**history taking and examination**:

We divide the arch into 3 segments from the canine to the canine on the other side (labial segment ),from the canineon the right side to the most posterior tooth (right posterior segment), from the canine on the left side to the most posterior tooth (left posterior segment)

We have to record the remaining teeth morphology , inclination and angulation , sometimes we might have supernumerary teeth ,hypodontia,impacted,delayed eruptions, asymmetrical eruptions of more than 6 to 9 months , retained deciduous teeth .

missing canines is not common , and central incisors are more common to be missing in the lower arch ,,check missing teeth and supernumerary ones by taking radiographs .

We have to examine as well the space condition ,to decide whether the arch is well aligned crowded or spaced.

We mean by the space available the (space available-space required)

Space available is the space from the mesial side of the 6 on one side to the mesial side of the 6 on the other side .

Space required is the width of each tooth alone from the 5 on one side to the 5 on the other side , then we add them all together and then find the difference between the space available and the space required , if the difference is 0 then each contact point is attached to the one on the adjacent tooth and the arch is well aligned , if its negative then space is needed to properly align the arch , and if its positive then space is available, arch is spaced.

When the value of the space available is negative it might be a mild-moderate-or severe crowding

Less than 4 …mild crowding

4-8…..moderate crowding

More than 8….severe crowding

We describe the rotation of the tooth according to the contact point migration , and we usually refer to the side that is severely displaced .

Inclination and angulation of the teeth

 ,, we mean by inclination the buccolingual angle of the tooth in the arch , its sometimes called the torque.

Angulation is the mesiodistal angle of the tooth in the arch , sometimes called the mesiodistal tip of the tooth .

overjet ? it is the horizontal overlap between the lower incisor labial surface and the upper incisor edge ,,average value is usually 2-4mm

is overbite ? it is the vertical overlap that describes how much the upper incisors are covering of the lower incisors ,,,on average its usually one –third the lower incisor

Overbite can be either complete or incomplete ,,,complete can be further classified into hard tissue or soft tissue contact

Complete overbite means that the lower incisal edge is in touch with the something either soft or hard tissue ,,and that’s how its classified into hard tissue and soft tissue contact according to the tissues in which the lower incisors are in touch with

Furthermore soft tissue contact is classified into traumatic and atraumatic contact according to the irritation and traumatization of the soft tissues caused by such contact .

-openbite : where the upper incisors are not covering the lower incisors ,,can be symmetrical or asymmetrical ,,measured in mm,,,,we have to describe its extent as well

We can have an anterior openbite or a posterior openbite

Canine relationship:ss

Calss1 ,,,where the upper canine is in the embrasure between the lower canine and the lower 1st premolar.

Calss 2….when its anterior to this position

Class 3..when its posterior to this position

in case of facial asymmetry we have to consider taking a posterior-anterior cephalogram

skeletal discrepancy ,,lateral cephalogram

space analyses can be made more accurately on a study model

**Cephalometry**

 We have an Anterior-posterior Cephalogram and a Lateral Cephalogram.

**#Uses of lateral Ceph:**

1) To asses the skeletal pattern A-P and vertically (the most imp use) *note: to asses the transverse skeletal pattern you need and A-P cephalogram*

2) Asses Incisal Inclination (another very imp use)

 3) Dental Arch length (not very effective)

4) soft tissue assessment (very poor for external soft tissue)

 5) growth prediction

 6) diagnosis

7) prognosis tracing/determination

 8) simulation treatment

 9)Assess treatment progress

10)research cephalogram is not used to asses local dental factors, we'd rather use panoramic radiographs or CBCT.

**# Lateral Ceph Asessment**

Mark the basic points: S , N , **Or**: Orbitale (most inferior anterior point on margin of orbit) , A , B , PO , ME , Go , ANS , PNS

Mark the following lines: SN , NA , NB , Mx , Mn , UIA , LIA

 Measure and record the following**: SNA** angle , **SNB** angle

**ANB** angle **UImxP** angle ( between upper incisal axis and maxillary plane) **LImnP** angle (between lower incisal axis and mandibular plane) **MMPA** (maxillary-mandibular plane angle) **LAFH %** (lower anterior facial height percentage) **SN-MxP** angle (between Sella Nasion line and Maxillary plane) **IIA** (Interincisal angle> between upper incisal axis and lower incisal axis)

**Assess the Anterior-Posterior Skeletal relationship** this is done by comparing ANB, S

ANB angle is the most important angle for assessing the skeletal problem. *It relates*

*the maxilla and the mandible to the cranium -through the nasion- which is considered a stable reference point*. >>If the ANB was greater than the normal range, then the A point is way in front of the B-point and the patient has a class 2 relation. >>If the ANB was less than the normal range, then the A point coincides or is behind the B-point and the patent has a class 3 relation

After knowing the skeletal problem, we can assess the cause of this problem through the SNA and SNB angles. SNA *shows the relative position of the maxilla in relation to the cranial base* SNB *shows the relative position of mandible in relation to the cranial base*

