

DIPLOMA OF PRIMARY CARE
DENTISTRY

-RCSI-

PART – 1

CLINICAL SKILLS

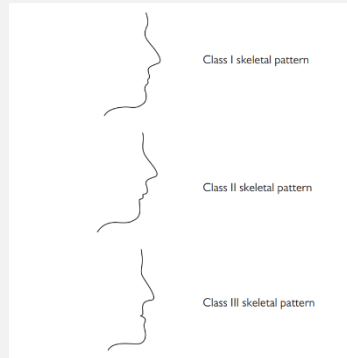
PART 5 : ORTHODONTICS RELEVANT
TO PRIMARY DENTAL CARE

✂ ORTHODONTICS:

- ◇ Orthodontics has been defined as that branch of dentistry concerned with growth of the face, development of the dentition, and prevention and correction of occlusal anomalies.
- ◇ Malocclusion is not a disease—it is variation from ideal occlusion.

- ◇ Prevalence of malocclusion:

- ✧ Crowding ~60%
- ✧ Class I 60%
- ✧ Class II/ 1 20%
- ✧ Class II/2 10–18%
- ✧ Class III ~5%



✧ When should we do orthodontics?

- Most orthodontic treatment is not started until the early 2° dentition, when the canines and premolars have erupted.
- At this stage, the response to orthodontic forces is more rapid, appliances are better tolerated, and, most importantly, growth can be utilized to help effect sagittal or vertical change.
- However, there is some evidence that protraction facemask therapy for Class III malocclusions achieves more skeletal change around age 8–9yrs than in older children.
- In adults, lack of growth, increase risk of periodontal disease, worn, damaged, and missing teeth, and slower tooth movement will limit the type of malocclusion that can be managed by orthodontics alone.

✧ What to refer and when:

Primary dentition

- Cleft lip and/or palate (if patient not under the care of a cleft team).
- Other craniofacial anomalies (if patient not under the care of a multidisciplinary team).

Early mixed dentition

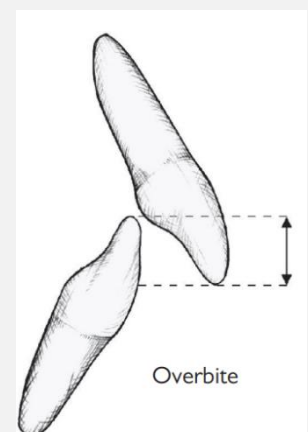
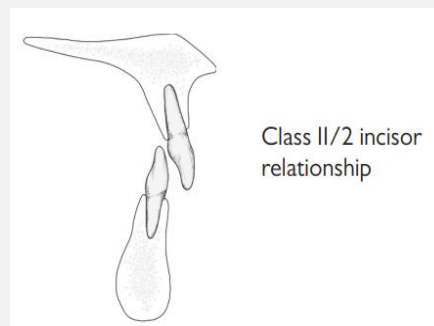
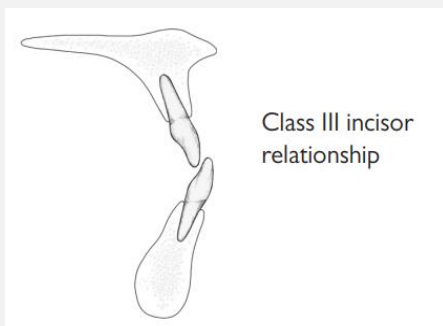
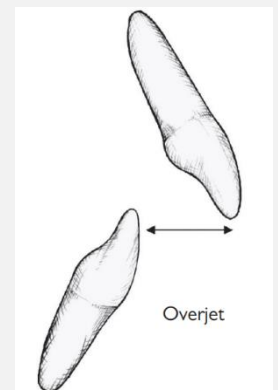
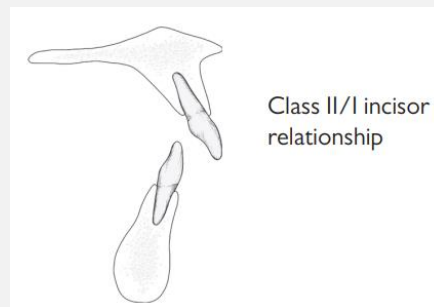
- Delayed eruption of the permanent incisors.
- Impaction or failure of eruption of the 6s.
- 6s of poor long-term prognosis.
- Severe Class III skeletal problems suitable for orthopaedic Rx with protraction facemask.
- Anterior crossbites (Xbites) which compromise periodontal support.
- Ectopic maxillary canines.
- Patients with medical problems where monitoring of the occlusion would be beneficial.
- Pathology, e.g. cysts.

Late mixed dentition

- Growth modification of skeletal Class II malocclusions.
- Hypodontia.
- Most routine problems.

