

$\frac{34 \times 100}{64} = 53.12$

Region	Calculated	measured	difference
Premolar	42.5	40	2.5
molar	53.1	46	7.12

inference: Expansion Required.

⑩ Asheey'Howey's index:

$$\frac{\text{Canine fossa width}}{\text{Total teeth material}} \times 100$$

$= \frac{44}{102} \times 100 = 43.13$ → Borderline

11) Nance & Carey's index = mandi arch

Calculated L.D = L.A + 2x

= 25 + 2x21 = 67

measured L.D	Calculated L.D	Difference	inference
80 mm	67 mm	13 mm	Extraction of 1st molar Required

12) Occlusion: on Rt side: Class II molar relation
Lt side: on both sides.

Overjet = 2mm Overbite = 2mm

13) Bolton's Ratio:

Sum of mandi 12 = 87 · Sum of maxi 6 = 40 mm

Sum of maxi 12 = 102 · Sum of mandi 6 = 50 mm

$$\text{Overall ratio} = \frac{\text{Sum of mandi 12}}{\text{Sum of maxi 12}} \times 100$$

$= \frac{87}{102} \times 100 = 85.29$

Excess → maxi excess = maxi 12 − $\frac{\text{mandi 12} \times 100}{91.3}$

$= 102 - \frac{87 \times 100}{91.3} = 6.71$

Anterior Ratio = $\frac{\text{Sum of mandi 6}}{\text{Sum of maxi 6}} \times 100$

$= \frac{40}{50} \times 100 = 80\%$.

$< 77.25 \rightarrow$ maxi Excess.

maxi Excess = $\frac{\text{maxi 6} - \text{mandi 6} \times 100}{77.25}$

= 40 mandi Excess = mandi 6 $- \frac{\text{maxi 6} \times 77.2}{100}$

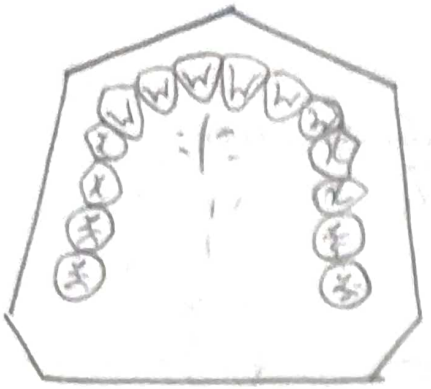
$= 40 - \frac{50 \times 77.2}{100} = 8.9$

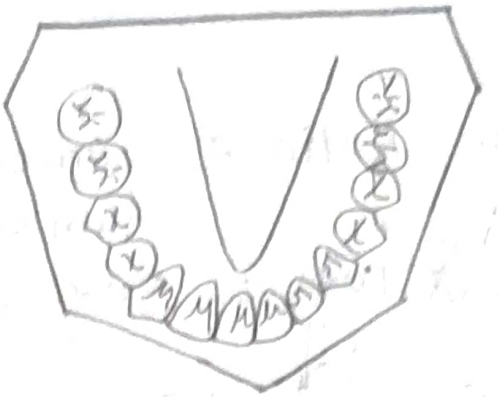
Space problem :

1> Space required for	maxillary	mandibular
i> To correct proclination	8 mm	4x2 = 8 m
ii> To correct crowding	6 mm	5 mm
iii> To correct curve of spee	-	-
iv> To correct rotation	-	-
	14 mm	13 mm

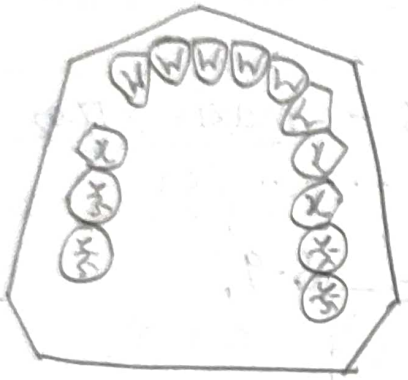
# Space available	maxillary	mandibular
1> Interdental spacing	-	-
2> Expansion	2 mm	2 mm
3> Distallization	-	-
4> Interproximal stripping	-	-
5> Derotation of posterior	-	-
6> Uprighting of posterior.	-	-
7> Extraction after anchorage lon	12 mm	11 mm
8> Total space available	14 mm	13 mm

