

Orthodontics — Notes in Orthodontics

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EXAM-DAY SUMMARY

everything on this page → detail in §§ overleaf

REFER — AND WHEN → §1

- **Deciduous:** cleft lip & palate; other craniofacial anomalies
- **Early mixed:** delayed incisor eruption; 6s impacted / poor prognosis; severe CI 3; anterior crossbite; ectopic maxillary canine
- **Late mixed:** skeletal CI 2 growth modification; hypodontia

TERMINOLOGY → §1

- OJ = horizontal; OB = vertical overlap
- **Complete OB = lowers contact uppers or palatal mucosa**; incomplete = neither
- AOB = no vertical overlap with buccal segments in occlusion
- Competent lips = meet with minimal/no muscle activity

IOTN STRUCTURE → §2

- 2 components: DHC (dental health) + AC (aesthetics)
- DHC 5 grades: 1 none · 2 little · 3 moderate · 4 great · 5 very great
- **Only the single worst occlusal feature is recorded**
- MOCDO: Missing · Overjet · Crossbite · Displacement · Overbite

DHC NUMBERS → §2

- OJ 3.6–6 mm; competent lips = 2a · incompetent = 3a
- OJ 6.1–9 = 4a · **OJ >9 mm = 5a**
- Reverse OJ 0.1–1 = 2b · 1.1–3.5 = 3b · >3.5 = 4b
- Displacement 1.1–2 = 2d · 2.1–4 = 3d · >4 = 4d
- Open bite 1.1–2 = 2e · 2.1–4 = 3e · >4 = 4e
- 5p cleft · 5s submerged deciduous · 5i impeded eruption (not 8s)

AESTHETIC COMPONENT → §2

- 10 colour photographs; 1 = most attractive → 10 = least
- 1–4 no need · 5–7 moderate/borderline
- **8–10 need treatment** (opposite polarity to DHC)

CEPH TECHNIQUE & LANDMARKS → §3

- **6 ft tube → film; 1 ft patient → film**; cephalostat + aluminium wedge
- S = midpoint of pituitary fossa · N = most anterior frontonasal suture
- A / B = deepest concavity, anterior maxilla / mandible
- Or = lowest inferior orbital margin · Po = upper edge of EAM
- Go = angle of **mandible** (slide says symphysis — wrong) · Me = lowest point of symphysis

CEPH NORMS → §4

- SNA 81 ± 3 → >84 CI 2 · <78 CI 3
- SNB 79 ± 3 → >82 CI 3 · <76 CI 2
- ANB 3 ± 2 → >5 = CI 2 · <1 = CI 3
- FMPPA = MPPA = 27 ± 5 → >32 high LFH · <22 low LFH
- U1/Mx 109 ± 6 · L1/Md 93 ± 6 · interincisal 133 ± 10

CLASSIFICATION → §5

- Skeletal: CI 2 = protruded maxilla or retruded mandible; CI 3 = reverse
- Angle: MB cusp U6 vs buccal groove L6 — in / **mesial = CI II** / distal = CI III
- Class IV = unilateral CI II or CI III
- BSI 1983: lower incisor edge vs cingulum plateau of upper centrals
- CI II div 2 = **retroclined** uppers, deep OB, broad arch, good-size mandible

ANGLE'S DRAWBACKS → §5

- **Reliable but invalid**
- AP relations only; no skeletal description
- Cannot classify if molars absent; not for deciduous dentition
- Molars not fixed skull points — key ridge

SPACE ANALYSIS → §6

- Crowding = arch length < tooth size; mild 2–4 · moderate 4–8 · severe >8 mm/quadrant
- **Incisor A/P: 2 mm space per 1 mm change**; arch width 0.5 mm per mm (RPE max 0.7)
- Inclination 1 mm per 5° (four incisors) · 0.5 mm if two
- Curve of Spee: 1 mm for 3 mm depth · 1.5 for 4 · 2 for 5
- Assess lower arch first; correct upper to OJ 3 mm

OPTIMUM FORCES (G) → §7

- **Intrusion 10–20** (lightest)
- Tipping · rotation · extrusion 35–60
- Root uprighting (torque) 50–100
- Bodily / translation 70–120 (heaviest)

MOVEMENT & REMOVABLES → §7–8

- Tipping = removable or fixed; **torque & bodily = fixed only**
- Extrusion → tension → deposition; intrusion → pressure → resorption
- Rotation needs a couple = force × distance
- Components: Active · Retainer · Anchorage · Base plate
- Wire: 0.5 mm Z/T spring · 0.7 mm labial bow, long labial bow, canine retractor

FUNCTIONAL APPLIANCES → §9

- Herbst = only **fixed** functional; Fränkel = only completely **tissue-borne** (types 1–4)
- Twin Block brings mandible forward; MOA = deep bite; Bionator = arch expansion
- **25% skeletal · 75% dentoalveolar**
- Mandibular growth 1–2 mm/month; no change at 3 months → switch to fixed
- Uppers distal + intrude; lowers mesial + extrude

§1 Scope, referral & occlusal terminology

- **Orthodontics:** branch of dentistry concerned with growth of the face · development of the dentition · prevention + correction of occlusal anomalies

1.1 What to refer, and when

Table 1 — Referral triggers by stage of dentition

Stage	Refer for
Deciduous dentition	Cleft lip & palate · other craniofacial anomalies
Early mixed dentition	Delayed eruption of permanent incisors · impaction or failure of eruption of 6s · 6s of poor long-term prognosis · severe Class 3 malocclusion · anterior crossbite · ectopic maxillary canine
Late mixed dentition	Growth modification of skeletal Class 2 · hypodontia

★ EXAM PEARL

Timing is the tested axis, not the diagnosis. **Cleft/craniofacial** → **deciduous** (earliest); **ectopic canine and poor-prognosis 6s** → **early mixed**; **skeletal Class 2 growth modification and hypodontia** → **late mixed**.