☀ Definitions:

- ☞ Ideal occlusion: Anatomically perfect arrangement of the teeth. Rare.
- ☞ Normal occlusion: Acceptable variation from ideal occlusion.
- ☞ Competent lips: Lips meet with minimal or no muscle activity.
- ☞ Incompetent lips: Evident muscle activity is required for lips to meet.
- ☞ Frankfort plane: Line joining porion (superior aspect of external auditory meatus) with orbitale (lowermost point of bony orbit).
- ☞ Class I: The lower incisor edges occlude with, or lie immediately below, the cingulum of upper incisors.
- ☞ Class II: The lower incisor edges lie posterior to the cingulum of the upper incisors.
- ☞ Division 1: the upper central incisors are upright or proclined and the o/j is increased.
- ☞ Division 2: the upper central incisors are retroclined and the o/j is usually d but may be increased.
- ☞ Class III: The lower incisor edges lie anterior to the cingulum of the upper incisors and the o/j is d or reversed.
- ☞ Bimaxillary proclination: Both upper and lower incisors are proclined.
- ☞ Overjet: Distance between the upper and lower incisors in the horizontal plane.
- ☞ Overbite: Overlap of the incisors in the vertical plane.
- ☞ Crossbite: A deviation from the normal bucco-lingual relationship. May be anterior/posterior &/or unilateral/bilateral.



✿ Diagnostic records:

1. Radiographs:

- ✧ Usually a DPT is taken and, if not clearly visible on the DPT, an intraoral of the inc.
- ✧ **A lateral skull view** is indicated if the patient has a skeletal discrepancy or AP movement of the incisors is anticipated.
- ✧ Look for unerupted, missing, displaced, supernumerary teeth, or other pathology. Check root morphology looking for blunt or pipette-shaped roots.
- ✧ **Cephalometric analysis.**
- ✧ **An upper standard occlusal** may be used in the parallax technique for identifying the position of impacted canines.

2. Study models: Study models should be trimmed so that they occlude correctly on a flat surface. Digital study models are becoming more popular as they are easier to store.

3. Photographs:

- ✧ Good-quality EO and IO colour photos.

✚ The Index of Orthodontic Treatment Need (The IOTN):

Box 4.1 The Index of Orthodontic Treatment Need

Grade 1 (none)

- 1 Extremely minor malocclusions including displacements less than 1mm.

Grade 2 (little need for treatment)

- 2a Increased overjet 3.6–6mm with competent lips.
- 2b Reverse overjet 0.1–1mm.
- 2c Anterior or posterior crossbite with up to 1mm discrepancy between retruded contact position and intercuspal position.
- 2d Displacement of teeth 1.1–2mm.
- 2e Anterior or posterior openbite 1.1–2mm.
- 2f Increased overbite 3.5mm or more, without gingival contact.
- 2g Pre-normal or post-normal occlusions with no other anomalies. Includes up to half a unit discrepancy.

Grade 3 (borderline treatment need)

- 3a Increased overjet $3.5\text{mm} \leq 6\text{mm}$ with incompetent lips.
- 3b Reverse overjet $1\text{mm} \leq 3.5\text{mm}$.
- 3c Anterior or posterior crossbites with $1\text{mm} \leq 2\text{mm}$ discrepancy between retruded contact position and intercuspal position.
- 3d Contact point displacements $2\text{mm} \leq 4\text{mm}$.
- 3e Lateral or anterior open bite $2\text{mm} \leq 4\text{mm}$.
- 3f Deep overbite complete to gingival or palatal tissues but no trauma.

Grade 4 (need treatment)

- 4h Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for a prosthesis.
- 4a Increased overjet $6\text{mm} \leq 9\text{mm}$.
- 4b Reverse overjet $>3.5\text{mm}$ with no masticatory or speech difficulties.
- 4m Reverse overjet $1\text{mm} < 3.5\text{mm}$ with recorded masticatory and speech difficulties.
- 4c Anterior or posterior crossbites with greater than 2mm discrepancy between retruded contact position and intercuspatal position.
- 4l Posterior lingual crossbite with no functional occlusal contact in one or both buccal segments.
- 4d Severe contact point displacements $>4\text{mm}$.
- 4e Extreme lateral or anterior open bites $>6\text{mm}$.
- 4f Increased and complete overbite with gingival or palatal trauma.
- 4t Partially erupted teeth, tipped and impacted against adjacent teeth.
- 4x Presence of supernumerary teeth.

Grade 5 (need treatment)

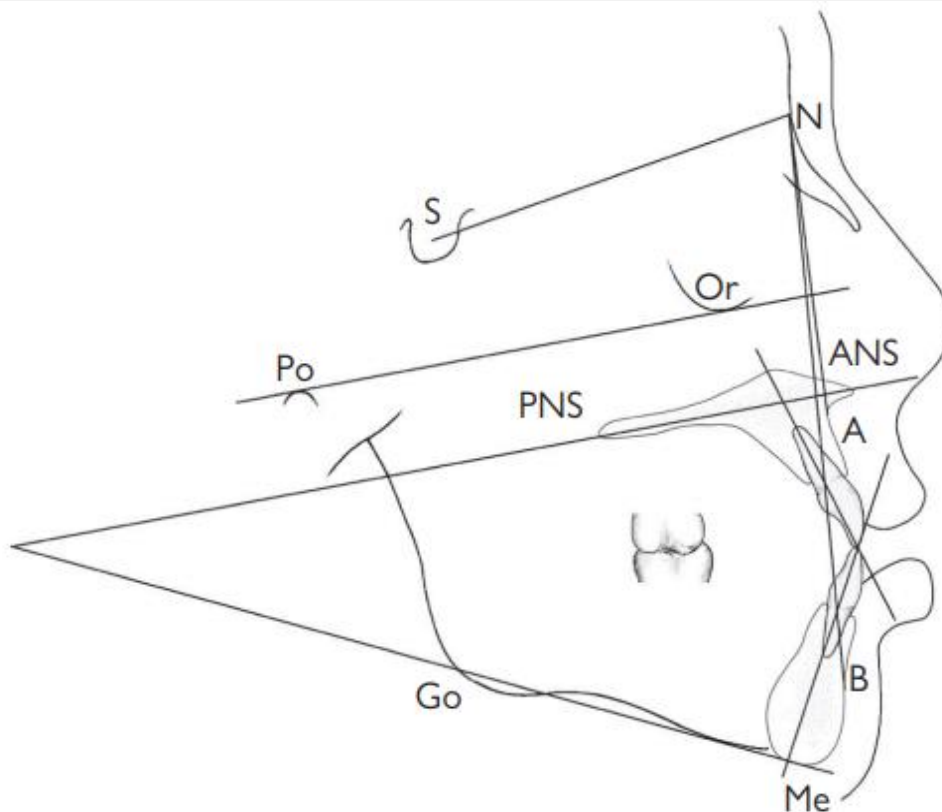
- 5i Impeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth or any pathological cause.
- 5h Extensive hypodontia with restorative implications (>1 tooth missing in any quadrant) requiring pre-restorative orthodontics.
- 5a Increased overjet $>9\text{mm}$.
- 5m Reverse overjet $>3.5\text{mm}$ with reported masticatory and speech difficulties.
- 5p Defects of cleft lip and palate and other craniofacial anomalies.
- 5s Submerged deciduous teeth.

