



University of Jordan

Year 2015-2016



Orthodontic Laboratory

manual – 2nd semester

Time table

Week	Date	Session	requirements
1-2	31/1/2016 – 11/2/2016	Removable Appliance Fabrication and Study model	
3-4	14/2/2016 - 25/2/2016	Functional appliances	Quiz
5-6	28/2/2016 - 10/3/2016	Fixed Orthodontic appliances	Placement and removal of wire on F.A typodont.
7-10	13/3/2016 – 7/4/2016	Lateral ceph tracing- Interpretation of the Cephalometric values	Hand in full tracing and report
11-12	10/4/2016 – 22/4/2016	Provision of space and space analysis	Hand in report on space analysis
13	24/4/2016 – 28/4/2016	Revision	
14	2/5/2016 – 5/5/2016	Final Exam	

4th year Orthodontic Lab requirements:

1. Hand in one full Adams clasp.
2. Adjustment of one Adams clasp.
3. Hand in one PFS.
4. Activation of one PFS.
5. Hand in Z-spring.
6. Activation of one Z-spring.
7. Placement and removal of wire on fixed appliance typodont.
8. Hand in full lateral cephalometric tracing and report.
9. Hand in report on space analysis.

Construction of Removable Orthodontic Appliances:

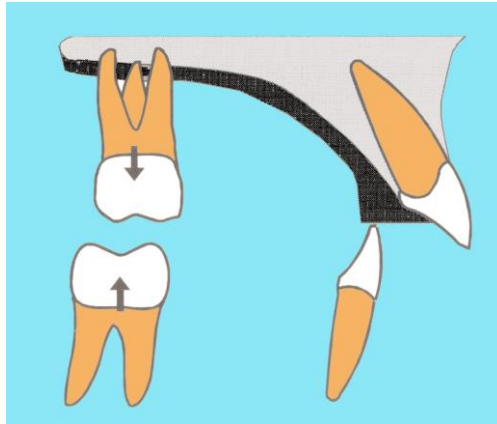
Before you attend this session please refer to your textbook and lecture notes and answer the following questions:

1. What are the basic components of removable appliances?
2. What is the composition of acrylic baseplate?
3. What are the main functions of baseplates?
4. What are the differences between heat-cure and cold-cure acrylic baseplates?

Design Criteria For Acrylic Baseplate:

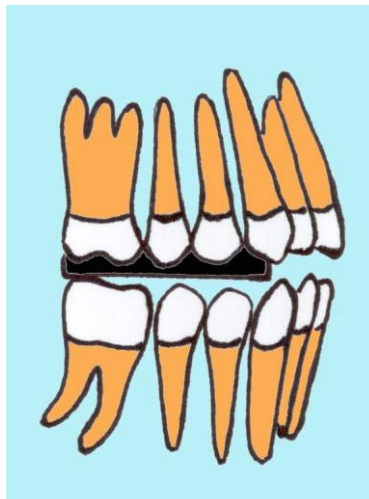
1. Thick enough to carry the components, but as thin as possible to allow adequate strength (thickness of a sheet of modeling wax).
2. Fit accurately onto the model.
3. Should normally cover most of hard palate, finishing just distal to first molars.
4. Posterior teeth should be collected i.e. acrylic should fit closely around the neck of teeth to prevent food trapping areas.
5. Anterior teeth should not be collected
6. Trimmed well clear of the teeth to be moved.
7. Wire tags should be positioned in a way that will not interfere with trimming of acrylic.
8. During appliance construction undercuts may require blocking out especially for lower appliances and for adults.
9. Have a high polish with no scratches visible.
10. Clear i.e. no porosity or plaster debris.
11. Fitting surfaces should not have any rough or sharp areas.
12. There should be a smooth finish between the junction of the wirework and acrylic.

Design Criteria For Anterior Biteplane:



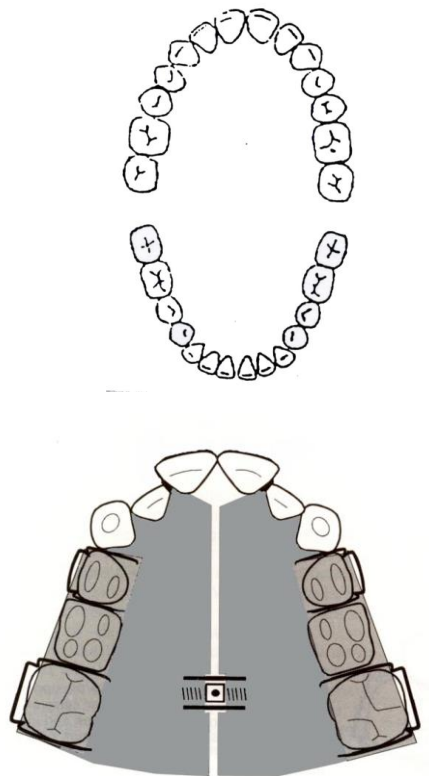
1. Should be thick enough to separate posterior teeth by 2-3 mm.
2. Should extend sufficiently to engage the lower incisors when the mandible is retruded (correspond to patient's overjet).
3. Should extend from upper right to left canines.
4. Occlusal surfaces should be parallel to the occlusal plane.
5. Should be finished with a high polish.

Design Criteria For Posterior Biteplane:



1. There should be even contact with posterior teeth on both sides of the arch.
2. Anterior teeth should be separated by 2-3 mm.
3. Should cover the occlusal surfaces of all premolars and molars, including the last standing molar, unless otherwise stated.
4. Should extend only halfway across the buccal segment to assist adjustment of Adam's clasp.
5. Should be finished with a high polish.

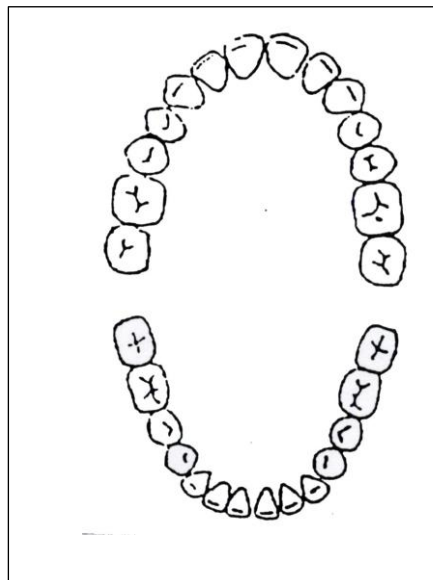
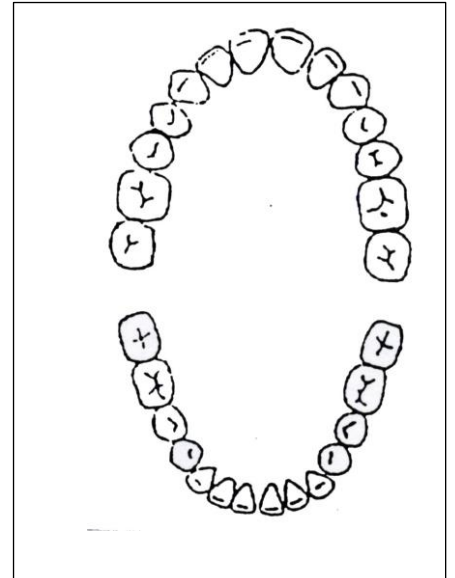
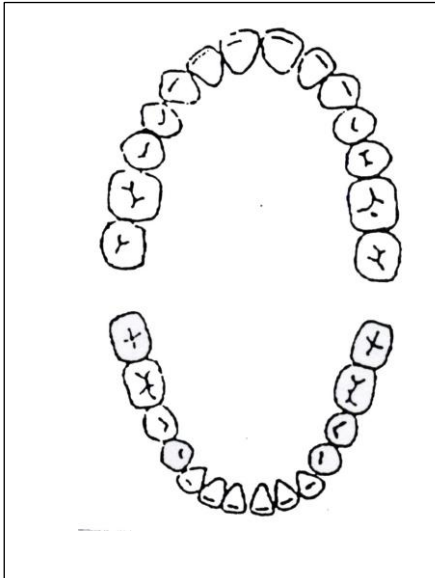
Design Criteria for The midline Split (If The Baseplate Includes Either Midline Expansion Screw or Coffin Spring):



1. The saw cut should follow the midline.
2. All edges should be smooth with no jagged or sharp areas

At the end of your lab session, you will be asked to draw:

- a midline expansion screw to expand upper arch.
- Anterior bite plane.
- Posterior bite plane.



Orthodontic Study Models:

Before you attend this session please refer to your textbook and lecture notes and answer the following questions:

1. What are orthodontic study models used for?
2. What type of impression materials is commonly used in orthodontics?

1. Impressions

- It is important that you obtain accurate impressions of the dentition and associate soft and hard tissue structures
- Care should be taken that the trays are neither too wide nor too narrow, so that minimal soft tissue distortion occurs. The edges of the trays are usually lined with a border of wax that prevents the edge from impinging on the soft tissues.
- The areas of tissue attachment (particularly in the area of labial fraenum and in areas of soft tissue attachment adjacent to the upper first premolars) should be reproduced in the impression.
- The impression should be smooth with no major voids, and borders should be rolled with good extension into the vestibular areas.

- Impressions should extend to the limits of buccal sulci and into the lingual sulcus of the molar region in the lower arch. The upper impression should cover the hard palate but should not extend on to the soft palate.
- The impression should be checked for presence of any large air bubbles, especially on the occlusal surfaces of teeth.
- Ideally, after making the impression, it should be rinsed thoroughly, then disinfected to prevent contamination of the laboratory area, and then rinsed again to remove any residual disinfectant that may adversely affect the surface of the poured stone.

2. Wax Bite Registration:

- Normally should be taken in centric occlusion.
- Two sheets of softened bite registration wax are usually used and placed on the maxillary dental arch.
- The patient should be instructed to bite through the wax, to avoid producing study models that “rock” or are unstable when trimmed.
- Some clinicians advocate keeping the labial surfaces of upper and lower anterior teeth free of wax, as the stone teeth will often break in the wax bite.
- After the impression and wax bite have been taken, they are wrapped in moistened (damp) paper toweling and placed in a sealable plastic bag.