1.2 Core definitions

Ideal occlusion

Anatomically and theoretically perfect arrangement of teeth.

Normal occlusion

Acceptable variation from ideal occlusion.

Competent lips

Lips meet with minimal or no muscle activity.

Incompetent lips

Evident muscle activity required for lips to meet.

Overjet (OJ)

Horizontal distance between upper and lower incisors.

Overbite (OB)

Vertical overlap of the upper incisors over the lower incisors.

Complete overbite

Lower incisors contact the upper incisors **or** the palatal mucosa.

Incomplete overbite

Lower incisors contact neither the upper incisors nor the palatal mucosa.

Anterior open bite (AOB)

No vertical overlap of the incisors when the buccal segment teeth are in occlusion.

Crossbite

Deviation from the normal bucco-lingual relationship → anterior or posterior · unilateral or bilateral.

KEY POINTS

Overjet = horizontal · overbite = vertical. Complete vs incomplete overbite turns on **contact** (tooth or palatal mucosa), not on depth. AOB is judged with the **buccal segments in occlusion**.

§2 IOTN — Index of Orthodontic Treatment Need

- **Two components:** dental health component (DHC) + aesthetic component (AC)
 - **DHC** — records malocclusion by the significance of tooth irregularities for personal dental health
 - **AC** — records the aesthetic impairment
- **DHC = 5-grade scale:** 1 no need · 2 little · 3 moderate · 4 great · 5 very great need
- **Scoring rule:** only the **★single worst occlusal feature** is recorded — features are not summed

- **MOCDO**: the hierarchy used to find that worst feature → **M**issing teeth (congenital absence, extra and impacted teeth) → **O**verjet (incl. reverse overjet) → **C**rossbite → **D**isplacement of contact points → **O**verbite (incl. open bite)

MNEMONIC

MOCDO — Missing · Overjet · Crossbite · Displacement · Overbite. Work down in order; the first category that scores is the grade.

2.1 DHC sub-codes (Box 4.1)

Table 2 — DHC grades 1–3

Code	Feature
1 (None)	Extremely minor malocclusions, including displacements less than 1 mm
2a	Increased overjet 3.6–6 mm with competent lips
2b	Reverse overjet 0.1–1 mm
2c	Anterior or posterior crossbite, up to 1 mm discrepancy between retruded contact position (RCP) and intercuspal position (ICP)
2d	Displacement of teeth 1.1–2 mm
2e	Anterior or posterior open bite 1.1–2 mm
2f	Increased overbite 3.5 mm or more, without gingival contact
2g	Pre-normal or post-normal occlusions with no other anomalies; includes up to half a unit discrepancy
3a	Increased overjet 3.6–6 mm with incompetent lips
3b	Reverse overjet 1.1–3.5 mm
3c	Anterior or posterior crossbites with 1.1–2 mm discrepancy
3d	Displacement of teeth 2.1–4 mm
3e	Lateral or anterior open bite 2.1–4 mm
3f	Increased and complete overbite without gingival trauma

Table 3 — DHC grades 4–5

Code	Feature
4a	Increased overjet 6.1–9 mm
4b	Reversed overjet greater than 3.5 mm with no masticatory or speech difficulties
4c	Anterior or posterior crossbites with greater than 2 mm discrepancy between RCP and ICP
4d	Severe displacement of teeth, greater than 4 mm
4e	Extreme lateral or anterior open bites, greater than 4 mm
4f	Increased and complete overbite with gingival or palatal trauma
4h	Less extensive hypodontia requiring pre-restorative orthodontic space closure to obviate the need for a prosthesis
4l	Posterior lingual crossbite with no functional occlusal contact in one or both buccal segments
4m	Reverse overjet 1.1–3.5 mm with recorded masticatory and speech difficulties
4t	Partially erupted teeth, tipped and impacted against adjacent teeth
4x	Supplemental teeth
5a	Increased overjet greater than 9 mm
5h	Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring pre-restorative orthodontics
5i	Impeded eruption of teeth (except third molars) due to crowding, displacement, supernumerary teeth, retained deciduous teeth, any pathological cause
5m	Reverse overjet greater than 3.5 mm with reported masticatory and speech difficulties
5p	Defects of cleft lip and palate
5s	Submerged deciduous teeth

Table 4 — Hierarchical (MOCD) scale: grade boundaries at a glance

Grade	M — missing	O — overjet	C — crossbite	D — displacement	O — overbite
IOTN 5	Cleft lip & palate · impacted/ectopic teeth · hypodontia >4 missing teeth	>9 mm OJ · >3.5 mm reverse OJ	—	—	—
IOTN 4	Supernumeraries · hypodontia <4 missing teeth	>6 mm OJ · -2 to -3.5 mm reverse OJ	Crossbite with >2 mm RCP-ICP displacement	>4 mm contact point displacement	Deep overbite + trauma · >4 mm AOB
IOTN 3	—	>4 mm OJ · <-2 mm reverse OJ	Crossbite with >1 mm RCP-ICP displacement	<4 mm contact point displacement	Deep overbite, no trauma · <4 mm AOB
IOTN 2	—	>2 mm OJ	—	<2 mm contact point displacement	—
IOTN 1	—	—	—	Minimal irregularity	—

Table 4 is the lecture's summary grid; where its reverse-overjet bands differ slightly from the sub-codes, Box 4.1 (Tables 2–3) is the authoritative wording.