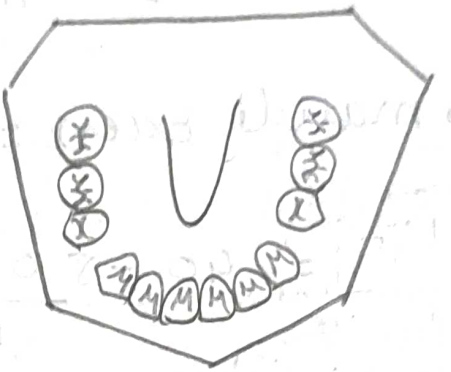
1) Pretreatment





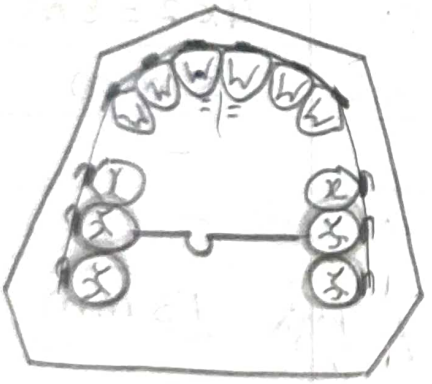
2) Extraction = $\frac{4|4}{4|4}$

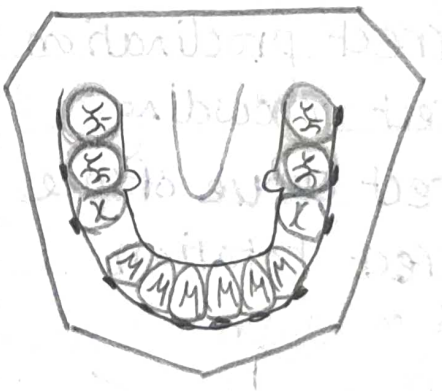




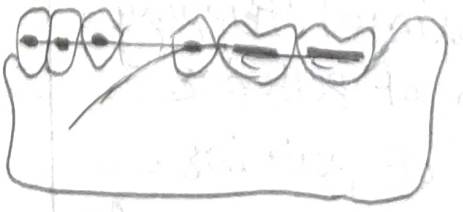
3) Alignment of maxillary & mandibular arch