3. Pouring The Impression:

1. The first step in pouring the impression is to fill in the area occupied by the tongue in the mandibular impression. This can be accomplished by placing a thumb or piece of moistured paper towel or tissue in the tongue space. A piece of wax is placed in the area normally occupied by the tongue. As the alginate begins to harden, dip your finger in water and smooth the alginate into the existing impression.
2. The impressions are cast in stone, that ideally have been mixed in a vacuum mixer to eliminate bubbles that otherwise might affect the integrity of the finished surface of the stone. The stone is first poured in the tooth portion of the impression.
3. After pouring of the anatomical portion of the impression is completed, the remaining stone is poured into a large base former, again using a vibrator. The impression tray is turned upside down and pushed into the stone in the base former. Care should be taken to verify that the occlusal surfaces of the impression remain parallel to the bottom surface of the base former.
4. The impression tray is removed from the poured stone after it is hardened. Ordinarily, a wait of 30-60 minutes after the onset of the mix is adequate to make sure that the orthodontic stone is set.
5. Care should be taken in removing the impression from the set stone so that the teeth (particularly the upper and lower incisors) are not fractured during any removal.

4. Trimming The Bases:

1. It is advisable to soak the cast in water for approximately 10 minutes to facilitate the trimming of the stone. Leaving the cast in water for longer period of time may result in pitting and dissolution of stone.
2. Once the impression trays have carefully been removed, any excess or rough edges are then removed from the back of the bases in order to allow both upper and lower models to be occluded. It is important to do this so that the correct bite can be ascertained before trimming.
3. Take the upper model and trim back edge perpendicular to the midline of the palate, as indicated by the orientation of the midline palatal raphe, leaving plenty of space at the back i.e. about 5 mm of stone distal to the most posterior teeth (**Figure.1**).

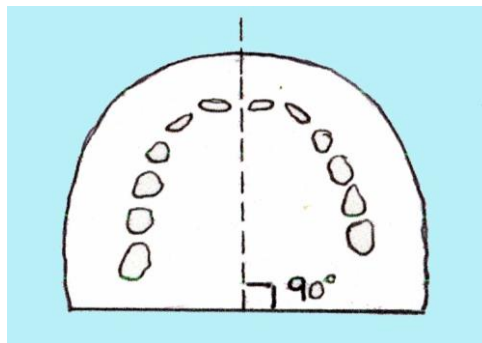


Figure.1

4. The base is then trimmed parallel to the occlusal plane of the teeth (**Figure.2**).

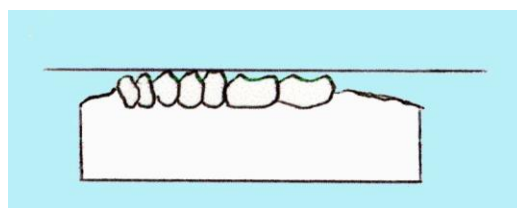


Figure.2

5. After occluding the upper and lower models together, trim the lower model's back edge to be level with the upper.
6. Trim the lower base so that it will be parallel to upper base and the occlusal plane.
7. Take the upper model and with angle slide trim the buccal surfaces to 65° (**Figure.3**).

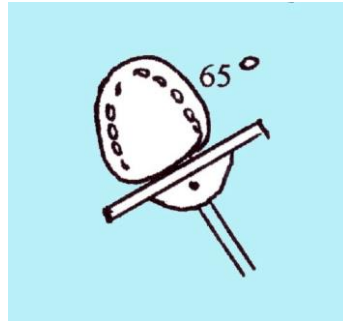


Figure.3 shows posterior surface being trimmed at 65°

8. Then trim the labial angles to 20° with the midpoint meeting on the midline (**Figure.4**).

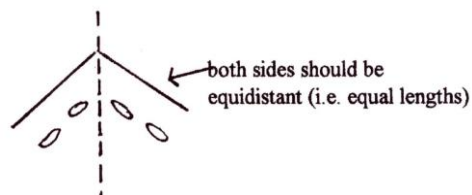


Figure.4

9. Then trim the heel angles to 30° but place the opposite labial angle on the slide (**Figure.5**).

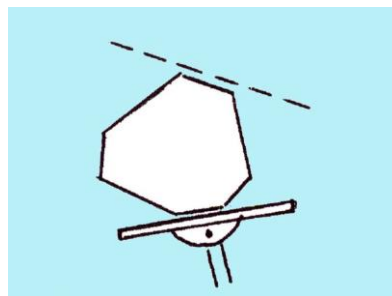


Figure.5

10. All angled sides should be of equal lengths i.e.
Left buccal = right buccal
Left labial = right labial

Left heel = right heel

11. Then occlude upper and lower models and trim lower to upper.
12. Take lower model and round out the labial section (**Figure.6**).

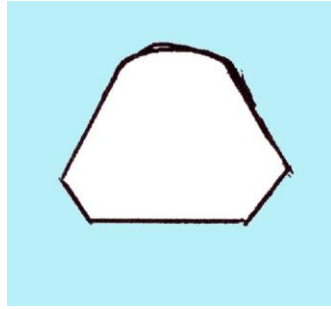


Figure.6

13. The sulcus areas are then trimmed and smoothed with a plaster or wax knife to allow teeth to be clearly viewed.
14. Make sure that bases of models are approximately 1/3 the overall height of the model (**Figure.7**).

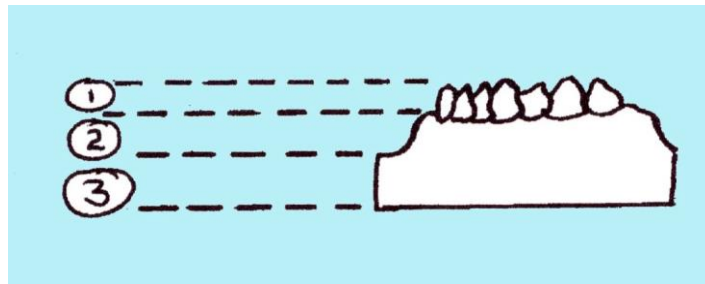


Figure.7

15. Write the name of the patient and the date of impression on both upper and lower bases.

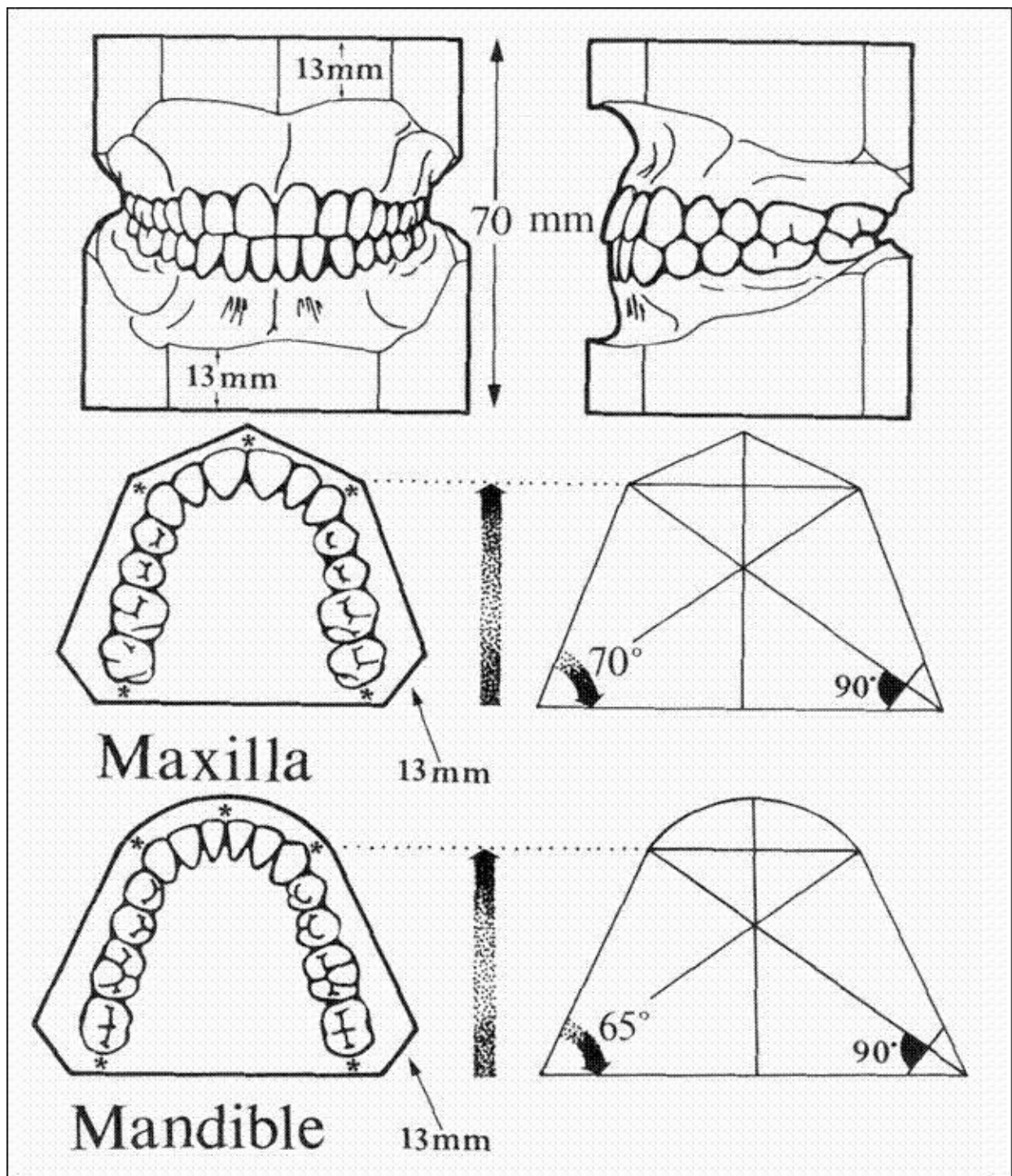


Figure.8

Functional appliance

Before you attend this session please refer to your textbook and lecture notes and answer the following questions:

- 1- What are the indications of using functional appliances?

- 2- What is the mode of action of functional appliances?

- 3- At what age should you start Orthodontic treatment?

- 4-What are the different types of functional appliances used in the treatment of class II malocclusion?

- 5- What are the different types of functional appliances used in the treatment of class III malocclusion?