2.2 Aesthetic component (AC)

- **Format:** scale of ★ten colour photographs showing different levels of dental attractiveness
- **Use:** patient's dental attractiveness rated by comparison against the standard AC photographs
- **Polarity:** grade 1 = **most** attractive → grade 10 = **least** attractive arrangement of teeth
- **Bands:** ★1–4 no need · 5–7 moderate/borderline need · 8–10 need treatment

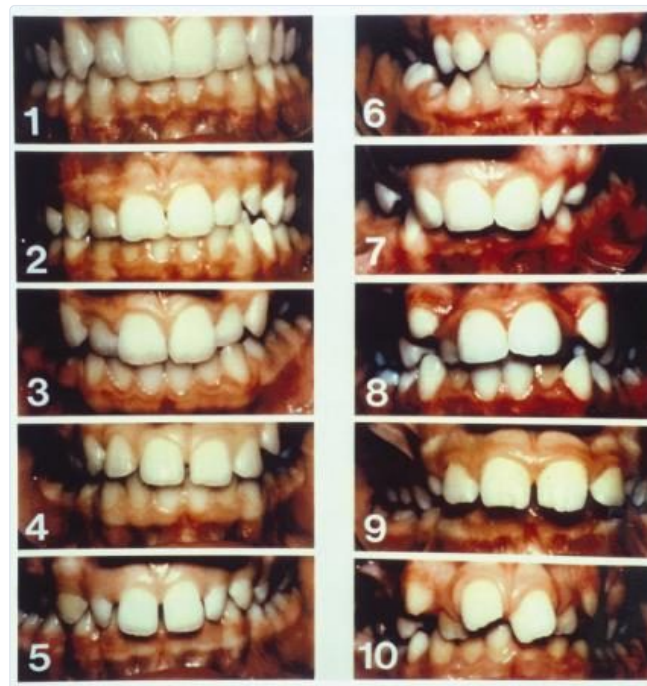


Fig. 1 — IOTN aesthetic component: the ten reference photographs, 1 (most attractive) → 10 (least attractive).

★ EXAM PEARL

The two scales run in **opposite directions** and examiners exploit it: DHC 1 = no need ... 5 = very great need, but AC 1 = most attractive ... 10 = least attractive. Treatment need sits at **DHC 4–5** and **AC 8–10**.

§3 Cephalometrics — technique, landmarks & planes

3.1 Standardisation

- **Geometry:** ★6 feet tube → film · ★1 foot patient → film (i.e. 5 ft source → patient, then 1 ft patient → film)
- **Set-up:** X-ray source → central ray → aluminium wedge → cephalostat holding the head → film/digital sensor
- **Purpose:** fixed distances + cephalostat → reproducible magnification and head position → serial films comparable

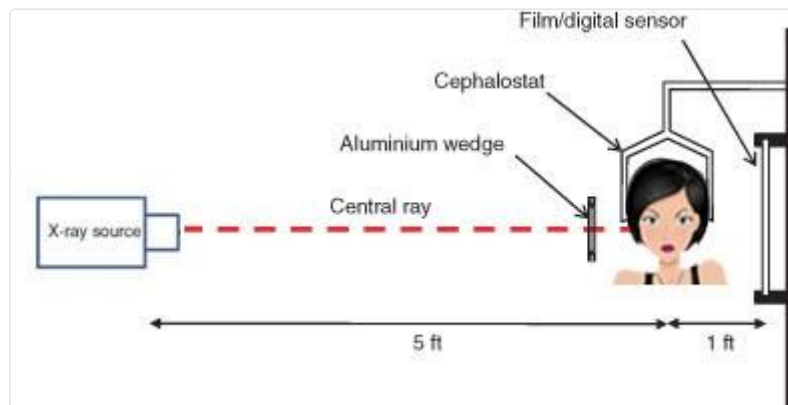


Fig. 2 — Cephalometric standardisation: source → central ray → aluminium wedge → cephalostat → film. 5 ft + 1 ft = 6 ft tube-to-film.

3.2 Cephalometric tracing

- **Definition:** clinical analysis of the dental and skeletal relationships of a human skull
- **Use:** orthodontic diagnosis and treatment planning
- **Structures traced on a lateral ceph:** frontal sinus · sella turcica · nasal bone · maxillary sinus · inferior border of the mandible · hyoid bone · cervical spine · soft tissue profile
- **Three things are then read off:** points → planes → angles