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✿ Cephalometrics:

- ⌘ Cephalometric analysis is the interpretation of lateral skull radiographs.
- ⌘ They are taken in a cephalostat to standardize position and magnification (usually around 7–8%) so that they are reproducible.
- ⌘ Where AP movement is required, a lateral skull radiograph will back up the clinical assessment of skeletal pattern and help to determine the degree of difficulty. Serial lateral skulls aid assessment of growth.

→ **Most commonly used cephalometric points:**



- S = Sella: mid-point of sella turcica.
- N = Nasion: most anterior point on fronto-nasal suture.
- Or = Orbitale: most inferior anterior point on margin of orbit (take average of two images).
- Po = Porion: uppermost outermost point on bony external auditory meatus.
- ANS = Anterior nasal spine.
- PNS = Posterior nasal spine.
- Go = Gonion: most posterior inferior point on angle of mandible.
- Me = Menton: lowermost point on the mandibular symphysis.
- A = A point: position of deepest concavity on anterior profile of maxilla.
- B = B point: position of deepest concavity on anterior profile of mandibular symphysis.
- Frankfort plane = Po–Or.
- Maxillary plane = PNS–ANS.
- Mandibular plane = Go–Me.

Normal ranges, Analysis and interpretation:

Table 4.1 Analysis of lateral skull tracings (normal values for Caucasians (UK), standard deviations in parentheses)

SNA	= 81° (±3)
SNB	= 78° (±3)
ANB	= 3° (±2)
1–Max	= 109° (±6)
1–Mand	= 93° (±6) or 120 minus MMPA
MMPA	= 27° (±4)
Facial proportion	= 55% (±2)
Inter-incisal angle	= 135° (±10)

Extractions:

- In orthodontics, teeth are extracted to relieve crowding, level and align, and to provide space to compensate for a skeletal discrepancy.
- Before planning the extraction of any permanent teeth, a thorough orthodontic and radiographic examination should be carried out.
- In a Class I or II, it is advisable to extract at least as far forward in the upper arch as the lower; vice versa in a Class III.

⇒ **Lower incisors:**

- ◇ These are rarely the teeth of choice as it is difficult to arrange 6 ULS teeth around 5 LLS teeth. Indications: d prognosis or perio support, Class I buccal segments and LLS crowding, mild Class III with well aligned buccal segments.

⇒ **Upper incisors:**

- ◇ If traumatized or dilacerated, there may be no alternative.
- ◇ A peg-shaped 2 may be extracted if the contralateral 2 is absent.

⇒ **Lower canines:** Usually only extracted if severely displaced.

⇒ **Upper canines:** Buccally displaced maxillary canines are usually tracked not extracted.

⇒ **First premolars:**

- ◇ These are a popular choice in moderate to severe crowding because of their position in the arch.
- ◇ They also give best chance of spontaneous improvement especially if extracted just as the 3s are appearing, but if appliance therapy is planned, defer until the canines have erupted.

⇒ **Second premolars:**

- ◇ These are preferred in cases with mild crowding, as their extraction alters the anchorage balance, favouring space closure by forward movement of the molars.
- ◇ FAs are required, especially in the lower arch.
- ◇ If 5s are hypoplastic or missing there may be no choice.
- ◇ Early loss of an E will often lead to forward movement of the 6 and lack of space for 5s.
- ◇ In the upper arch this results in 5 being displaced palatally and provided 4 is in a satisfactory position, extraction of 5 on eruption is advisable.
- ◇ In the lower arch, 5s are usually crowded lingually.
- ◇ Extraction of lower 4 is easier and will give lower 5 space to upright spontaneously.

⇒ First permanent molars: Extraction of poor-quality first permanent molars.

⇒ Second permanent molars:

- ◇ Extraction of 7 will not alleviate incisor crowding but may relieve mild lower premolar crowding and avoid difficult extraction of impacted 8.
- ◇ To increase likelihood of 8 erupting successfully to replace 7, need: posterior crowding and 8 formed to bifurcation and at an angle of between 15° and 30° to long axis 6.
- ◇ Even so, may still require appliance therapy to align 8 on eruption.
- ◇ In the upper arch, extraction of 7 is often limited to facilitating distal movement of the upper buccal segments.