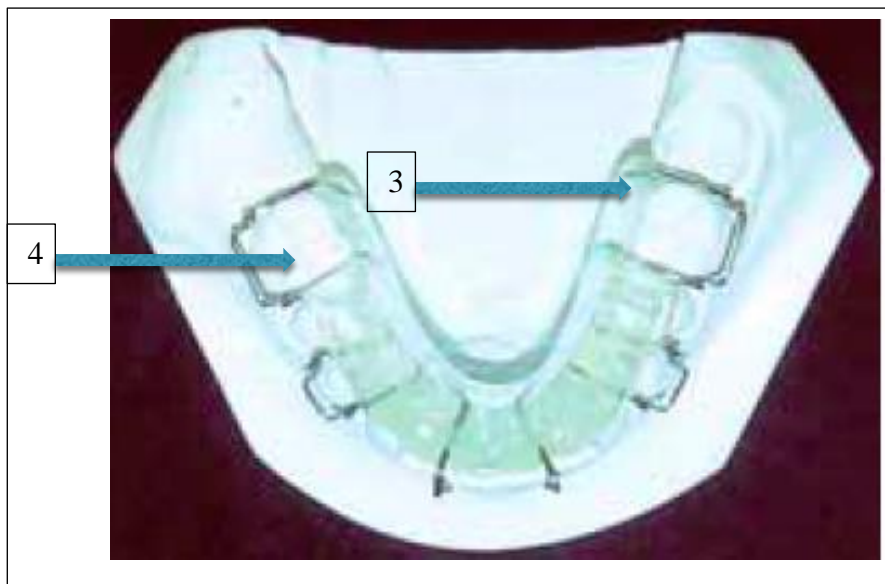
Design Criteria for the Twin Block Appliance:

Twin block appliance is made of maxillary component and mandibular component.

The mandibular component:

The mandibular component consists of acrylic base plate with:

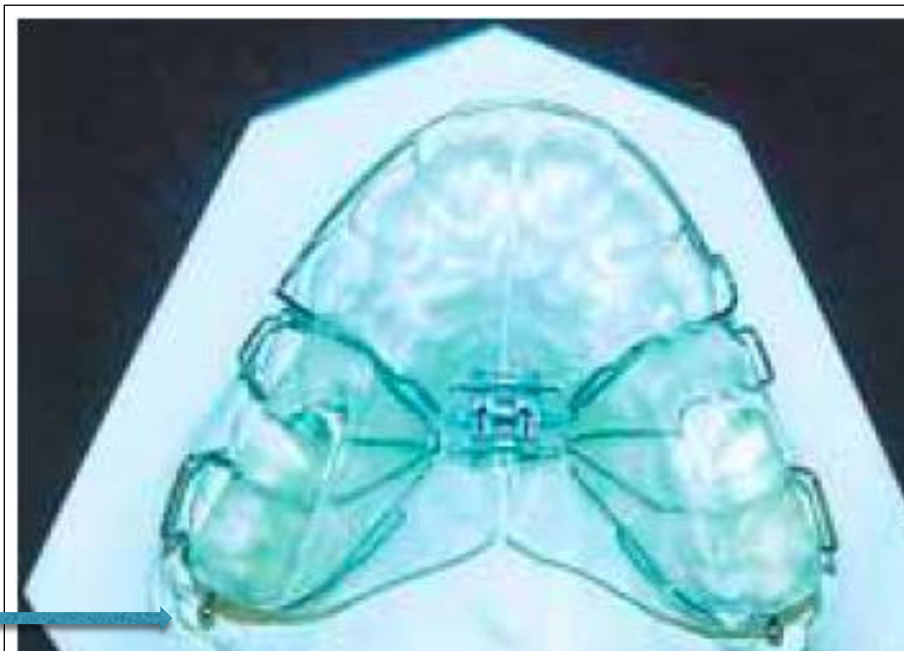
- 1- Adam's clasp placed on the first premolar and sometime on the first molar Figure (1).
- 2- Ball ended clasps engaging 21/12.
- 3- Base plate should extend lingually to distal of 5's.
- 4- The lower occlusal blocks should not cover the lower 6's.
- 5- Occlusal sections of clasp should be free from acrylic to allow for flexibility into undercuts.



The maxillary component:

The maxillary component consists of acrylic base plate with:

- 1- Mid-line expansion screw should be sited in 4/5 region.
- 2- Adam's clasp on the first permanent molar and first premolar.
- 3- Labial bow.
- 4- The biteblocks should cover the occlusal surface of the premolars and molars, including the second molars if these have erupted at the time of appliance construction.
- 5- Occlusal stops can be used to control the eruption of second molar instead of the acrylic base plate.



The relationship between the maxillary and the mandibular components:

- 1- An opening of 4-5 mm within the premolar region is generally accepted as an ideal working functional bite.
- 2- The angle of the occlusal ramps should be approx. 60-70 degrees with both blocks parallel in order to maintain the forward posturing of the mandible.
- 3- The upper occlusal ramps should be in contact with the lower ramps, and the buccal aspects of blocks should ideally fit flush together. This will reduce the likelihood of cheeks being impinged upon.

1



2



Modifications on Twin block:

1- Treatment of Class II div 2 malocclusion:

The treatment of a growing class II div 2 patient with moderate skeletal discrepancy has involved proclining the upper labial segment thereby, converting the incisal relationship to class II division 1 malocclusion. This has commonly been achieved by using URA. This is followed by a phase of functional appliance therapy.

Addition of double cantilever or expansion screw to the twinblock to procline the upper incisors can be done to avoid the need for two appliances and to reduce the treatment time.



Class II div 2 incisor relationship



Proclination of the upper incisors can be achieved simultaneously with correction of Class II occlusion incorporating double cantilever to the upper component of the Twin block.

2- Elimination of labial bow

To improve patient cooperation, labial bow can be removed. Four Adam's clasp will be used on first premolars and first permanent molars.



Using Twin block without Labial bow will show less metal in the front, this will improve patient acceptance of the appliance

Design Criteria for the Medium Opening Activator:

It is a monoblock removable functional appliance:

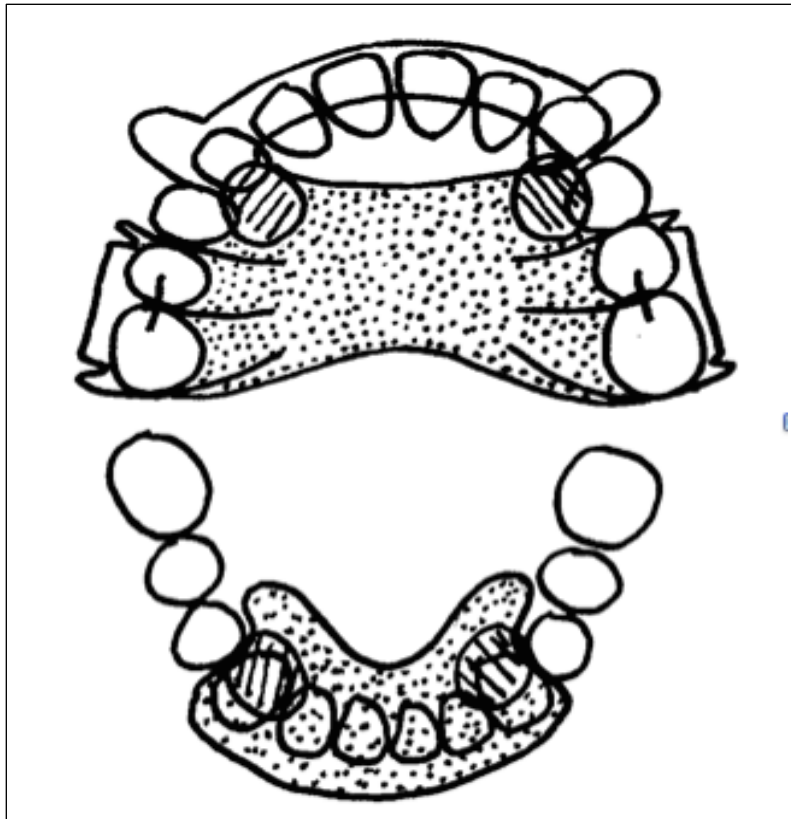
Wire work:

1. Labial bow should be constructed in 0.8/0.9mm wire, and placed as high gingivally as the interdental papilla permit, with medium sized U-loops.
2. Palatal wire should be constructed in 0.8/0.9 mm wire and formed into an ideal arch and sited high on cingulum of 12/12 towards the incisal tip, to minimise uprighting of the upper incisors. The palatal wire must also be rested on cingulum of 3/3.
3. Adam's clasp constructed from 0.7 mm SS wire on either the First permanent molar and first premolar or on the First permanent molar and second premolar.
4. Occlusal rests can either be pre made butterfly rests or fabricated in 1mm wire.

Acrylic:

1. Lower should extend lingually to distal of 4's with lower incisors capping 3/3.
2. The upper and lower plates should be linked together with struts or pillars sited in the premolars region. These should be sufficiently thick enough to facilitate strength, without being too bulky.
3. It should meet the criteria of an acrylic base plate.





Design criteria for Herbst appliance

The Herbst appliance is a fixed functional appliance working as an artificial joint between the maxilla and the mandible. Attached to orthodontic bands, keeps the mandible continuously in an anterior jumped position during all mandibular functions.

The design of the Herbst:

- 1- Casted from cobalt chromium.
- 2- In the lower arch, bands of the Herbst framework are extended from the canines posteriorly to include all the erupted teeth.
- 3- In the upper arch, bands of the Herbst framework are extended from first permanent molar to the first premolar.
- 4- The appliances are cemented with glass ionomer cement.