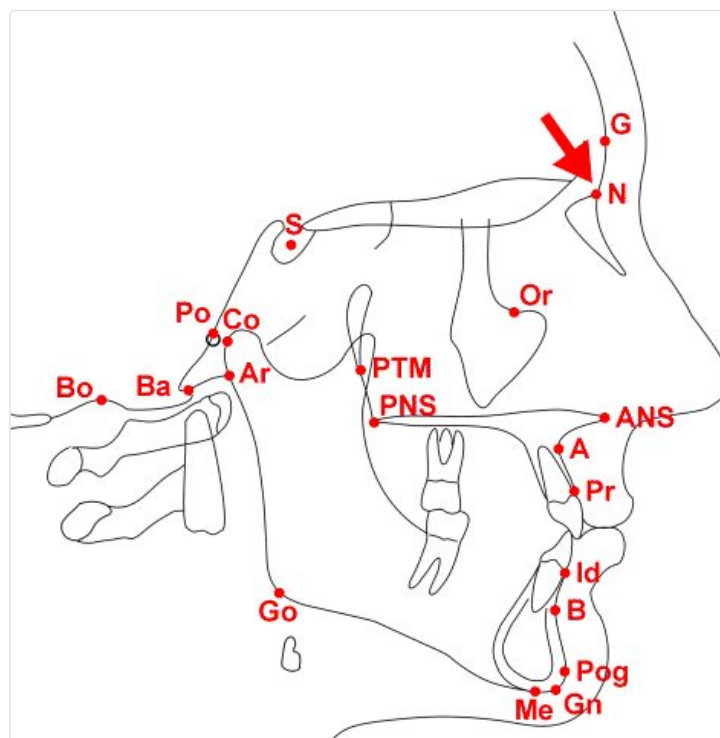


Fig. 3 — Cephalometric landmark points on a lateral tracing.

3.3 Landmark points

Sella turcica (S)

Depression in the base of the skull where the pituitary gland sits; the point is the **midpoint of the pituitary fossa** — a constructed point in the median plane.

Nasion (N)

Most anterior point of the frontonasal suture, in the median plane.

A point

Deepest concavity on the anterior surface of the **maxilla**.

B point

Deepest concavity on the anterior surface of the **mandible**.

Orbitale (Or)

Lowest point on the inferior bony margin of the orbit; on a cephalogram, the lower orbital margin directly below the pupil with the patient looking straight ahead.

Porion (Po)

Midpoint on the upper edge of the external auditory meatus; as a cephalometric landmark, the middle of the metal rods of the cephalostat.

Gonion (Go)

Most posterior–inferior point on the **angle of the mandible**.

Menton (Me)

Lowest point of the mandibular symphysis.

- **Also labelled on Fig. 3** (named on the tracing, not defined in the lecture): G glabella · Co condylion · Ar articulare · Ba basion · Bo Bolton point · PTM pterygomaxillary fissure · PNS posterior nasal spine · ANS anterior nasal spine · Pr prosthion · Id infradentale · Pog pogonion · Gn gnathion

★ EXAM PEARL

Slide error to correct: the lecture defines Gonion as the most posterior-inferior point on the angle of the *symphysis*. Gonion is at the **angle of the mandible**; the symphysis is the anterior midline of the mandible and is where **Menton** (and Pogonion/Gnathion) sit. Learn it as: **Go = angle** · **Me = lowest point of symphysis**.

3.4 Planes

- **S–N plane:** sella → nasion = the **cranial base** reference for SNA/SNB
- **Frankfort horizontal (F–H):** porion → orbitale; the reference for FMPA
- **Maxillary plane:** ANS → PNS; with the mandibular plane gives MMPA
- **Mandibular plane:** along the lower border of the mandible (Go → Me/Gn)
- **Occlusal plane** · **Facial plane** · **Y axis:** further planes labelled on the tracing

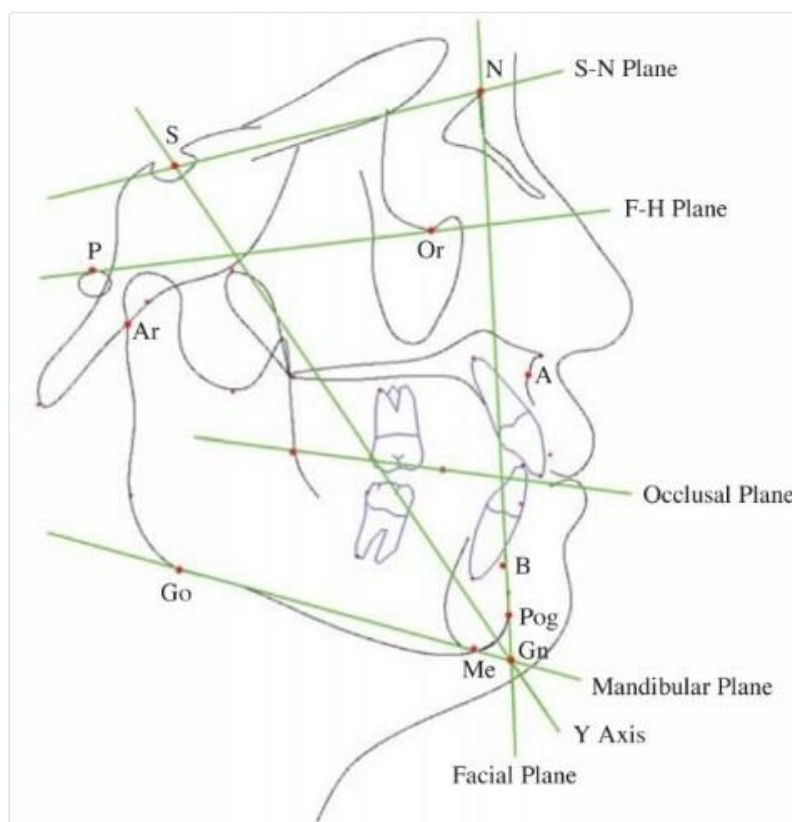


Fig. 4 — Cephalometric planes: S–N, F–H, occlusal, mandibular, facial and the Y axis.