→

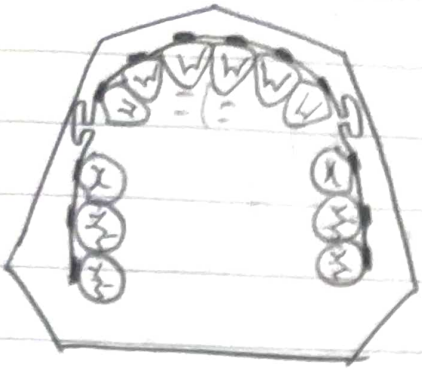


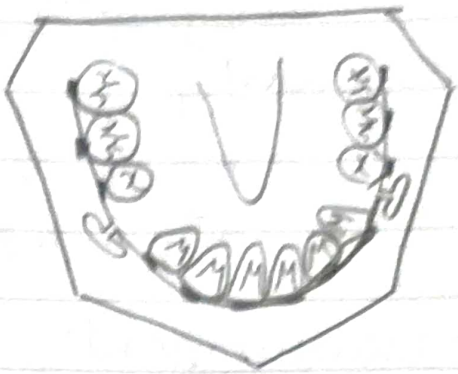


4) leveling → by using arch wire →

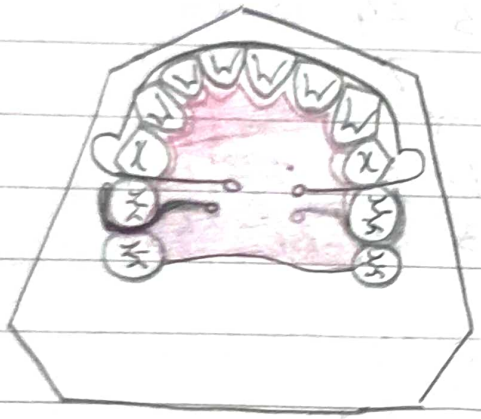


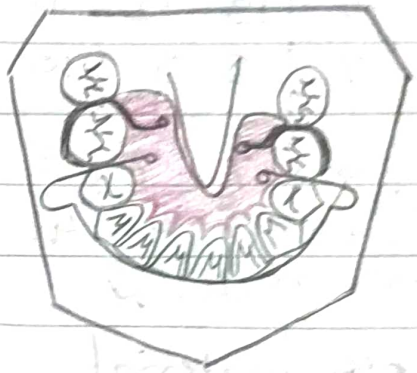
5) Space Closure



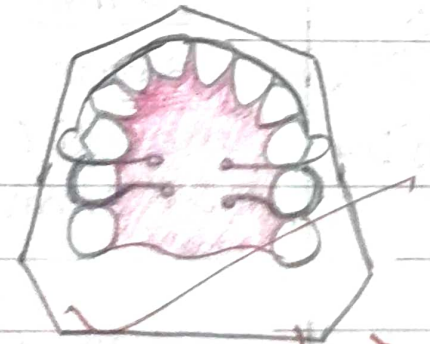


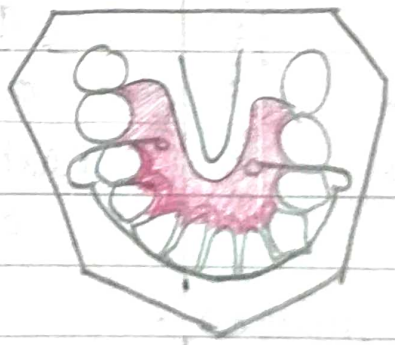
6) Post space closure





7) Retention by Hawley's Retainer -





6) ~~Retention by~~ Hawley's Retainer →

Model Analysis -10

1) Teeth present :

7 6 5 4 3 2 1	1 2 3 4 5 6 7
7 6 5 4 3 2 1	1 2 3 4 5 6 7

2) Teeth measurement

1) maxillary arch

16	15	14	13	12	11	21	22	23	24	25	26
11	7	7	8	8	10	10	8	8	7	7	11
12	7	6	7	7	5	5	7	7	6	7	12
46	45	44	43	42	41	31	32	33	34	35	36

mandibular arch.

3) Total teeth material

	maxillary	mandibular
Actual	92 mm	~~87~~ mm
Normal	91.7mm	84 mm
Difference	0.3mm	3mm
inference	maxi TTM excess by 0.3 mm	mandi TTM excess by 3mm

4) Sum of incisors -

	maxillary	mandibular
1) actual	36mm	24mm
2) Normal	31.3mm	23mm
3) Difference	4.7mm	1mm
4) Inference	maxi incisors excess by 4.7 mm	mandi incisor excess by 1mm

3) Proclination -

	maxillary	mandibular
actual	9mm	4mm
Normal	2mm	0mm
Difference	7mm	4mm
inference	maxi aut. proclined by 7mm	mandi anterior proclined by 4mm

4) Depth of Palate (maxi arch.)

actual	Normal	Difference	inference
24.4mm	17.5mm	6.5mm	Deep palate

5) Curve of spee

actual	Normal	Diff	inference
2.5mm	1.5mm	1mm	Deep curve of spee

5) Spacing & crowding :

	Spacing	Crowding
upperarch	1+0.5+0.5 = 2mm	-
lower arch		1+0.5 = 1.5mm

6) Pont's index =

1) Premolar region = $\frac{\text{Sum of incisor}}{80} \times 100$

= 1.25×36.8 = 45

2) Molar region = $\frac{\text{Sum of incisor}}{64} \times 100$

= $\frac{36}{64} \times 100$ = 36×1.56

= 56.25

Region	measured	Calculated	Difference	inference
1) Premolar	39 mm	45mm	6 mm	Need for expansion
2) molar	44 mm	56.2mm	12.2 mm	Need for expansion

measured < Calculated → Need for expansion.