Face mask

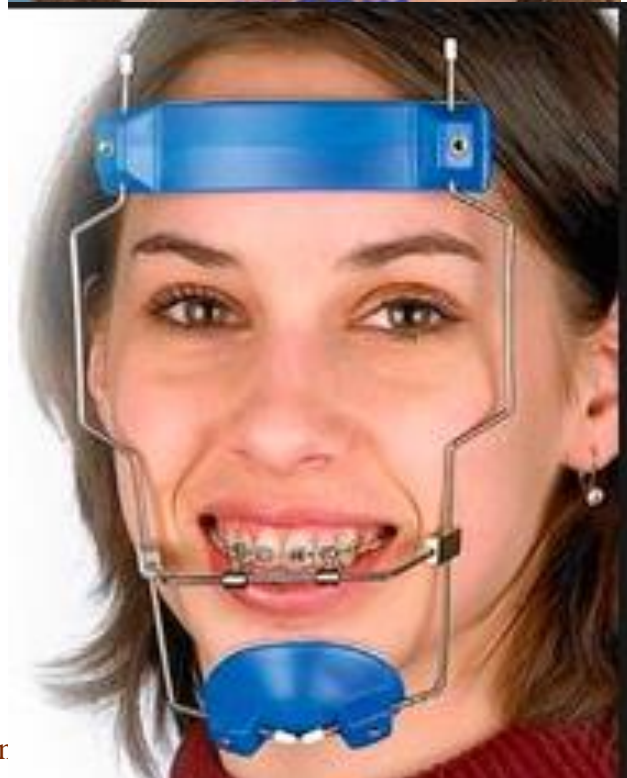
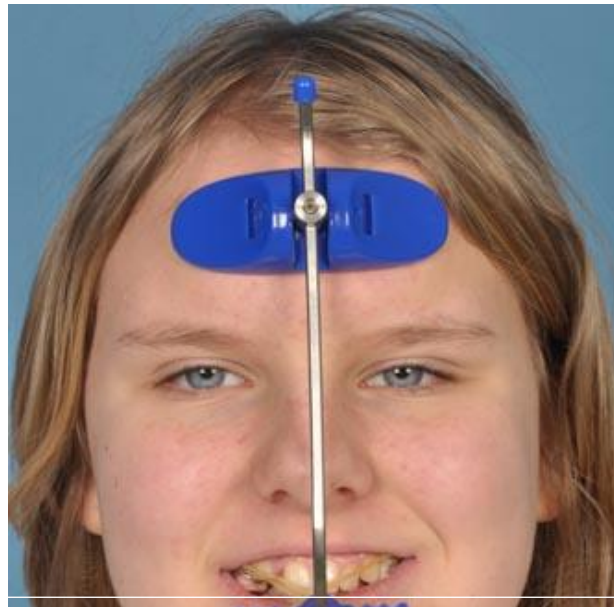
(Protraction headgear)

Definition:

Means of applying anterior directed forces to teeth or skeletal structure from extra oral source

Components:

- 1- Face mask: e.g. Delair type formed of chin and forehead cap connected by rigid stainless steel support rod, A crossbow is connected to the support rod which allows placement of elastics to produce a forward and downward elastic traction of the maxilla.
- 2- Upper removable appliance, fixed appliance or rapid maxillary expansion appliance (banded or bonded). To resist tooth movement, the maxillary teeth should be splinted as a single unit. The major modification that would be needed for the designs shown would be the addition of facial mask hooks in the region of the upper first deciduous molar/canine region above the occlusal plane.
- 3- Elastics: 300-500 gram per side, applied for 12-14 hours per day. The force should be 20-25 below the occlusal plane



Fixed Orthodontic Appliances

Contents of the fixed appliance lab:

- Components of the fixed appliance, brackets, archwire ..etc
- Three order bends and how it is incorporated into the bracket.
- Tooth movements that can be done with fixed appliance.
- Different types of brackets; ceramics, metal, and selfligation
- The different types of archwires and the stress strain curve.
- Identification of the fixed appliance instruments e.g. distal end cutter.
- Every two students will share a fixed appliance typodont , archwire, modules, short ligature and fixed appliance instrument.
- Students will be asked to place archwire, snap it, and tie it with elastomeric module and wire ligature.
- Before attending the lab, students should read: The manual, Fixed appliance lecture and orthodontic materials lecture.

Before you attend this session please refer to your textbook and lecture notes and answer the following questions:

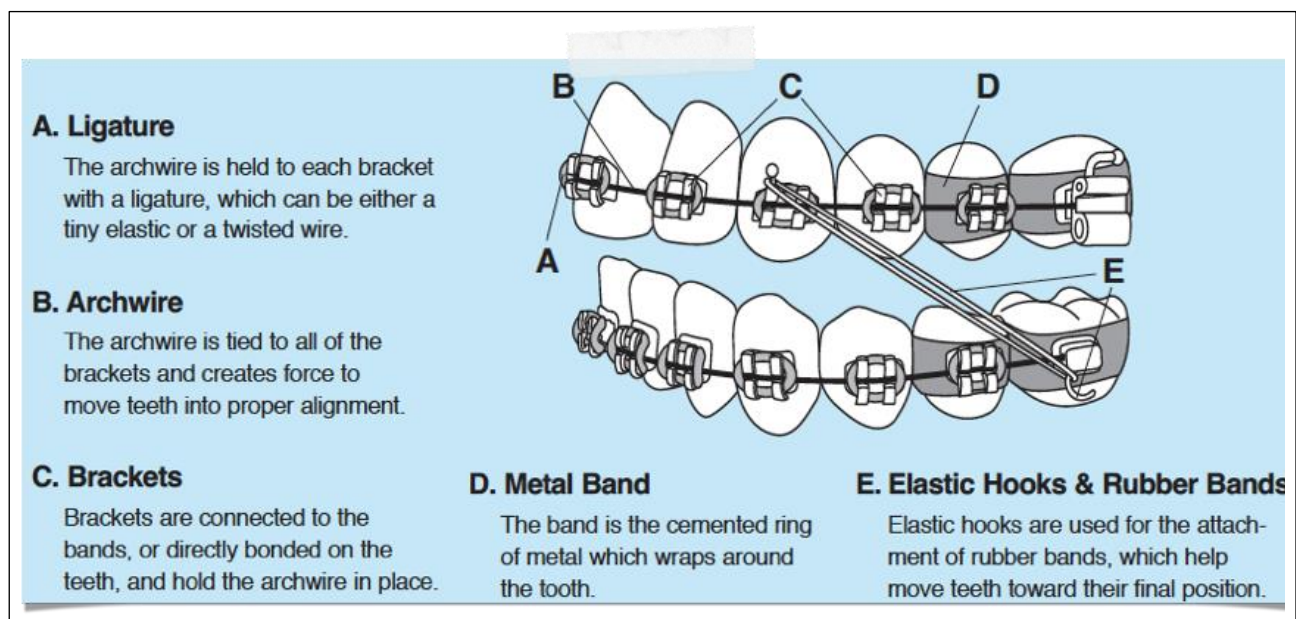
1- What are the different types of fixed orthodontic appliance?

2- What are the components of fixed orthodontic appliance?

3- What are the Tooth movements that can be done with fixed appliance?

4- What are the different types of arch wires?

Components of fixed orthodontic appliance:



1- Brackets:

Orthodontic brackets are fixed to the crown and mediate forces applied by the arch wires and auxiliaries.

Components of Orthodontic bracket:

1- Bracket body:

A. Bracket slot:

- The part of the bracket where the archwire will be placed.

- Determine the M-D tip (2nd order).
- Determine the torque (Torque in the face brackets)

B. Tie wings:

- The part of the bracket to which the elastomeric module or wire ligature will be tied to hold the arch wire

3- The stem.

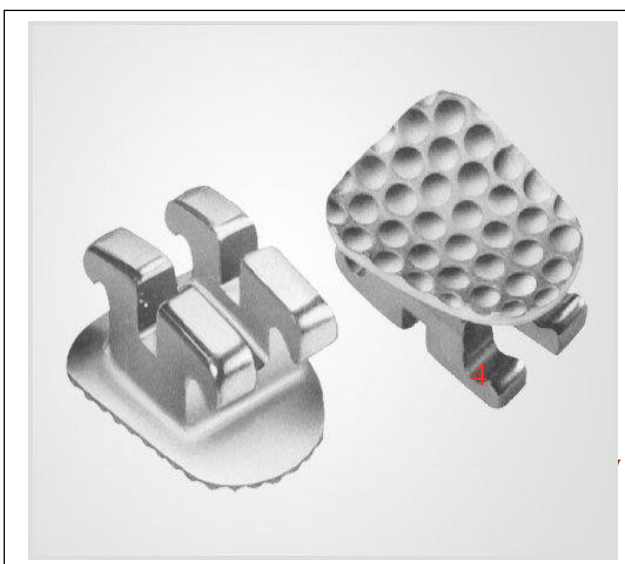
- Narrower occlusogingival from the tie wings, to provide undercut to retain the elastomeric module, and also narrower M-D than the bracket base so that the E.M rest on the bracket base not on the enamel.
- Determine the In-Out position of the tooth (first order bend).

4- Bracket base.

- Provide the attachment with bonding agent. Therefore provide mechanical interlock with the bonding agent, in metal bracket it could be a mesh soldered to the base or cast metal.



1. Archwire slot.
2. Tie wing.
3. Bracket stem.
4. Bracket base.

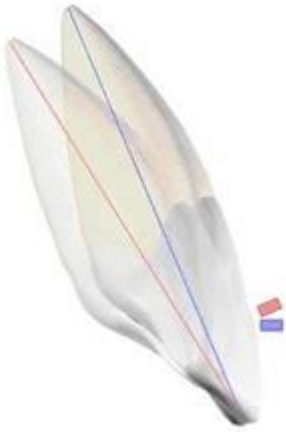


Exercise:

Go back to your lecture notes and decide which order bend each of the following drawings is:



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Brackets materials:

- 1- Stainless steel brackets.
- 2- Ceramic brackets.
- 3- Ceramic brackets with metal slot.



2

Or

Exercise:

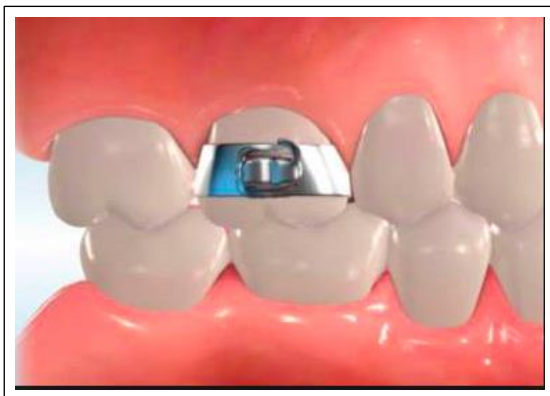
Go back to your lecture note and write the advantages and disadvantages of each type of these brackets.