§4 Cephalometric angles & norms

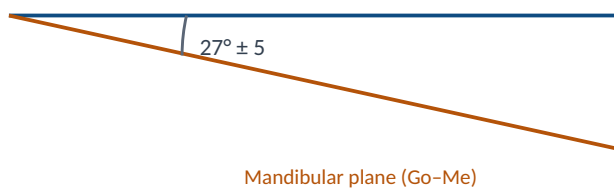
- **SNA**: antero-posterior position of the **maxilla** relative to the cranial base
- **SNB**: antero-posterior position of the **mandible** relative to the cranial base
- **ANB**: position of maxilla and mandible **relative to each other** → the skeletal classification itself
- **FMPA**: angle between the mandibular plane and the Frankfort plane → vertical proportion
- **MMPA**: angle between the maxillary plane and the mandibular plane → vertical proportion
- **Vertical read-out**: high angle → high lower face height (LFH) · low angle → low LFH

Table 5 — Cephalometric norms and cut-offs

Measurement	Mean	Increased value	Decreased value
SNA	$81^\circ \pm 3$	$>84^\circ$ prognathic maxilla → skeletal Class 2	$<78^\circ$ retrognathic maxilla → skeletal Class 3
SNB	$79^\circ \pm 3$	$>82^\circ$ prognathic mandible → skeletal Class 3	$<76^\circ$ retrognathic mandible → skeletal Class 2
ANB	$3^\circ \pm 2$	$>5^\circ$ skeletal Class 2	$<1^\circ$ skeletal Class 3
FMPA	$27^\circ \pm 5$	$>32^\circ$ high LFH	$<22^\circ$ low LFH
MMPA	$27^\circ \pm 5$	$>32^\circ$ high LFH	$<22^\circ$ low LFH
Upper incisor / maxillary plane	$109^\circ \pm 6$	Increased = proclined uppers · decreased = retroclined uppers	
Lower incisor / mandibular plane	$93^\circ \pm 6$	Increased = proclined lowers · decreased = retroclined lowers	
Interincisal angle	$133^\circ \pm 10$	Lecture figures also quote the working range 130–134°	

FMPA

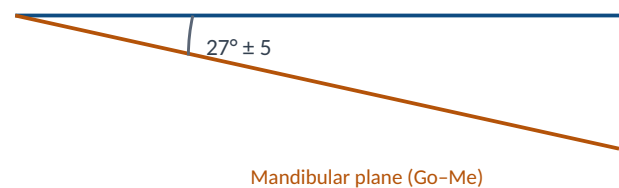
Frankfort plane (Po–Or)



$>32^\circ \rightarrow$ high lower face height

MMPA

Maxillary plane (ANS–PNS)



$<22^\circ \rightarrow$ low lower face height

Diagram 1 — FMPA is measured from the **Frankfort** plane, MMPA from the **maxillary** plane; both meet the mandibular plane, and both share the same mean and cut-offs.

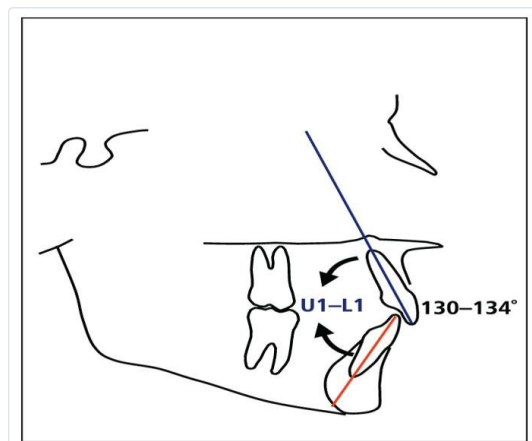


Fig. 5 — Interincisal angle U1–L1, 130–134°.

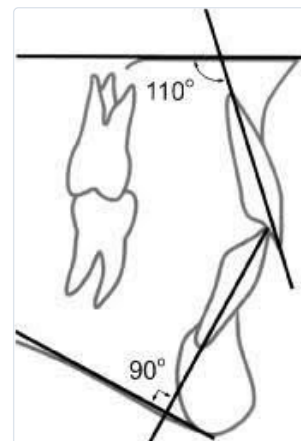


Fig. 6 — Incisor inclinations to their own jaw planes ($\approx 110^\circ$ upper, $\approx 90^\circ$ lower).

★ EXAM PEARL

Two sets of norms appear in this lecture. The borrowed slides quote SNA 82°, SNB 80°, ANB 2° with "above/below the mean"; the lecture's own slides quote **SNA 81 ± 3, SNB 79 ± 3, ANB 3 ± 2** with hard cut-offs at 84/78, 82/76 and 5/1. Answer with the **± SD version and its cut-offs** — that is the British teaching and the one the numbered slides intend.

§5 Classification of malocclusion

5.1 Skeletal classification

- **Class 1:** normal relationship → straight profile
- **Class 2:** protruded maxilla **or** retruded mandible → convex profile
- **Class 3:** retruded maxilla **or** protruded mandible → concave profile

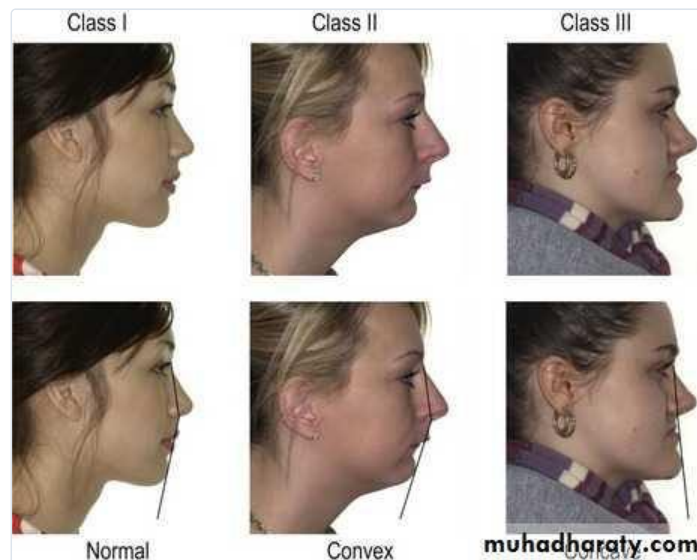


Fig. 7 — Skeletal Class I (normal/straight), Class II (convex), Class III (concave) profiles.