FOR EXAMPLE: > If the ANB is large then as we said this is a class 2 relation: this can be due to:-prognathic maxilla (large SNA) - retrognathic mandible (small SNB) - or BOTH

> If the ANB is small then this is a class 3 relation which can be due to:-retrognathic maxilla (small SNA) - prognathic mandible (large SNB) - or BOTH *This can be done, given that the nasion is in its correct stable position! Sometimes the position of the nasion is variable, and this would affect the value of ANB and give us inaccurate results. To compensate for this error we apply EASTMAN CORRECTION. YET, to be able to apply Eastman correction the angle between SN and Maxillary plane should be within normal range* ***5-11˚***

**APPLY EASTMAN CORRECTION**

*keep in mind that we are using this method to compensate for the inaccuracy in the ANB angle due to the variable position of the nasion. (so we will correct the ANB) >* As we said we first make sure that the SN-MxP angle is within normal range (5-11˚) > IF SNA is increased: for every degree above the normal range we SUBTRACT 0.5˚ from the ANB angle IF SNA is decreased: for every degree below the normal range we ADD 0.5˚ to the ANB angle FOR EXAMPLE: if the measured SNA is 89˚, and the measured ANB is 8˚. When we apply Eastman correction: SNA is 8˚ above the normal range (normal SNA=81˚) Therefore we are going to subtract 4˚ from the measured ANB. Corrected ANB= 4˚ *(note that before correction, the ANB angle showed that the skeletal relation is class 2, but after correction the ANB angle is within normal range = skeletal class 1)*

**Assess the Vertical skeletal relationship**

this is done by comparing the Maxillary mandibular plane angle *MMPA* and the Anterior Lower facial height percentage *ALFH%* to the normal values.

These values will enable us to assess if the lower facial height proportions are increased or decreased, also will give us an idea about anterior/posterior growth rotations

 If MMPA is increased this mostly indicates: - posterior growth rotation

- increased lower facial height - mostly has anterior open bite

If MMPA is decreased this mostly indicates: - anterior growth rotation - decreased lower facial height - mostly has deep overbite

*(if you remember, when we assess the vertical relation CLINICALLY we used the FMPA-Frankfort mandibular plane angle, rather than the MMPA. We prefer to use the MMPA in radiographic assessment since it's easier to locate)*

**Assess the Dental Relation**

By assessing the relation between the **1)** Incisors and their skeletal base and **2)**between the upper and lower incisors

 Incisal inclination in relation to skeletal base is assessed through the angle between

>the upper incisal axis and the maxillary plane > *UIMxP* >the lower incisal axis and the mandibular plane > *LIMnP* these angles are compared to the normal values too, and it will give you an idea about the position of the incisors (Proclined/retroclined), and whether they have a role in the etiology of the malocclusion or not.

 The relation between the two incisors is important When might have a skeletal class 2 malocclusion but with normal Overjet. What does that mean? it means that *Dentoalveolar*

*Compensation* have taken place to compensate for the skeletal malocclusion. The intericisal angle *IIA* is used to assess the relation between the upper and the lower

incisor, to have a proper stable relation between the two incisors this angle

**Prognosis Tracing**

Prognosis tracing for *removable appliances* is only applicable in class 2 division 1 skeletal malocclusion with increased overjet; in which we are planning to change the incisal pattern to class 1 by decreasing the overjet. In this case we do prognosis tracing to see if its APPLICABLE TO USE A REMOVABLE APPLIANCE OR NOT for this case.

If the resultant *Interincisal angle*, after Simulation or prognosis tracing is **>150**˚ (not stable) AND the resultant *Upper incisor to maxillary plane Angle* is **<95˚** (incisors will appear retroclined- not esthetic) THEN, treatment using a removable appliance is **NOT applicable**

**space analysis**

- **objectives**:
 🡪 space analysis; helps us in decision making regarding extraction
 🡪 anchorage; do we need to use headgear or not
. **Etiology** **of crowding**:
 - **primary**:
 \* inherited “genetically determined”
 \* either the jaw is small or the teeth are large “tooth size-jaw size discrepancy
 \* features through which we can predict if it’s genetically related:
 🡪 splaying out of upper incisors
 🡪 lingually locked upper lateral
 🡪 No spacing in **primary** dentition
 🡪 early loss of “a” and “c”
 🡪 undermining resorption of “E” by “6”
 - **secondary**:
 \* **acquired** throughout local factors
 \* represented by: early loss of primary teeth
 \* example:
 🡪 early loss of “e” 🡪 mesial tipping of “6”🡪 no enough space for “5

 - **tertiary**:
 \* also known as: **late incisor crowding**
 \* multifactorial (late? growth of the mandible, Soft tissues “lips”,…)
 \* starts after an age of 12-13 year
 \* nearly “7” factors ,,, dr. didn’t mention