⇒ Third permanent molars:

- ◇ Early extraction of lower 8s is no longer advocated to prevent LLS crowding (as now thought to be due to late facial growth and soft tissue change).
- ◇ Space can also be provided in selected cases by:
 - ✓ Expansion (only in upper arch with a Xbite, otherwise not stable).
 - ✓ Distal movement of the upper buccal segments.
 - ✓ Reducing the width of the teeth interproximally (usually limited to LLS in selected cases).

Spacing:

⌘ Generalized spacing:

- This is due either to hypodontia or small teeth &/or large jaws.
- Note that hypodontia is associated with small teeth (% Hypodontia (oligodontia)).
- Treatment of spacing is problematic; a purely orthodontic approach is liable to relapse and requires prolonged retention.
- In milder cases, it may be wiser to build up the teeth if small or accept the spacing. In more severe cases, a combined restorative/orthodontic approach to localize space for the provision of prostheses or implants may be required.

⌘ Median diastema:

- Prevalence 6yr-olds = 98%, 11yr-olds = 49%, 12–18yr-olds = 7%.
- Aetiology: Small teeth in large jaws; absent or peg-shaped 2|2; midline; proclination of ULS; physiological (caused by pressure of developing teeth on upper incisor roots which reduces as 3 erupts), or due to a fraenum.
- The upper incisive fraenum is attached to the incisive papilla at birth.

- As 1|1 erupt the fraenum recedes, but this is less likely if the arch is spaced.
 - A fraenum contributes to a diastema in a small number of cases and is associated with the following features:
 - ◇ Blanching of incisive papilla when fraenum put under tension.
 - ◇ Radiographically there is a V-shaped notch in the interdental bone between 1|1 indicating the attachment of the fraenum.
 - ◇ Anterior teeth may be crowded.
- ⇒ **Management:** Take a periapical radiograph to exclude presence of a supernumerary:
- ✂ Before 3 erupted: if diastema 3mm—may need to approximate incisors to provide space for canines to erupt, but care is required not to resorb roots of 2|2 against crowns of 3|3. Requires FA and prolonged retention.
 - ✂ After 3 erupted: orthodontic closure will require prolonged retention as has high tendency to relapse. If fraenum an aetiological factor, consider doing a fraenectomy. There is no evidence to indicate whether this should be done before or during FA treatment.
 - ✂ Long-term retention still required. Alternatively, measure width of 1 and 2, and if they are narrower than average (1 = 8.5mm, 2 = 6.5mm) consider composite additions or veneers to close space. If teeth of normal width and no other orthodontic Rx required, you could try and talk the patient into accepting their diastema.

✂ Buccally displaced maxillary canines:

- ✓ 2 Width 3 > width 4 > width C.
- ✓ 3 is usually the last tooth to erupt anterior to 6.
- ✓ If the upper arch is crowded, 3 may be squeezed buccal to its normal position, in which case space needs to be created for its alignment.
- ✓ Usually 4 is the tooth of choice for extraction and, if so, this should be carried out just as 3 is about to erupt.
- ✓ If space is critical, an appliance should be fitted first.
- ✓ Where 2 and 4 are in contact, extraction of 4 alone will not provide sufficient space to accommodate 3 so consider extracting 3.
- ✓ Less commonly, 3 may develop well forward over the root of 2. In this case, orthodontic treatment to align 3 will be prolonged.
- ✓ If the arch is crowded, it may be simpler to extract 3 and align remaining teeth.
- ✓ If 3 has been extracted, there is a need to rotate 4 slightly mesio-palatally with a FA to hide the palatal cusp.

Palatally displaced maxillary canines:

- Early detection is essential.
- Width 3 > width 4 > width C.
- Prevalence: Up to 2%.
- Occurs bilaterally in 17–25% of cases.
- F > M. Aetiology In normal development, the maxillary canine develops palatal to C and then migrates labially to erupt down the distal aspect of the root of 2.
- **The aetiology** of palatal displacement is not fully understood, but some suggest a lack of guidance is the reason behind the association with missing or short-rooted 27 (~6% of palatal 3 associated with small 2).
- Others argue that it is an inherited polygenic trait and that the link with missing or short-rooted 2 is part of an association with other dental anomalies including microdontia and hypodontia.
- Others have noted that palatal displacement of 3 is evident radiographically as early as age 5 years.

Assessment:

- ⊘ Clinically by palpation and from inclination of 2; and by radiographs. A DPT and an IO view or two IO views with tube shift can be used to assess the position of the canine by parallax technique.
- ⊘ Consider also position and prognosis of adjacent teeth (including C), the malocclusion, and available space.

Management:

- ⊘ Early detection is key, therefore when examining **any child >9yrs**, palpate for unerupted 3.
- ⊘ If there is a definite hollow &/or asymmetry between sides, further investigation is warranted.
- ⊘ Interceptive extraction of C has long been advocated to facilitate an improvement of a displaced 3 but there is currently no robust evidence to support this approach.
- ⊘ Nevertheless most orthodontists continue provided:
 - χ The 3 is not too far displaced.
 - χ The pros and cons have been discussed with the patient and informed consent obtained.
 - χ The patient is willing to commit to exposure and alignment if the 3 does not erupt unaided.
 - χ Recent evidence has suggested the chances of success are i if space is created.