5.2 Angle's classification (molar relationship)

- **Reference:** tip of the mesiobuccal cusp of the maxillary first molar vs the buccal groove of the mandibular first molar
- **Class I:** MB cusp occludes **in** the buccal groove
- **Class II:** MB cusp occludes ★ **mesial** to the buccal groove
- **Class III:** MB cusp occludes ★ **distal** to the buccal groove
- **Class IV** (lecture's term): unilateral Class II or Class III

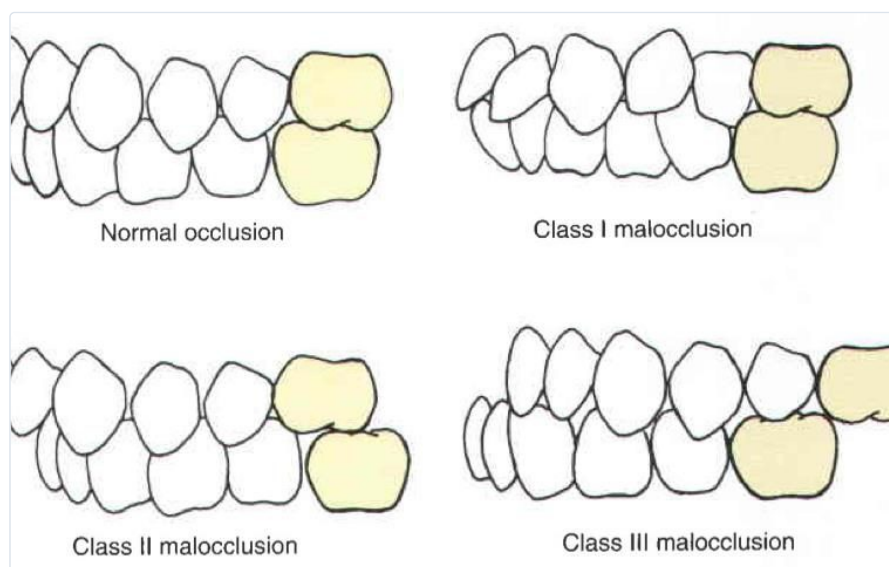


Fig. 8 — Normal occlusion and Angle Class I, II and III malocclusion.

5.3 Angle Class II divisions

- **Division 1:** maxillary protrusion or mandibular retrusion reflected in the profile · **incompetent** lips
- **Division 2:** maxillary central incisors overlapped by the lateral incisors · **competent** lips

Table 6 — Class II division 1 vs division 2

	Class II division 1	Class II division 2
Upper incisors	Proclined	Lingual inclination of upper centrals; may be overlapped by the upper laterals
Overjet / overbite	Excessive overjet + deep overbite	Deep overbite
Upper arch form	V-shaped — narrow in the canine region, broad between molars	Broad upper arch (usually)
Lips	Shorter upper lip → failure of anterior lip closure	Normal upper lip and lip seal; deep mental groove
Mandible	May be deficient, chin underdeveloped	Of good size

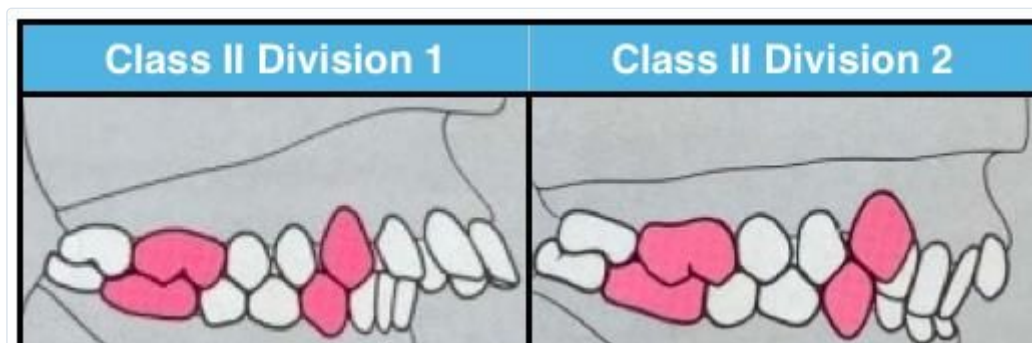


Fig. 9 — Class II division 1 vs division 2 (proclined vs retroclined upper centrals).