2- Orthodontic Bands:

- Bands are made from stainless steel strip and preformed to the anatomy of individual teeth. Bands are nearly always prewelded with attachments (such as buccal tubes or lingual cleats), the smaller the band, the easier it is to get it to fit well and the easier the patient will find it to maintain a high standard of oral hygiene.
- Bands require space between the teeth in order to place them; this is achieved by placing separators.
- Bands are difficult to fit accurately and are more difficult to keep clean than a bonded attachment.
- Although all teeth used to be banded, most people now only band first and second molars.



- 1- Arch wire slot.
- 2- Headgear tube.
- 3- Size of the band.



3- Archwire:

The archwire, through mechanical interaction with the bracket slots, are designed to move teeth from malocclusion to a preferred dental occlusion.

Types of arch wire:

- a- Stainless steel
- b- Nickle Titanium:
 - 1- Martensitic stable.
 - 2- Martensitic active.
 - 3- Austenetic active.
- c- Titanium Molybdenum Alloy (TMA).

Exercise:

Go back to your lecture and read the properties and the stress-strain curve of each arch wire.

4- Ligature:

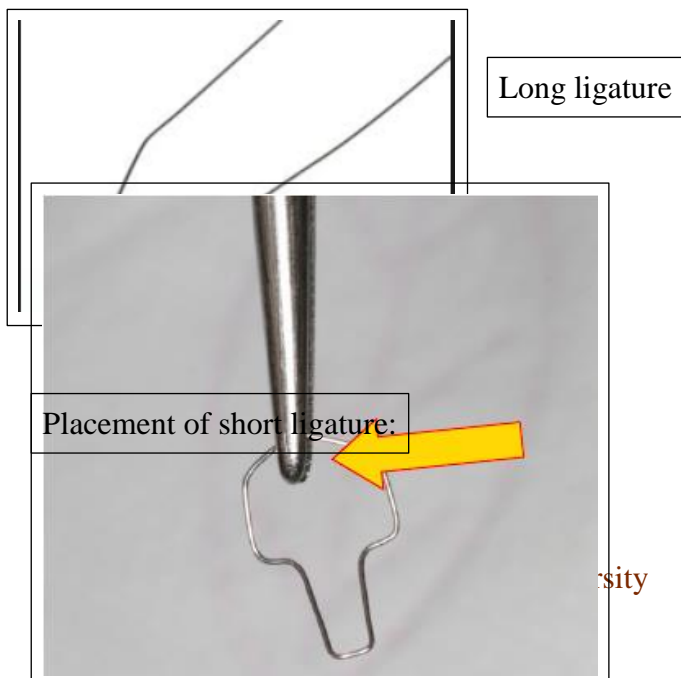
These are used to retain the archwire in the bracket slot.

Types:

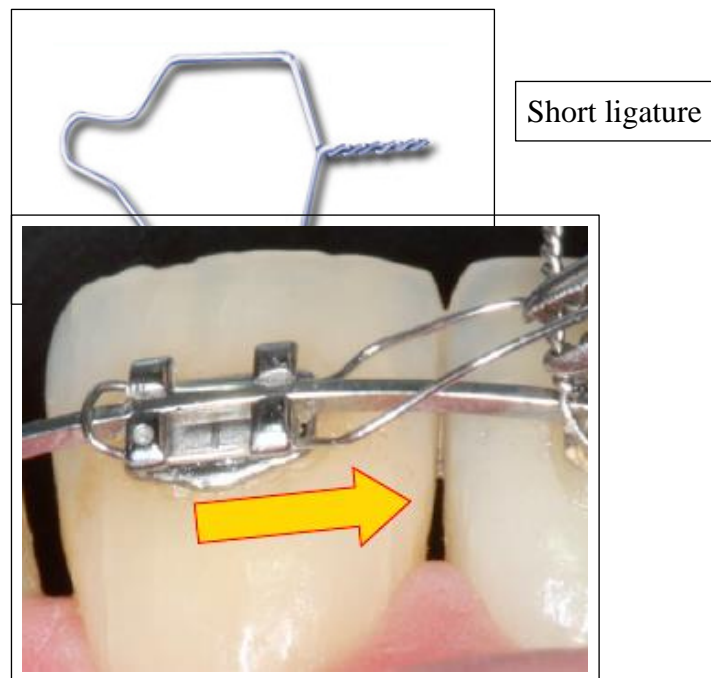
- A. Elastomeric ligature:
 - Made of polyurethane.
 - Have different colors.
- B. Metal ligature:
 - Made of Stainless steel of 0.3 mm in diameter.
 - Can be short (Use to tie one tooth) or long (Use to tie more than one tooth together).
- C. Self-ligation brace:
 - Use a built in metal gate to hold the wire instead of using elastomeric or wire ligature.



Elastomeric ligature



Long ligature



Short ligature

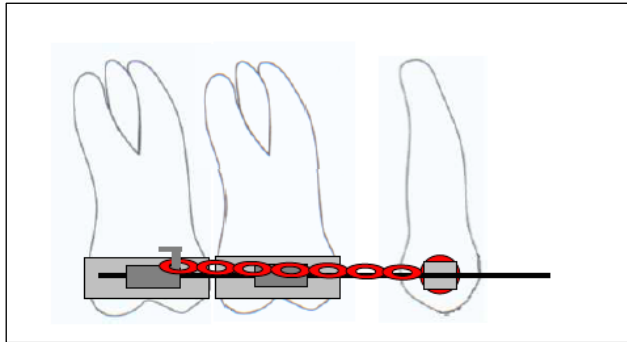


Self ligation bracket
(Notice the metal gate)



5- Force generation component:

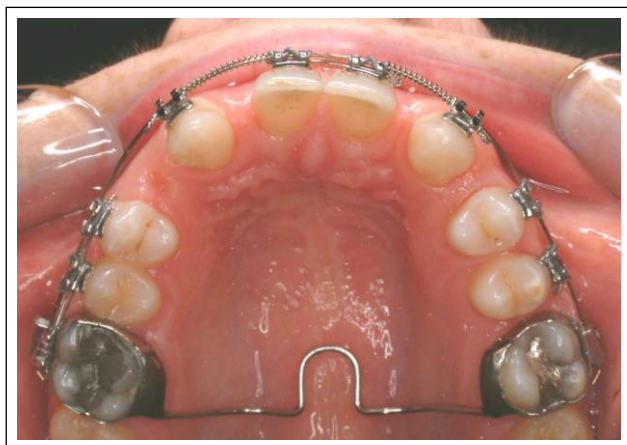
- A. Elastomeric powerchain.
- B. Coil spring:
 - It can be open or close.
 - Stainless steel or NiTi
- C. Intermaxillary elastics.



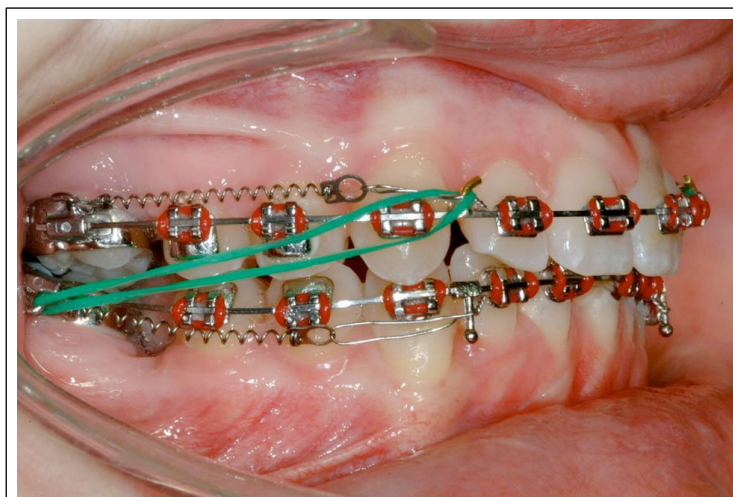
Elastomeric power chain



NiTi spring to close the space



NiTi spring to open the space



Intermaxillary elastics to help space closure

Lateral Cephalogram

Before you attend this session please refer to your textbook and lecture notes and answer the following questions:

1. What are the Components of cephalometric x-ray machine?
2. What is the difference between cephalometric and lateral skull x-ray?
3. What are the indications for cephalometric x-ray?
4. What are the components of Eastman analysis, and what are the values for this analysis?
5. What is the cephalometric prognosis tracing?

Tracing Technique:

a. Tracing equipment:

- a. Light viewing box
- b. Sharp 4H pencil or 0.3 mm leaded propelling pencil
- c. Ruler
- d. Protractor
- e. Tracing paper or acetate sheet
- f. Masking tape
- g. Dark room

b. Tracing steps:

In order to be able to derive meaningful information from a lateral cephalometric tracing, an accurate and systematic approach is required which also involves selecting the right conditions and equipment for the task:

- i. Before starting tracing it is important to examine the radiograph for any abnormality or pathology, e.g. increase in the size of sella turcica due to pituitary tumor.
- ii. The tracing should be oriented in the same position as the patient was when the radiograph was taken, i.e. with the Frankfort plane horizontal.
- iii. The tracing paper or acetate sheet should be secured onto the film and the light viewing box, still allowing it to be lifted from the film to check obscure points.
- iv. All but the area being traced should be shielded to block out any extraneous light.
- v. Draw in:
 - **Soft tissues:**
 - Profile from just above soft tissue nasion to just behind soft tissue menton.

- **Skeletal:**
 - Outline of sella turcica.
 - Profile of frontal bone (2-3 cm above nasion, frontonasal suture and down to end of nasal bones).
 - Maxilla, including palatal bone and bony shadow of palate behind upper incisors.
 - Mandibular outline including symphysis.
- **Teeth:**
 - Upper and lower incisors.
 - Upper and lower first molars (including occlusal surfaces).
- **Basic points:**
 - Mark 8 points: S, N, A, B, Me, Go, ANS, PNS.
 - **PNS** point is often obscured by the developing third molars, but lies directly below the pterygomaxillary fissure.
 - **Go** point can be estimated or determined more accurately by bisecting the angle formed by tangents from the posterior border of the ramus and the inferior border of the mandible. If two mandibular shadows present take the midpoint of the 2 points obtained as Go (**Figure.1**).