➔ Resorption:

- ⌚ Unerupted and impacted canines can cause resorption of incisor roots.
- ⌚ For this to occur, a 'head-on' collision between the two seems to be required.
- ⌚ If detected on a radiograph, a specialist opinion should be sought, quickly.
- ⌚ Extraction of the canine may be necessary to limit resorption, but if extensive, removal of the affected incisor may be preferable, thus allowing the canine to erupt.

✚ Management of increased overjet:

⇒ Class I or mild Class II skeletal pattern:

- The majority of patients in this category are managed using FA to retract the upper incisors.
- Extractions are often required to relieve crowding and provide space for o/j d.
- Anchorage requirements should be assessed and if required reinforced.
- If the skeletal pattern is more Class II then a functional appliance can be used for growth modification prior to FA.

⇒ Moderate to severe Class II skeletal pattern:

- Approaches available:

- Modification of growth**—either by restraint of maxillary growth with headgear, or by encouraging mandibular growth with a functional appliance.
- Orthodontic camouflage**—by extractions in upper arch and bodily movement of inc with FAs.
- Surgical correction.**

✚ Management of increased overbite:

- Approaches to reducing overbite:

⌘ Extrusion/eruption of molars:

- Passive eruption of lower molars occurs when a URA incorporating a bite plane is worn. Active extrusion of molars in either arch is possible using FAs.
- However, unless the patient grows vertically to accommodate this increase dimension, the molars will re-intrude under the forces of occlusion once appliances are withdrawn.
- This approach is of limited value in adults.

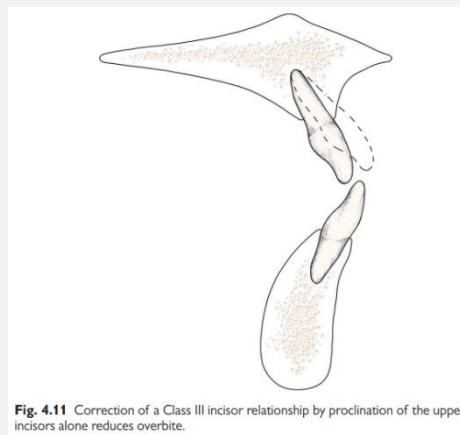
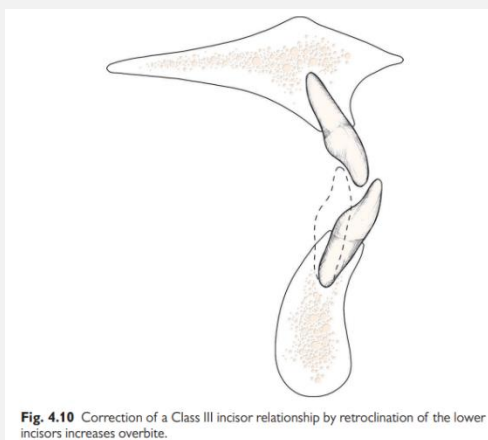
⌘ Intrusion of incisors: This is difficult, requires FAs, and in most cases the major effect is extrusion of the buccal segments. More successful in growing patients.

⌘ Proclination of lower incisors:

→ Movement of the lower incisors from their position of stability within the soft tissue envelope is unstable in most cases.

→ Active proclination should only be attempted by the experienced orthodontist, who will be better able to judge those cases where this is indicated.

⌘ Surgery: Indicated in severe cases especially if associated with AP skeletal discrepancy, and in adults.



✚ Crossbites:

a. Anterior crossbites:

- ✘ Anterior Xbites can be treated interceptively in mixed dentition if associated with a displacement, provided sufficient o/b exists to retain the result.
- ✘ If not, it is probably best to defer until the 2° dentition and use FAs.
- ✘ Upper lateral incisors that are displaced bodily will require buccal root torque for correction.

b. Posterior crossbites:

✘ Unilateral:

- χ Generally, the greater the number of teeth involved, the greater the skeletal contribution to the aetiology.
- χ If only one or two teeth in each arch are affected, movement of opposing teeth in opposite directions can be achieved by cross-elastics attached to attachments on the affected teeth.

- χ Unilateral Xbite from the canine region distally is usually associated with a displacement, as true skeletal asymmetry is rare.
- χ Treatment should be directed towards expanding the upper arch so that it fits around the lower, provided the upper teeth are not already buccally tilted.

× **Bilateral buccal crossbite:**

- ⦿ This suggests a greater underlying transverse skeletal discrepancy.
- ⦿ It is less commonly associated with displacement.
- ⦿ Correction of a bilateral Xbite should be approached with caution, because partial relapse may result in the teeth occluding cusp to cusp and development of a unilateral Xbite with displacement.

× **Bilateral lingual crossbite (or scissor bite):**

- ⦿ This occurs due to either a narrow mandible or a wide maxilla.
- ⦿ In milder cases, only 4|4 may be involved, and if these teeth are extracted to relieve crowding or for retraction of 3|3, so much the better.
- ⦿ Where the whole buccal segments are involved, treatment will probably involve expansion of the lower &/or contraction of the upper, therefore refer to a specialist.