5.4 Drawbacks of Angle's classification

Angle's classification is **reliable but invalid** (AJODO 1992; Proffit; Graber):

1. Considers malocclusion only in **antero-posterior** relations
2. If the molars are **absent** → cannot classify
3. Does **not describe the skeletal relationship**
4. Maxillary and mandibular molars are **not fixed points** in skull anatomy — the key ridge is
 - **Key ridge** = outline representing the zygomatic process of the maxilla; a dense thickening of bone extending upward to join the dorsal limit of the orbit and running parallel to the lateral border of the orbit
5. Cannot be applied to the **deciduous dentition**

5.5 British Standard incisor classification (1983)

- **Basis:** the incisor relationship; molar relationship is not considered in some cases
- **Class I:** lower incisor edges occlude with, or lie immediately below, the **cingulum plateau of the upper central incisors**
- **Class II:** lower incisor edges lie **posterior** to the cingulum plateau → two sub-divisions
 - **Division 1** — upper centrals proclined or of average inclination + **increased overjet**
 - **Division 2** — upper centrals **retroclined**; overjet usually minimal, may be increased
- **Class III:** lower incisor edges lie **anterior** to the cingulum plateau; overjet reduced or reversed

★ EXAM PEARL

Know which classification a question is using. **Angle** = **molars** (fails when 6s are missing or in the deciduous dentition, and says nothing skeletal). **British Standard** = **incisors and the cingulum plateau** — the reference point is the **upper central's cingulum plateau**, and Class II div 2 is defined by **retroclined uppers**, not by overjet size.

§6 Space analysis

- **Spacing:** arch length > teeth size
- **Crowding:** arch length < teeth size
- **Severity (per quadrant):** ★mild 2–4 mm · moderate 4–8 mm · severe >8 mm

Table 7 — Space requirements: what to measure and how much to allow

Item	Allowance / rule
Crowding and spacing	Measure in relation to the line of arch , which reflects the majority of teeth
Level occlusal curve	Assess depth of the lower curve from premolar cusps to a flat plane on the distal cusps of the first molars and the incisors. Only one value per arch, and only if the premolars have not been assessed separately as crowded. Allow 1 mm space for 3 mm depth · 1.5 mm for 4 mm · 2 mm for a 5 mm curve (usually no allowance necessary). In the upper arch, 1 mm is recorded in Class II division 2 cases with a significant occlusal curve
Arch width change	Allow 0.5 mm space per mm of posterior arch width change. More space creation may be recorded with rapid palatal expansion (max 0.7 mm per mm expansion)
Incisor A/P change	Allow 2 mm space per mm of change. Assess the lower arch first , then correct the upper incisors to an overjet of 3 mm . Where the upper first premolars are extracted and the incisors retracted by 5 mm or more , 1 mm less space is required, because of the change in arch form
Angulation change	Maxillary incisors only. Although 0.5 mm is appropriate per parallel-sided vertical tooth, no allowance is entered — angulation corrections tend to be included in the crowding assessment
Inclination change	Maxillary incisors only. Allow 1 mm space per 5° change affecting all four incisors, 0.5 mm if only two teeth are affected

★ EXAM PEARL

The number that gets asked is the **incisor A/P rule: 2 mm of space per 1 mm of incisor movement** — because you move both sides of the arch. Contrast with arch **width**, where it is only **0.5 mm per mm**. And always assess the **lower arch first**.

§7 Tooth movement & optimum forces

7.1 Types of movement

- **Tipping:** movement of the crown with no or little movement of the root
 - **Controlled** — crown moves around the **root tip**
 - **Uncontrolled** — tooth moves around the **centre of resistance**
 - Easiest movement · little force · achievable with a **removable or fixed** appliance
- **Torque:** the opposite of tipping → movement of the **root** with no or little movement of the crown · more difficult · ★**fixed appliance only**
- **Bodily movement (translation):** all parts of the tooth move equally · needs great force · fixed appliance
- **Rotation:** needs two equal and opposite forces (a **couple**) · force required depends on the **cross-section of the root**
 - **Couple** = two parallel forces of equal magnitude acting in opposite directions and separated by a distance (different lines of action); magnitude = force × distance between them
- **Vertical movement:**
 - **Extrusion** → induced **tension** → bone **deposition**
 - **Intrusion** → induced **pressure** → bone **resorption**

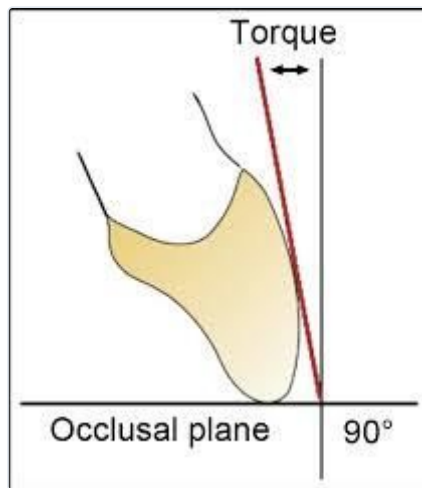


Fig. 10 — Torque: root movement relative to the occlusal plane.

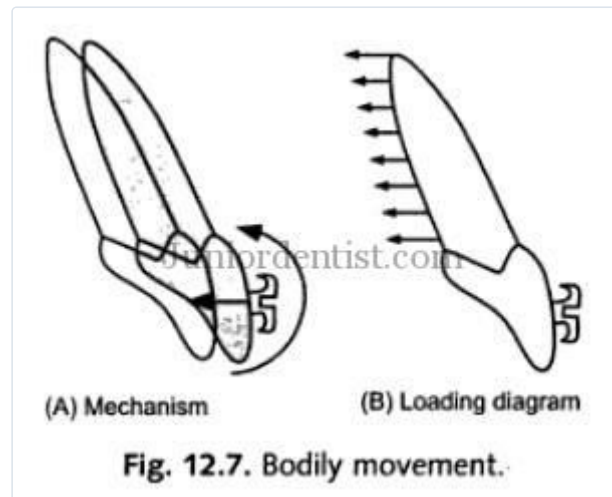


Fig. 11 — Bodily movement: mechanism (A) and loading diagram (B).