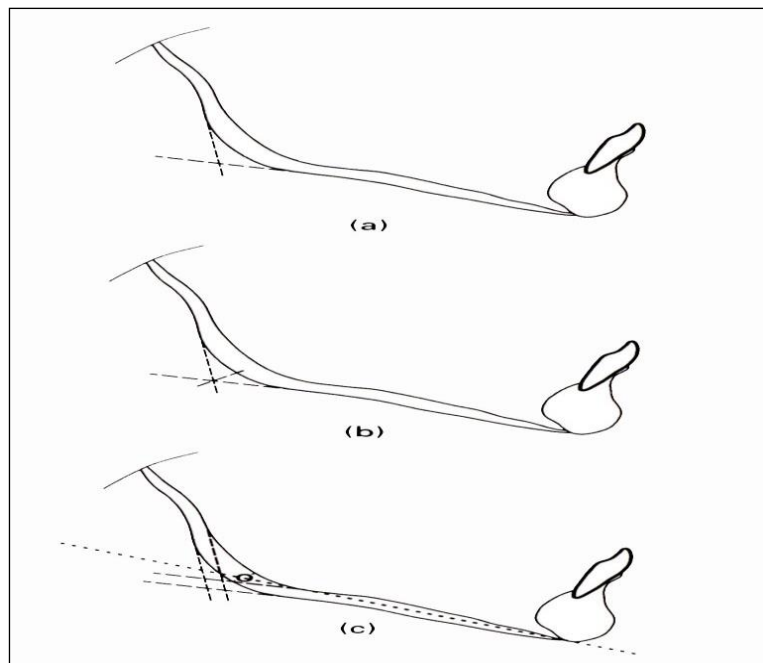


Figure.1

- **Mark 7 lines (Figure.2):**

- SN
- NA
- NB
- Mx (ANS-PNS)
- Mn (Go-Me)
- Upper incisor axis
- Lower incisor axis

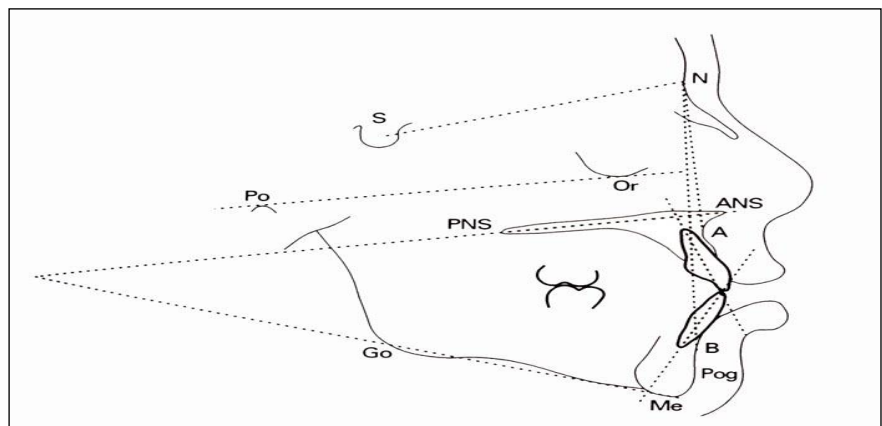


Figure.2

- **Record measurements:**

- SNA
- SNB
- ANB
- UIMxP: (upper incisor to maxillary plane)
- LIMnP: (lower incisor to mandibular plane)
- MMPA: (maxillary to mandibular planes angle)
- LAFH (**Figure.3**): This is the ratio of lower facial height to the total anterior facial height measured perpendicularly from the maxillary plane, calculated as a percentage:

Facial proportion = $\frac{MxP-Me}{(MxP-Me + MxP-N)} \times 100$

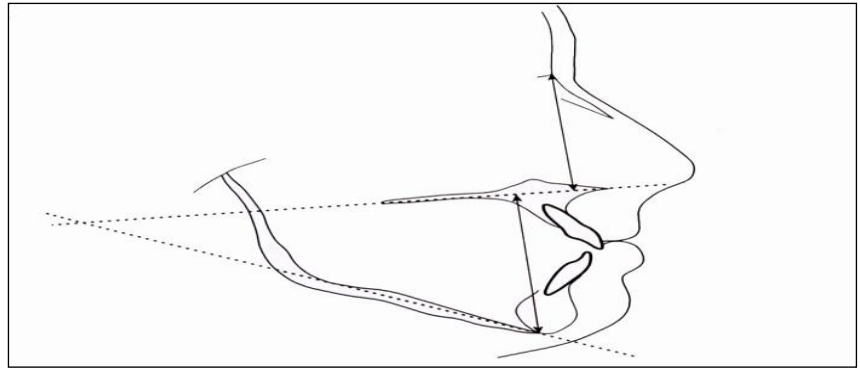


Figure.3

- SN-MxP
- Inter-incisal angle (IIA)

C. Eastman Correction:

The variations in the position of N (remodeling anteriorly/superiorly) may affect the ANB value and lead to misinterpretations (**Figure.4**). Eastman analysis has compensation for this:

Provided that SN-MxP angle is within (i.e. 5° - 11°):

- If SNA is increased, for every degree that SNA is greater than 81° , subtract 0.5° from ANB;
- If SNA is reduced, for every degree that SNA is less than 81° , add 0.5° to ANB.
- If the SN-MxP angle is not within 5° - 11° , this correction is not applicable.

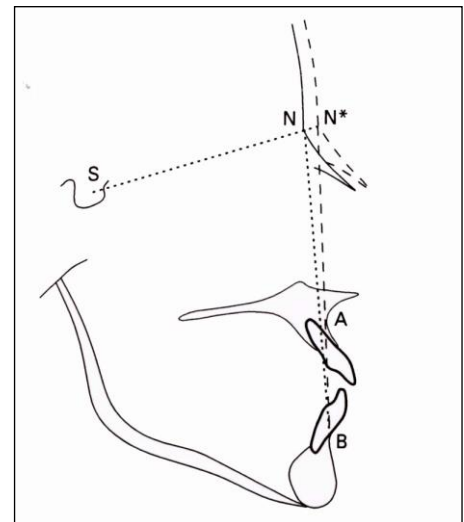


Figure.4

For example, if a patient has the following cephalometric values:

SNA 79°

SNB 77°

ANB 2°

SN-MxP 9°

Since the SN-MxP angle is within limits and SNA angle is less than 81° , Eastman correction can be applied and ANB will be corrected to 3° . If the SN-MxP angle was 13° , this correction would not be applicable.

d. The Removable Appliance Prognosis Tracing:

Overjet reduction using removable appliances is achieved by retroclining the upper incisors about a pivot a third along the root from the apex. It is not possible to change the position of the lower incisors in most cases, although the height of these teeth may be decreased with respect to the buccal segments so that overbite is reduced. The prognosis tracing gives a pictorial representation of the results of removable appliance treatment.

Measurements of final incisor angulation and bite opening requirements determine whether the prognosis of removable appliance treatment is good or bad.

The lowest acceptable **UIMxP** is **95°** (appearance).

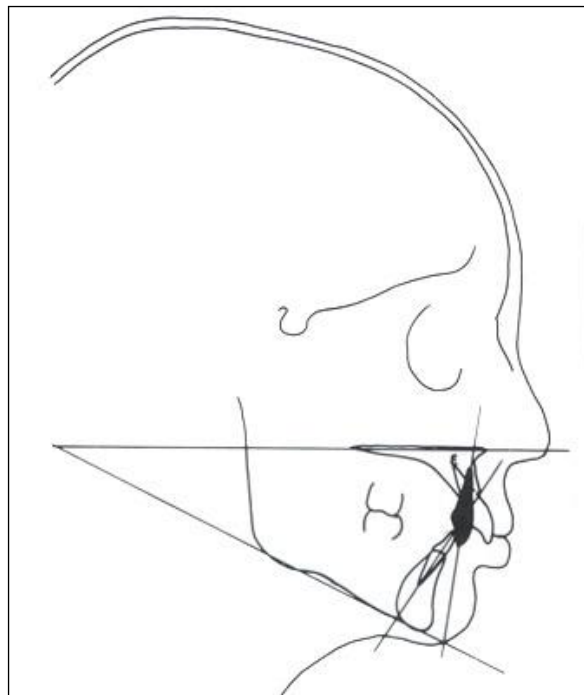
The highest acceptable **Inter-incisal angle** is **150°** (overbite stability)

The procedure is as follows:

1. Complete a basic tracing.
2. Fixed a second piece of tracing paper.
3. Draw maxillary plane, mandibular plane, occlusal plane, lower incisor access and upper incisor pivot.
4. Detach upper tracing.
5. Keeping the lower incisor axes superimposed, move the upper paper upwards until the lower incisor tip on the lower paper just touches the occlusal plane on the upper tracing. If the lower incisor tip is already on the occlusal plane so that this correction is not required, the lower incisors are merely drawn in their existing position onto the new tracing.