⇒ **Rapid maxillary expansion:**

- This involves a screw appliance comprising bands attached to 64|46 and connected to a midline screw.
- The object is to expand the maxilla by opening the midline suture and is therefore more successful in younger patients.
- Large forces are required to accomplish this—the screw is turned 0.2mm twice a day for about 2 weeks.
- Over-expansion is necessary as the teeth relapse about 50% under soft tissue pressure.

⇒ **Quad helix appliance:**

- This is a very efficient fixed, slow expansion appliance.
- It is made of 1mm SS attached to bands on 6|6 and is W-shaped.
- Activated by expanding 1/2 tooth width per side before placement.

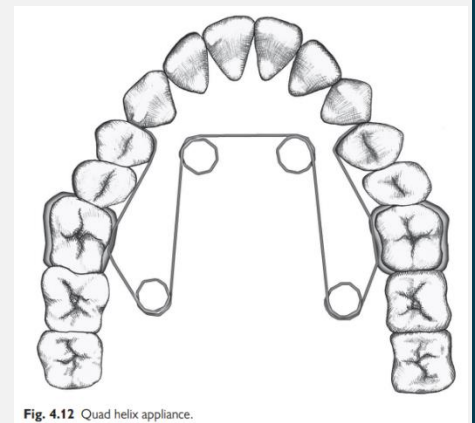


Fig. 4.12 Quad helix appliance.

✿ Removable appliances:

- ⌘ Removable appliances are single-arch appliances that can be taken out of the mouth by the patient.
- ⌘ They are only capable of tilting movements of individual teeth but can be used for moving blocks of teeth.
- ⌘ In addition, they can be used to allow differential eruption of teeth via bite planes or buccal capping.
- ⌘ Now used more as an adjunct to comprehensive FA Rx and **for retention** after FAs.

⇒ Indications:

a. **Active:**

- ⌚ Movement of blocks of teeth, like correction of a buccal Xbite by expansion of upper arch.
- ⌚ As an interceptive Rx in the mixed dentition, like correction of an upper incisor in Xbite.
- ⌚ o/b reduction.
- ⌚ In conjunction with other appliance, like to facilitate distal movement of upper molar(s) with headgear.
- ⌚ Elimination of occlusal interferences by addition of bite plane or buccal capping.
- ⌚ Useful for movement of a tooth over the bite during FA Rx.

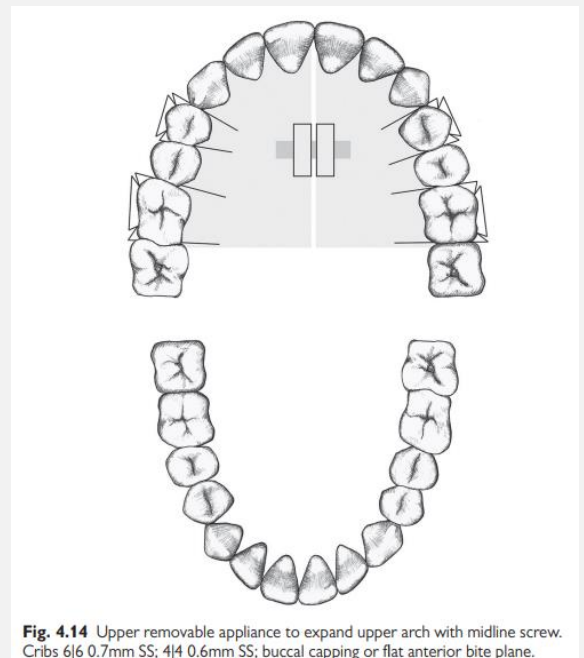


Fig. 4.14 Upper removable appliance to expand upper arch with midline screw. Cribbs 6|6 0.7mm SS; 4|4 0.6mm SS; buccal capping or flat anterior bite plane.

b. **Passive:**

- ⌚ Space maintainer, like following loss of an upper central incisor due to trauma.
- ⌚ Retaining appliance, like following FA Rx.
- ⌚ Habit deterrent.

⇒ Practical points:

a. Active components:

- ⌚ Springs (made in SS wire) are the most commonly used active component because they are versatile and cheap to construct.
- ⌚ Screws are useful when the teeth to be moved need to be clasped for retention.

b. Retention:

- ⊗ This is the means by which the appliance is retained in the mouth.
- ⊗ The best retention posteriorly is provided by the Adams crib, which is made in SS wire in either 0.7mm (for permanent molars) or 0.6mm (for premolars and 1° molars).
- ⊗ Anterior retention can be gained by a labial bow or a clasp—these components are usually constructed in 0.7mm wire.

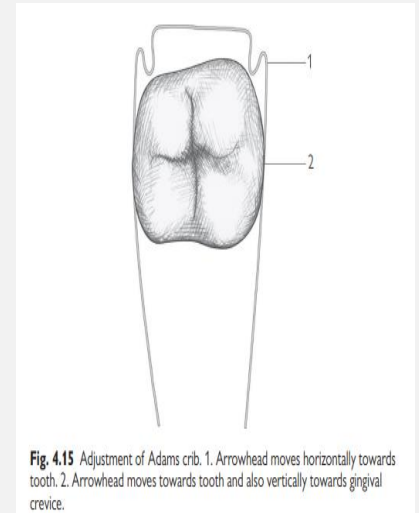


Fig. 4.15 Adjustment of Adams crib. 1. Arrowhead moves horizontally towards tooth. 2. Arrowhead moves towards tooth and also vertically towards gingival crevice.

c. Baseplate:

- ⊗ Holds other elements together and may also itself be active.
- ⊗ Heat-cure acrylic is more robust than self-cure.
- ⊗ A flat anterior bite plane will allow the lower molars to erupt and will if worn well result in o/b d.
- ⊗ Buccal capping frees the occlusion on the tooth being moved and allows further relative eruption of the incisors (therefore is C/I if o/b is already increased).

Fixed appliances:

- FAs should only be used in cooperative patients with good OH, to minimize damage to the teeth and their supporting tissues.
- FAs give precise 3-D control of tooth movement.
- They can be used to tilt, rotate, intrude, extrude, and move teeth bodily.

⇒ Principles:

- ☀ Treatment planning.
- ☀ Need particular attention to anchorage requirements, especially if apical movement is planned.
- ☀ As FAs are able to achieve bodily movement, it is possible (within limits) to move teeth to compensate for a skeletal discrepancy.
- ☀ FAs can be used in conjunction with other appliances &/or headgear.
- ☀ For initial alignment, flexible archwires are used, but to minimize unwanted movements, progressively more rigid archwires are necessary.
- ☀ Archwires should be based on the pre-Rx lower arch-form for stability.
- ☀ Mesio-distal movement is achieved either by: (i) sliding the teeth along the archwire with elastic force (sliding mechanics), or (ii) moving the teeth with the archwire.

✦ Components of fixed appliances:

1. Bands: are usually used on molar teeth.
 - ⊖ They are indicated for other teeth if bands fail or lingual attachment is required for de-rotation.
 - ⊖ If tooth contacts are tight, these will need to be separated prior to band placement using an elastic doughnut stretched around the contact point for 1–7 days.
 - ⊖ Use of GI cements help to decrease decalcification.
2. Bonds: are attached to enamel with (acid-etch) composite.
 - ⊖ There are two commonly used types: (i) metal (poor aesthetics) and (ii) ceramic (prone to # and can cause enamel wear).
 - ⊖ There is a wide variety of designs.
3. Archwires: Flexible nickel titanium archwires are used in the initial stages of treatment and more rigid SS wires used in the later stages for the planned tooth movements. Tungsten molybdenum and cobalt chromium alloys are also popular.
4. Auxiliaries: Elastic rings or wire ligatures are used to tie the archwire to the brackets. Forces can be applied to the teeth by auxiliary springs or elastics.

✦ Functional appliances:

- ⇒ **Functional appliances** utilize, eliminate, or guide the forces of muscle function, tooth eruption, and growth to correct a malocclusion.
- ⇒ **Functional appliances are ineffective for individual tooth movement.**
- ⇒ Indications:
 - ⊖ To achieve some AP correction for a Class II malocclusion prior to FA ± extractions.
 - ⊖ Ideally: Class II/1 with mandibular retrusion, average or reduced LFH, or upright or retroclined LLS.
 - ⊖ A useful test is to examine the profile with the patient postured forward to a
 - ⊖ Class I incisor relationship, and if not improved consider another appliance
 - ⊖ Can also use for Class II/2 but need to procline ULS, e.g. with sectional FAs.

⇒ Changes produced by functional appliances:

1. Skeletal:

- ∂ Research would suggest that changes seen are 25% skeletal and 75% dental.
- ∂ Optimizing of mandibular growth.
- ∂ The evidence would suggest that in the short term an extra 1–2mm mandibular growth results, however, in the long term that overall gain is small.
- ∂ Restraint of forward maxillary growth.
- ∂ Forward movement of the glenoid fossa.
- ∂ Increase LFH.

2. Dental:

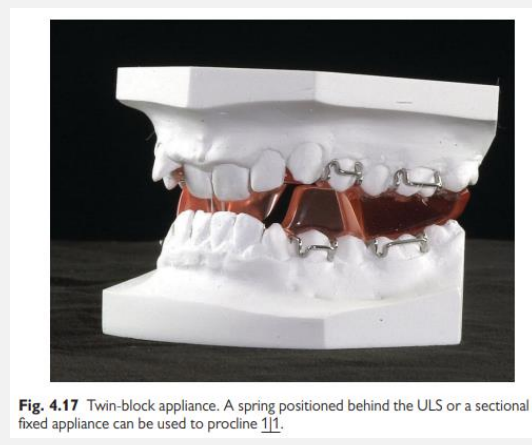
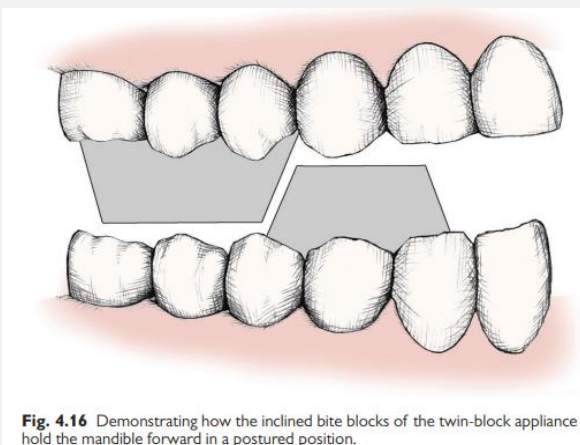
- ∂ Palatal tipping of the upper incisors.
- ∂ Labial tipping of the lower incisors (not a consistent finding).
- ∂ Inhibition of forward movement of the maxillary molars.
- ∂ Mesial and vertical eruption of the mandibular molars.

✚ Types of functional appliance and practical tips:

⇒ Choice of appliance: some of the more popular types include:

1. Twin block:

- ∅ This is the most commonly used design.
- ∅ It comprises separate upper and lower removable appliances which by means of sloping buccal blocks help to posture the mandible forward.
- ∅ Because they are individual upper and lower appliances and are retained by clasping the teeth, they are well tolerated by patients and can be worn for meals. In addition, a screw can be incorporated in the upper twin block if expansion is required, as well as springs (to procline ULS or align 2).
- ∅ Need a wax bite recorded with the mandible postured forwards 7–10mm so that blocks are >5mm height.



2. Medium opening activator (MOA):

- ⊖ This is useful in cases with d LFH as the design allows eruption of lower molars.
- ⊖ It is a one-piece functional therefore a preliminary phase of upper arch expansion prior to fitting the MOA is required in most patients to coordinate arch widths.
- ⊖ Must be made in heat-cure acrylic as extensions to lower arch are prone to fracture. Worn full-time except during eating.



3. Herbst:

- ⊖ This is a fixed functional appliance.
- ⊖ It comprises metal cast splints cemented onto the buccal segment teeth which are connected by metal arms in a piston arrangement which hold the mandible forward.
- ⊖ Achieves rapid AP correction.
- ⊖ Expensive to make.



✱ Cleft lip and palate:

➔ Prevalence:

- ∂ CLP varies with racial group and geographically.
- ∂ Occurs in ~1:1000 Caucasian births, but prevalence high M > F.
- ∂ If unilateral L > R.
- ∂ Family history in 40% of cases.
- ∂ Isolated cleft palate occurs in 1:2000 births.
- ∂ F > M. Family history in 20%.

➔ Aetiology:

- ∂ Multifactorial with both genetic and environmental factors (including maternal smoking, alcohol, and phenytoin intake) involved.
- ∂ Can occur in isolation or as part of a syndrome.

➔ Classification:

- ∂ Many exist, but the best approach is to describe cleft: 1° &/or 2° palate; complete or incomplete; unilateral or bilateral.
- ∂ Submucous cleft of the palate is often missed until poor speech noticed, as overlying mucosa is intact.

➔ Management (of unilateral complete CLP):

- Team usually includes cleft surgeon, ear, nose, and throat (ENT) surgeon, health visitors, orthodontist, speech therapist, clinical psychologist, and central coordinator.

a. Prenatally/birth:

- Parents need explanation, reassurance, and help with feeding.
- Pre-surgical orthopaedics is now out of vogue as benefits are not proven.

b. Lip closure:

- Usually between 3 and 6 months of age.
- Delaire or Millard &/ or modifications are the most popular.
- Some surgeons do a Vomer flap at same time. Bilateral lips are closed in either one or two operations.

c. Palatal closure:

- Usually between 9 and 12 months.
- Delaire or Von Langenbeck ± modifications are the most popular.
- Deferring repair until patient is older & growth disturbance, but speech development is adversely affected.

d. Primary dentition:

- Speech and hearing assessments.
- Establishment of good dental care.

e. Mixed dentition:

- In most cases any orthodontic Rx is better deferred until just prior to 2° bone grafting at **8–10yrs.**

f. Alveolar bone graft:

- If an alveolar cleft is present, then this should be grafted when the canine root is half to two-thirds formed (around age 8½ to 10½yrs) with cancellous bone.

- Advantages:

- ✱ Provides bone for 3 to erupt through.
- ✱ Allows tooth movement into cleft site, may avoid prosthesis.
- ✱ Increase bony support for alar base.
- ✱ Aids closure of oro-nasal fistulae.
- ✱ Also helps to stabilize mobile premaxillary segment in bilateral cases.

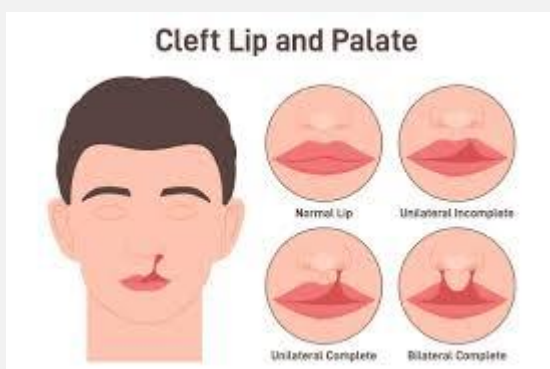
- ⇒ To aid surgical access and improve outcome, usually need to expand collapsed arches and align the upper incisors prior to grafting.
- ⇒ FAs are usually used, and care is required not to move roots of adjacent teeth into cleft.
- ⇒ Bone usually harvested from the iliac crest.

g. Permanent dentition:

- Because of the restraining effects of 1° surgery upon facial growth, cleft patients often have a Class III malocclusion.
- If this is not significant (and/or patient doesn't want orthognathic surgery) then definitive Rx for alignment and space closure with FA can be carried out.
- Ideally, if 2 missing, treatment should aim to bring 3 forward to replace it, thus avoiding a prosthesis.

h. Late teens:

- If orthognathic surgery is indicated, then this should be deferred until active growth has slowed to adult levels.
- Pre-surgical orthodontic alignment with FAs will be required.
- If nasal revision surgery is planned, then this should be carried out after bony surgery.



The End