Table 8 — Optimum forces for orthodontic tooth movement

Type of movement	Force (g)
Tipping	35–60
Bodily movement (translation)	70–120
Root uprighting (torque)	50–100
Rotation	35–60
Extrusion	35–60
Intrusion	10–20

★ EXAM PEARL

Anchor the table on the two extremes: **intrusion is the lightest force (10–20 g)** and **bodily movement the heaviest (70–120 g)**. Tipping, rotation and extrusion all share **35–60 g** — one number covers three movements.

§8 Removable orthodontic appliances

• Four components:

- Active component — spring · screw · elastics
- Retainer — Adams clasp · long labial bow
- Anchorage
- Base plate

MNEMONIC

A R A B — Active component · Retainer · Anchorage · Base plate. The lecture bolds these initials for exactly this reason.

Table 9 — Removable appliances: advantages vs disadvantages

Advantages	Disadvantages
Removable for social function · suitable for simple malocclusion · smaller anchorage requirement · uncompromised oral hygiene · short chair-side time · ease of adjustment · require less training for management	Dependent on patient compliance · less precise control of tooth movement · unable to perform complex tooth movement · difficult to control space closure · fewer tooth movements · more difficult to correct rotation · affect speech · retention poor in the lower arch · prone to breakage and loss

8.1 Wire components

- **Labial bow:** ★0.7 mm wire · extends canine to canine · repairs minor overjet · post-treatment retainer · flexibility depends on the vertical height of the loop
- **Long labial bow:** ★0.7 mm wire · extends between contralateral **first premolars** · repairs minor overjet · retainer · closes space distal to the canine (between canine and premolar) · controls canine retraction
- **Double cantilever / Z spring:** ★0.5 mm wire · corrects retroclination of anterior teeth (**T spring** is the posterior equivalent) · must sit **perpendicular to the palatal surface** of the tooth

- **Canine retractor:** ★ **0.7 mm wire** · retracts the canine **palatally and distally** · the coil must be **distal to the long axis** of the tooth

CAUTION

A Z/T spring not perpendicular to the palatal surface delivers a vertical force component → unintended **intrusion or extrusion** of the tooth being pushed.



Fig. 12 — Labial bow, 0.7 mm, canine to canine.

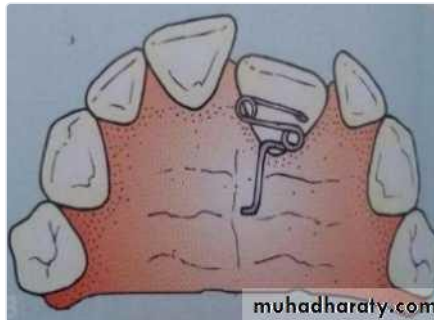


Fig. 13 — Double cantilever (Z) spring, 0.5 mm.



Fig. 14 — Canine retractor, 0.7 mm; coil distal to the long axis.

- **Disadvantages of labial bows:** not well tolerated by the patient · time consuming to fabricate · cannot be used in a **shallow sulcus**

★ EXAM PEARL

Wire gauge is a clean single-best-answer: **0.5 mm = Z/T spring** (the only active spring on this list) · **0.7 mm = labial bow, long labial bow and canine retractor**.

§9 Functional appliances

- **Herbst:** the ★ **only fixed functional appliance** · brings the lower jaw forward without surgery
- **Twin Block:** brings the lower jaw forward · two occlusal blocks (A and B) + bow + crib
- **Fränkel:** the ★ **only completely tissue-borne appliance** · expensive and difficult to use · four types
 - **Type 1** → Class II division 1 · **Type 2** → Class II division 2
 - **Type 3** → Class III · **Type 4** → open bite and bilateral maxillary protrusion
- **Medium opening activator:** one piece · corrects **deep bite**
- **Bionator:** holds the cheeks out of contact with the teeth · helps in **arch expansion**

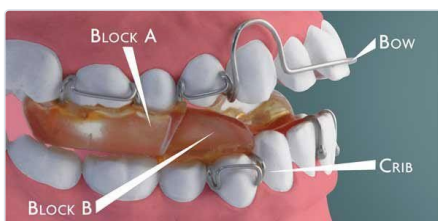


Fig. 15 — Twin Block: blocks A and B, labial bow, crib.



Fig. 16 — Herbst: the only fixed functional appliance.



Fig. 17 — Fränkel: completely tissue-borne.

9.1 Mode of action

- **Skeletal changes — 25%**
 - Promotes postural mandibular growth by ★ **1–2 mm per month**
 - If no change after ★ **3 months** → switch to fixed orthodontic treatment
 - Promotes a forward position of the **glenoid fossa**
 - ↑ lower anterior facial height (LAFH)
- **Dentoalveolar changes — 75%**
 - Upper anteriors tip **palatally** · lower anteriors tip **labially**
 - Upper molars → **distal** movement + **intrusion**
 - Lower molars → **mesial** movement + **extrusion**

KEY POINTS

Functional appliance effect is mostly **dental, not skeletal**: 75% dentoalveolar vs 25% skeletal. The molar changes are mirror images — **upper distal + intrudes, lower mesial + extrudes** — which is how the Class II molar relationship is corrected.

★ EXAM PEARL

Three "only" facts are prime single-best-answer material: **Herbst = the only fixed functional** · **Fränkel = the only completely tissue-borne** · and the **3-month no-response rule** for abandoning functional therapy.