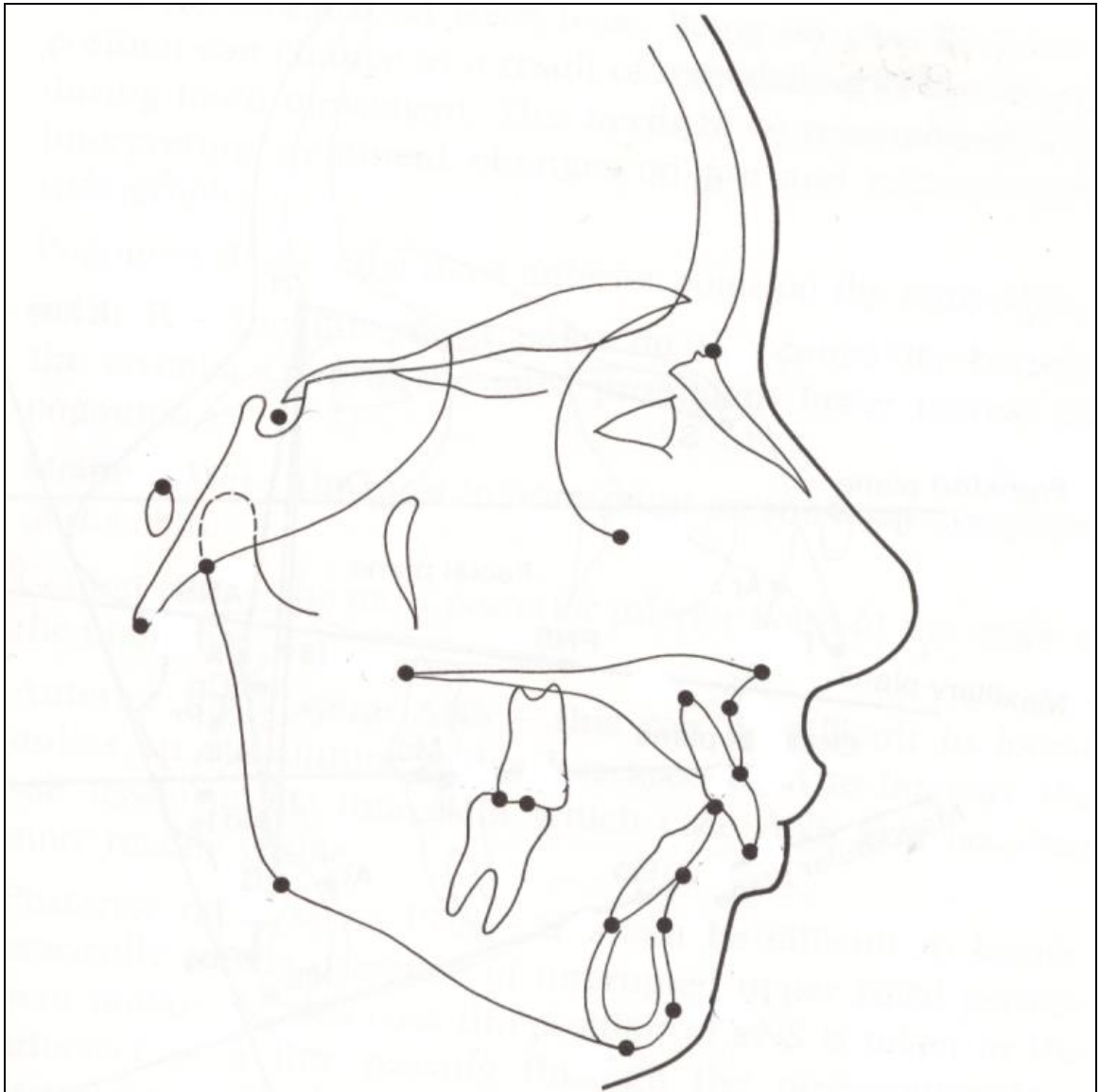
6. Reposition the upper paper so that all structures are superimposed with exception of the lower incisors which will appear to have moved down in most cases.
7. Keeping the pivot point superimposed, turn the upper paper anti-clockwise until the outline of the upper incisor on the lower paper gives a normal overjet with the outline of the lower incisor on the upper paper.
8. Draw in the “new” upper incisor outline.
9. Replace the upper paper in its original position. The tooth movement can now be seen.
10. On the second paper, measure the upper incisor angle, inter-incisal angle, and bite opening needs.

On the basis of this tracing, the desirability of beginning treatment with removable appliances is decided.



E. Tracing Exercise:

- Trace the following x-ray for Eastman analysis and prognosis tracing:



Eastman analysis:			
SNA		MMPA	
SNB		ALFH%	
ANB		UIMxP	
SN-MxP		LIMnP	
Corrected ANB		IIA	
Prognosis Tracing:			
UIMxP		IIA	

Cephalometric and Prognosis Tracing Report:

1. Skeletal relationship:

2. Dental relationship:

3. Soft tissue relationship:

4. Prognosis tracing:

Provision of space and space analysis

In this laboratory session, you will be given a study model of a patient in the permanent dentition and another one for a patient in the mixed dentition and you will be asked to do space analysis for both casts. For the permanent dentition one, you will be asked to suggest the methods of space provision.

Provision of space and space analysis

The process of space planning is carried out in 2 stages. The first is an assessment of space requirement, and the second is an assessment of any additional space to be created or used during treatment, including a prediction of anteroposterior molar movements required for occlusal correction and an estimation of future growth.

Space requirements:

+ = Space available or gained

- = Space required or lost

	LOWER	UPPER
Crowding and spacing:	_____ mm	_____ mm
Leveling occlusal curve:	_____ mm	_____ mm
Arch width change:	_____ mm	_____ mm
Incisor A/P change:	_____ mm	_____ mm
Angulation/inclination change:	_____ mm	_____ mm
	<hr/>	
	TOTAL _____ mm	_____ mm

Space creation/utilization in addition to any planned above

Tooth reduction/enlargement: (+ or -)	_____ mm	_____ mm
Extractions:	+ _____ mm	+ _____ mm
Space opening for prosthetic replacement:	- _____ mm	- _____ mm
Molar distal movement:	+ _____ mm	+ _____ mm
Molar mesial movement:	- _____ mm	- _____ mm
Differential U/L growth: (+ or -)	_____ mm	_____ mm
	<hr/>	
RESIDUE (should = 0)	_____ mm	_____ mm

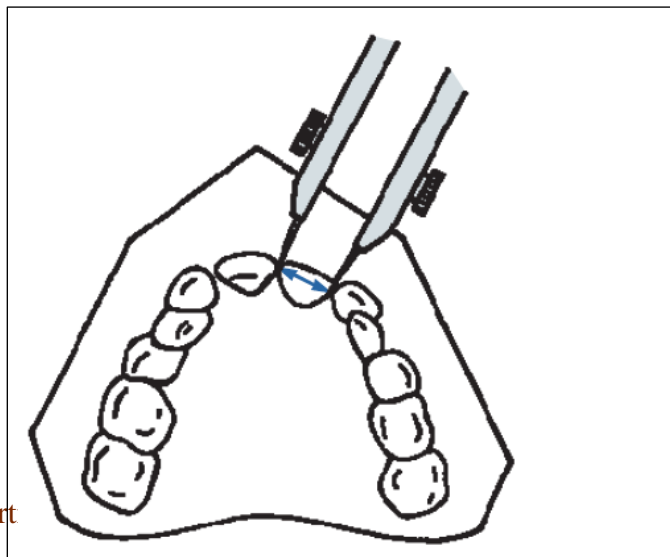
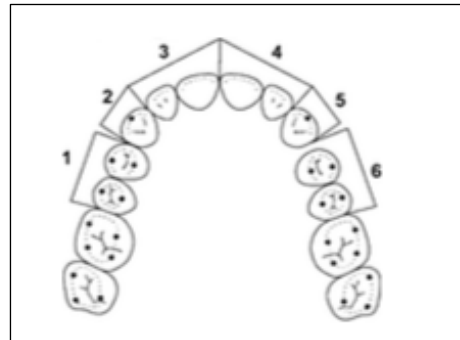
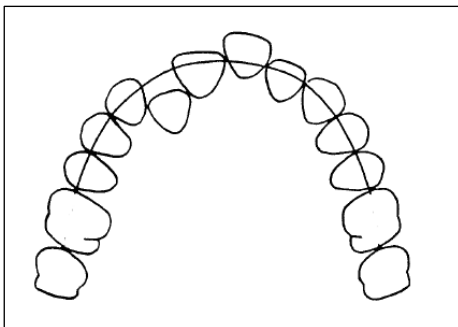
ASSESSMENT OF SPACE REQUIREMENT:

Six specific aspects of the occlusion are considered for which any change has an effect on the space required. The measurements are taken and scores recorded to the nearest millimeter or, at times, half millimeter, and are positive when space is present or is created (eg, by incisor advancement) and negative when there is crowding or space is required (eg, for incisor retraction).

A. Crowding and Spacing:

To determine the amount of crowding or spacing in an arch, subtract the sum of widths of the teeth figure (1) mesial to the first molars from the sum of arch lengths mesial to the first molars. A crowded arch has a negative remainder, and the arch with spaces has a positive remainder.

Arch length is measured from the mesial surface of the first molar on the right side around the arch to the mesial surface of the first molar on the left side by brass wire which reflects the majority of teeth figure (1) or by dividing the arch into segments (Figure 2).



TOOTH SIZE AND ARCH LENGTH ANALYSIS

Patient: _____

Date: _____

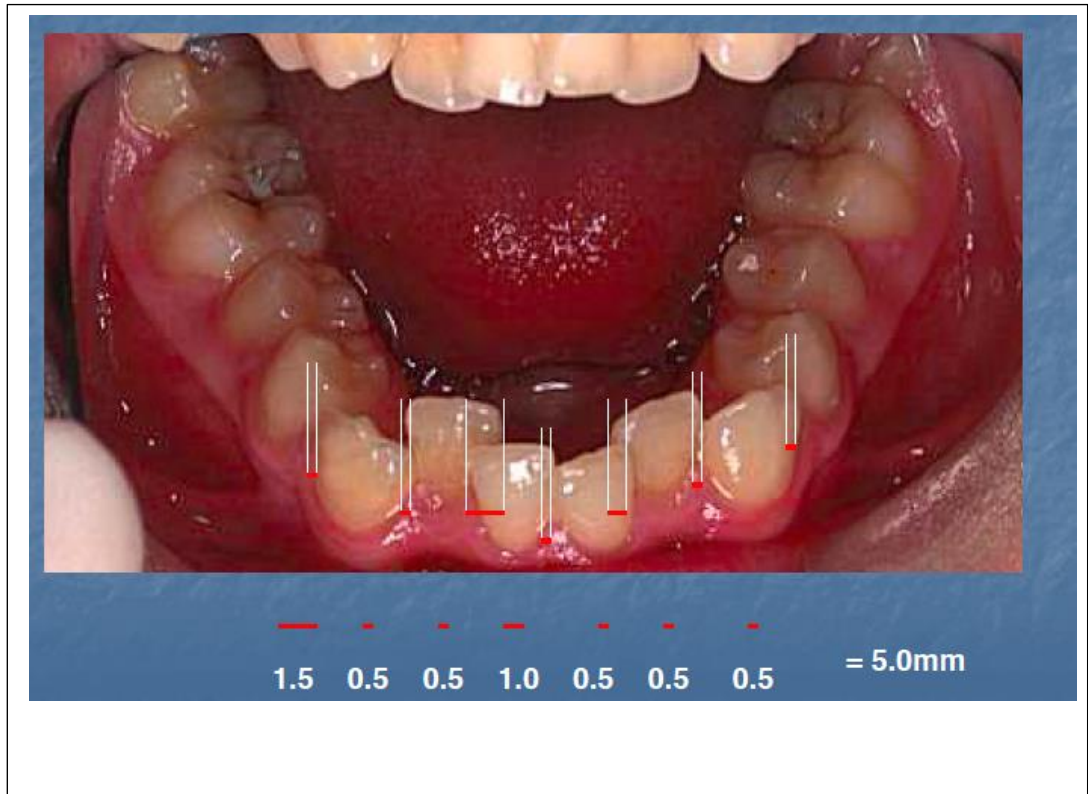
MESIODISTAL WIDTHS OF PERMANENT TEETH

<u>MAXILLA</u>			<u>MANDIBLE</u>		
LEFT	RIGHT	BOTH	LEFT	RIGHT	BOTH
___ I ¹	___		___ I ₁	___	
___ I ²	___	TOTAL(UA)	___ I ₂	___	TOTAL(LA)
___ C	___	_____	___ C	___	_____
___ PM ¹	___		___ PM ₁	___	
___ PM ²	___		___ PM ₂	___	