2) Nance & Carey's index:

Calculated linear dimension = L.A + 2X
= Sum of incisor + 2X
= 24 + 40 = 64

Calculated LD = 64
measured LD = 60
Difference = 4mm → Extraction of 2nd premolar

Calculated ≥ measured
inference applied

3) Occlusion = Class II on both side
overjet = 10mm
overbite = 4mm

4) Ashley Howe's index - $\frac{\text{Canine fossa width}}{\text{Total teeth material}} \times 100$

$= \frac{46}{92} \times 100 = 43.47$ → Borderline

5) Bolton's ratio:

Sum of maxi 12 = 87mm.
Sum of mandi 12 = 92mm.
Sum of maxi 6 = 38mm.
Sum of mandi 6 = 52mm.

Overall ratio = $\frac{\text{Sum of maxi 12}}{\text{Sum of mandi 12}} \times 100 = \frac{87}{92} \times 100$

$= 94.56$ → mandi TTM excess.

< 91.3.1. - maxi TTM excess.

• Posterior ratio -

maxi excess = maxi 12 - $\frac{\text{maudi 12}}{91.3} \times 100$

maudi excess = maudi 12 - $\frac{\text{maxi 12}}{91.3} \times 100$

$= 87 - \frac{92}{91.3} \times 100$

$= 87 - 83.9 = 3.1$ mm

Anterior ratio - $\frac{\text{Sum of maudi 6}}{\text{Sum of maxi 6}} \times 100 = \frac{38}{52} \times 100$

$= 73.07$

<77.2⇒ maxi Anterior excess

maxi ~~ant~~ excess

$= \text{maxi 6} - \frac{\text{maudi 6}}{77.2} \times 100$

$= 52 - \frac{38}{77.2} \times 100 = 52 - 49.2$

$= 2.8$.

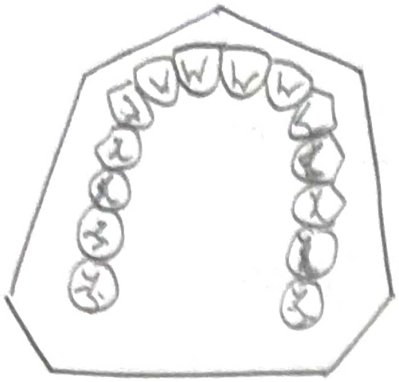
Space problem -

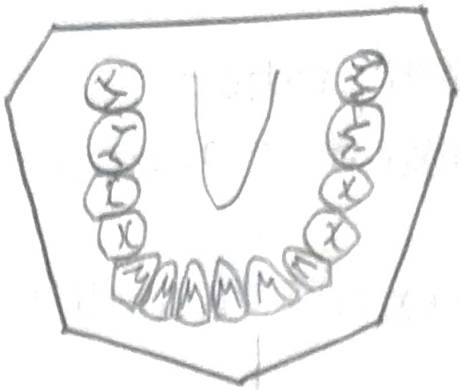
Space required	maxillary	mandibular
1) To correct prodination -	7 X 2 = 14	4 x 2 = 8 mm
2) To correct crowding -		1.5 mm
3) To correct deep curve of spee		2 mm
4) To correct rotation -		
5) Total space required -	14 mm	11.5 mm

Space available

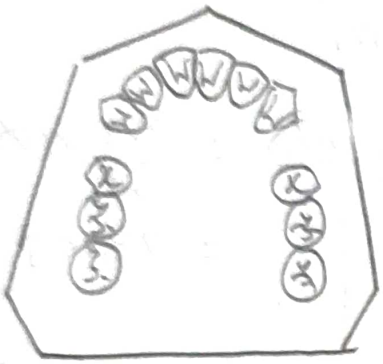
1) Interproximal stripping	2 -	-
2) Spacing	2 mm	
3) Extraction	12 mm	11.5 mm
4) Total space available	14 mm	11.5 mm

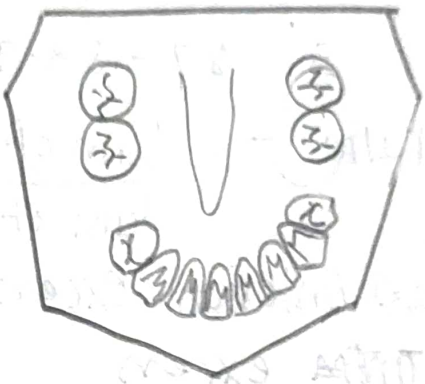
2) Pretreatment :