**Space analysis**:
 - **Principle**: bacically, we want to compare the space available for alignment, and the
 space required to align each individual tooth
 - it can be done: 1. directly on the cast using “Divider”
 2. On “3D” models using CAD/CAM technique
 🡪 scanning of cast or impression = digital cast
 🡪 space analysis is done on that digital cast by it self
 🡪 it is becoming more and more accurate, but that doesn’t mean that it’s more accurate than the direct way

🡪 **How to calculate the space “available” in the arch**:
 \* Space from mesial side of “6” on one side to the mesial side of “6” on the other:
 1. Wire is passed from the contact point “6” on one side along with those
 “contacts” of posteriors and incisal edges of anteriors terminating in “6”
 on the other side, then we measure the wire
 2. Four segments way; we bring the **divider** and measure from:
 🡪 mesial of “6” to the mid of canine (segment “1”)
 🡪 mid of canine to the midline (segment “2”)
 🡪 midline to the mid of canine on the other side (segment “3”)
 🡪 mid of canine to the mesial side of the other “6” (segment “4”)
 \*\* the second way is more accurate.

🡪 **How to calculate the space “required”**:
 - we need to measure the MD width of each “erupted” tooth from contact tocaontact
 point using the divider or more accurately using the digital caliber “0.1 mm”,, then
 we sum the values together resulting the value of required space.

🡪 **The problem with space analysis**:
 1- it doesn’t give us any idea regarding the “protrusion”:
 🡪 meaning that it’s not necessary to see the crowding grossly in the arch, there
 could be an indication of that crowding through adaptation of teeth to that
 condition
 2- it doesn’t give as any idea about the growth:
 🡪 this method gives us the space required for this moment only, it can’t predict the space later on
 🡪 **example**: till the age of “12 years”, the arch continues to grow and expand, as a result of this we will have spaces that couldn’t be predicted previous to
 that age.

 3- Difficulty in calculating the required space in Mixed dentition:
 🡪 due to multiple un-erupted teeth in that stage, there is some kind of difficulty in calculating the MD width of those un-erupted teeth
 🡪**solution**: “step by step”
 - there is no problem in measuring the space in mixed dentition from “6” to “6”, so we can find out the space “**available**”
 - the space “**required**” is measured **indirectly** through sth. Known as “mixed dentition analysis”

 🡪 **mixed dentition analysis**: method through which assessment/analysis the space for the permanent teeth when the patient is in the mixed dentition, involving estimation the size of erupted permanent teeth (ex: “3”,,”4”,,”5”,.)

**\*Methods of mixed dentition analysis**:
 1. ***Radiograph***:
 - in a radiograph, “5” is un-erupted and overlied by “E”, and we want to estimate the width of “5” from this radiograph: “steps”
 🡪 construct a study model: we will get “E”, then we can measure
 the width of “E”.
 🡪 Take a periapical radiograph “parallel technique more accurate”: from this radiograph, we can measure the width of both “E” and “5” under it
 🡪 use this formula: **“compensation method in order to know the magnification”**
 width of “E” on radiograph = width of “5” on radiograph
 width of “E” on the cast width of “5” on cast (x)
 🡪 for every individual tooth, we take a periapical radiograph
 🡪 ***the problem with this method:***
 1. Usually, we have distortion in the radiograph specially in the canine area
 2. Too much exposure to radiation “each individual tooth must be radiographed

 2. ***Proportionality tables without using radiographs:***
 - Tanaka & Johnston measure the **total** width of lower incisors from the cast, and from this value, they could predict the width of “3”,”4”,and “5” in **onequadrant**

- why we don’t use the width of upper:
 🡪 cuz there are a lot of variations specially in upper laterals “peg-shaped,
 missing,..”
 🡪 advantages: no radiographs
 🡪 disadvantages: small tendancy for over-estimation of the width compared to it’s actual value, but it’s practical and used (Y)
3. ***Combination of both “most accurate method”***:
 - no need to take it in details
 - combination between both methods, but it’s **only** related to **lower arch**
 - population specific
\* **Space planning**:
 - After we determine the amount of space that is **required**, we want to calculate the amount of space that we’ll create during treatment.

- you have to put in your mind that there are many orthodontic procedures that need space, ***not only the crowding*** also **Decrease overjet** , **Arch contraction ,**
 **Tooth angulation “mesio-distal tipping** , **Tooth inclination “bucco-lingual tipping” , Torque**  and **Leveling of curve of spee**

**- How to correct retroclination:
 🡪 bringing the root palatally, and this involves movement of contact points
 distally
 🡪 the idea: bringing the roots palatally “retroclination” does need space**

**about expansion**:
 - by arch expansion, we provide a space
 - by arch contraction, we need a space
 - according to many experiments, every “1 mm” expansion of the whole arch, a space of “0.5 mm” is provided in the whole arch, and vice versa “regarding contraction