ARCH LENGTH MEASUREMENTS

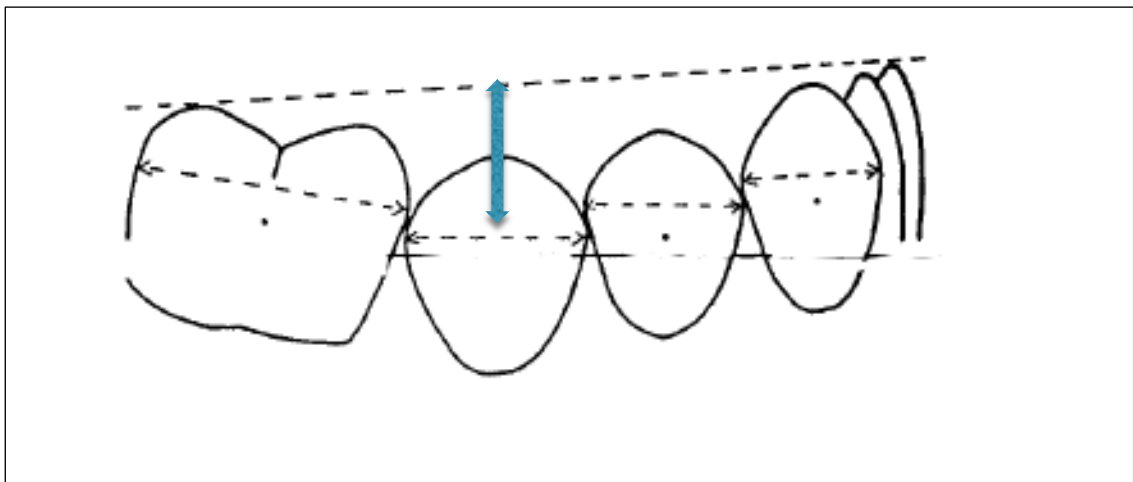
		<u>MAXILLA</u>		<u>MANDIBLE</u>	
		Left	Right	Left	Right
1.	Anterior ¹	___	___	___	___
2.	Canine Region ²	___	___	___	___
3.	Posterior ³	___	___	___	___
4.	Total Arch Length (1+2+3)	___	___	___	___
5.	Tooth Size (Total 1)	___	___	___	___
6.	Discrepancy (4 minus 5)	___	___	___	___
Total Arch Length Discrepancy ⁴		___		___	

The amount of crowding can be measured by summing the overlap between the contact points of the teeth anterior to the first permanent molar.



B. Leveling Occlusal Curves:

Assess the depth of curve from premolar cusps to a flat plane on distal cusps of first molars and incisors. Only one value is given for the arch, and only if the premolars have not been assessed separately as crowded. Allow 1 mm space for 3 mm depth of curve, 1.5 mm for 4 mm depth, and 2 mm space for a 5 mm curve.



C. Arch Expansion and Contraction

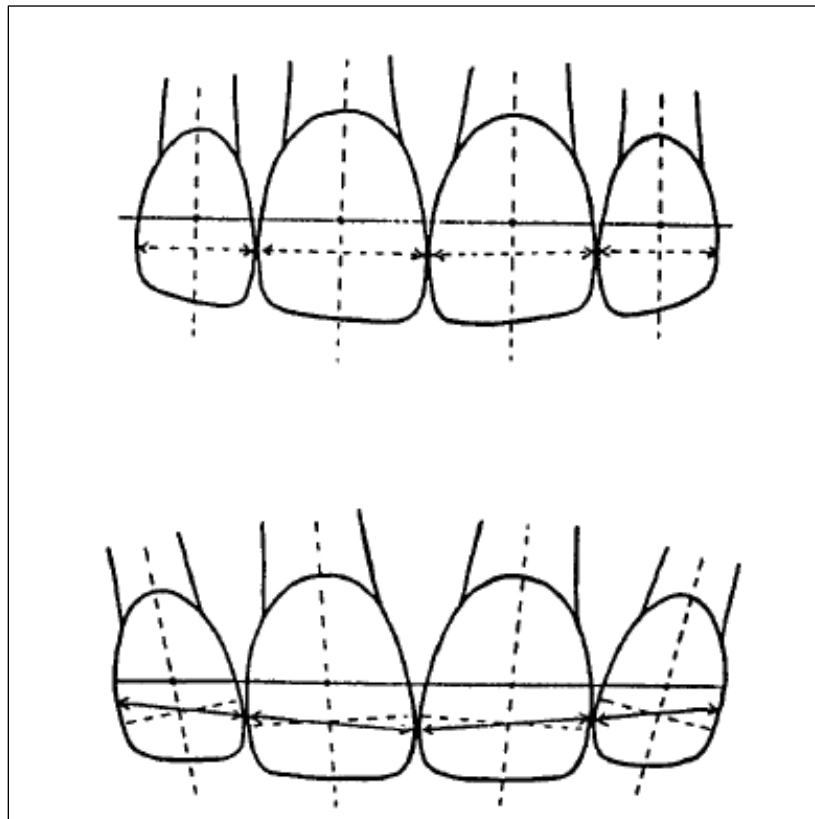
Allow 0.5 mm space for each mm posterior arch width change.

D. Incisor A/P Change:

Allow 2 mm space for each 1mm change. Assess the lower arch first and then correct the upper incisors to overjet 2 mm.

E. Angulation (Mesiodistal Tip)

If upper incisors are too vertical, they take up less space in the arch than if correctly angulated. Applies only to maxillary incisors. Allow 0.5 mm space for correction of each parallel sided vertical tooth.



Space creation/use:

a) Tooth reduction:

Record the total mesiodistal enamel reduction for each arch. This may be to reshape an individual tooth or to relieve small amounts of crowding.

b) Tooth enlargement:

Record the space to be used by building up teeth pretreatment, or to be created if the build up is to be undertaken posttreatment.

c) Extractions:

Record the mesiodistal width of the permanent teeth to be extracted (excluding second and third molars).

d) Space opening:

Record any space to be created or kept in the arches for prostheses.

e) Molar distal change:

f) Estimate the amount of distal movement required from molars during treatment.

g) Differential growth:

Estimate the A/P growth differences between the maxilla and mandible during treatment (not necessary for most patients). A positive upper space assessment applies to forward growing Class II cases, but a negative lower assessment applies for the creation of additional space in Class III cases where deterioration in arch relationship is anticipated during and after treatment.

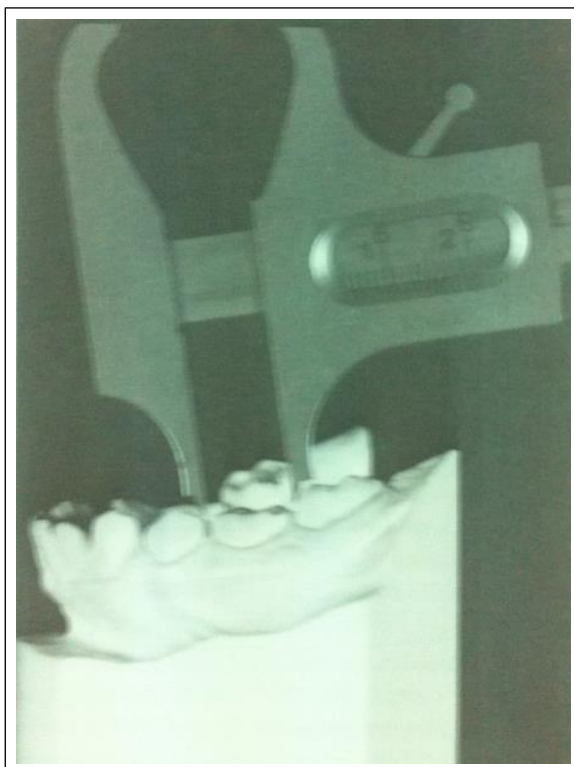
Space analysis in mixed dentition:

In the mixed dentition, the permanent incisors and first molars are erupted. The permanent canines and premolars have not erupted. Their mesial-distal widths can be measured by one of the following:

1- Measurement of the teeth on radiograph:

This requires an undistorted radiographic image, which is more easily achieved with individual periapical radiograph than panoramic radiograph.

(True width of primary molar ÷ apparent width of primary molar) =
(True width of unerupted premolar ÷ Apparent width of unerupted premolar)



2- Estimation from proportionality tables:

There is a reasonably good correlation between the size of the erupted permanent incisors and the unerupted canine and premolar. These data have been tabulated for white American children by Moyers Table (1). To utilize Moyers prediction tables, the mesiodistal width of the lower incisors is measured and this number is used to predict the size of both the lower and upper unerupted canine and premolar.

Moyers Prediction Values (75% level)

Total mandibular-incisor width		19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0
Predicted width of canine and premolars	Maxilla	20.6	20.9	21.2	21.3	21.8	22.0	22.3	22.6
	Mandible	20.1	20.4	20.7	21.0	21.3	21.6	21.9	22.2

23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0
22.9	23.1	23.4	23.7	24.0	24.2	24.5	24.8	25.0	25.3	25.6	25.9
22.5	22.8	23.1	23.4	23.7	24.0	24.3	24.6	24.8	25.1	25.4	25.7

3- Estimation from equation:

Tanaka and Johnson developed another way to use the width of the lower incisors to predict the size of unerupted canine and premolar as following:

$\frac{1}{2}$ of the mesiodistal width of the four lower incisors + 10.5 = estimated width of mandibular canine and premolars in one quadrant.

$\frac{1}{2}$ of the mesiodistal width of the four lower incisors + 11 =

estimated width of maxillary canine and premolars in one quadrant.