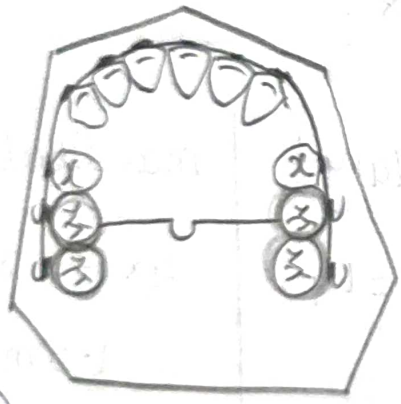
2) Extraction $\bar{c}$ $\frac{4|4}{5|5}$

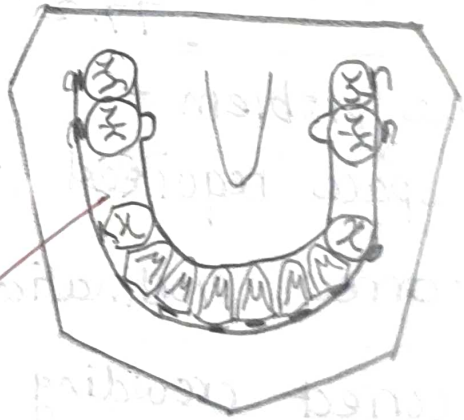




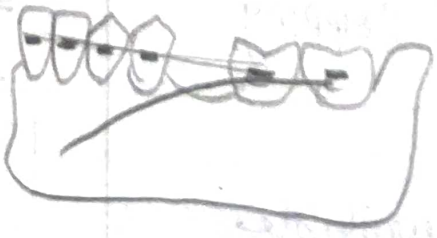
3) leveling & alignment using arch wire -

① Archwire alignment

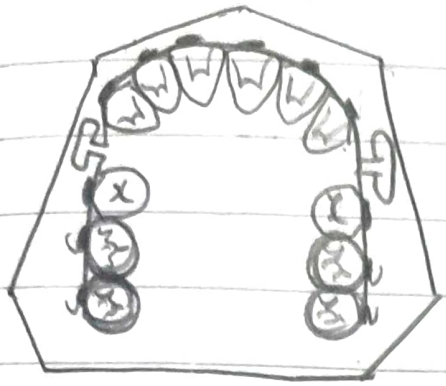


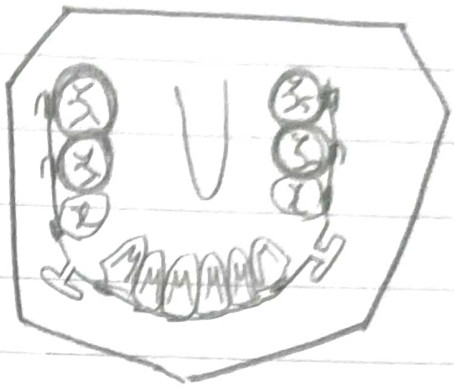


② Leveling

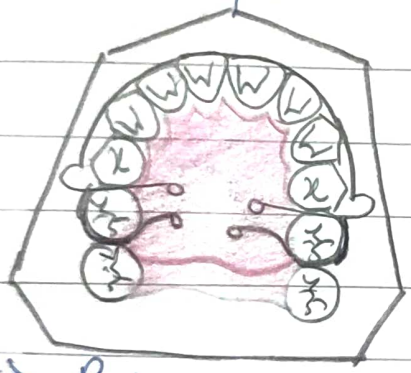


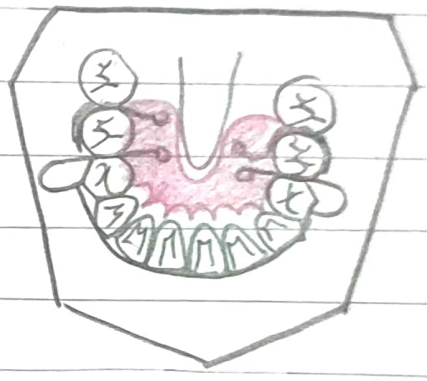
4) Retraction of anteriors by 'T' loops - Space closure:





5) Post space closure:





6) Retraction with hawley's Retainer: