



Principles of Cross-bite Treatment

Columbia University School of Dental and Oral Surgery

Ulku Z. Ersoy DDS, DMSc; Dr. Gliedman

June 8th, 2004



Overview

Definition

Prevalence

Etiology

**Rationale for Early Interceptive Treatment
and Sequelae of Untreated Crossbites**

Diagnosis

Treatment



What is cross-bite?

- Deviations from ideal occlusion in the transverse plane of space in the posterior and/or in the sagittal plane of space in the anterior

Further classification:



Anterior or

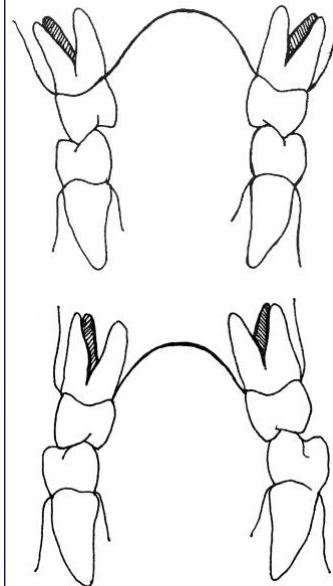
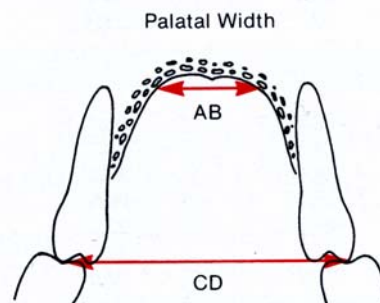
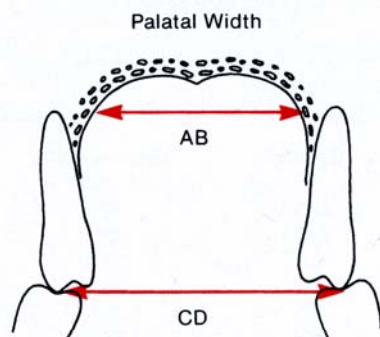


posterior

Single tooth or groups of teeth

Dental or skeletal

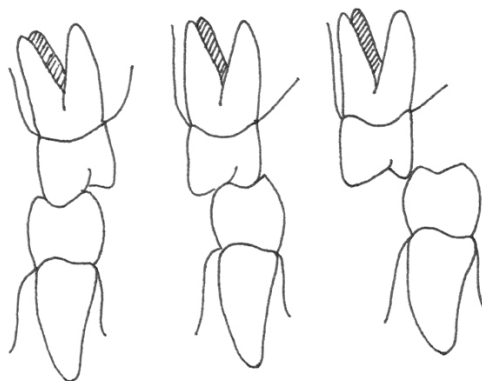
Unilateral or bilateral



What is cross-bite?

*Definition of American Association of
Ortodontists Glossary:*

**An abnormal relationship of a tooth or teeth
to the opposing teeth, in which normal
buccolingual or labiolingual relationships
are reversed**

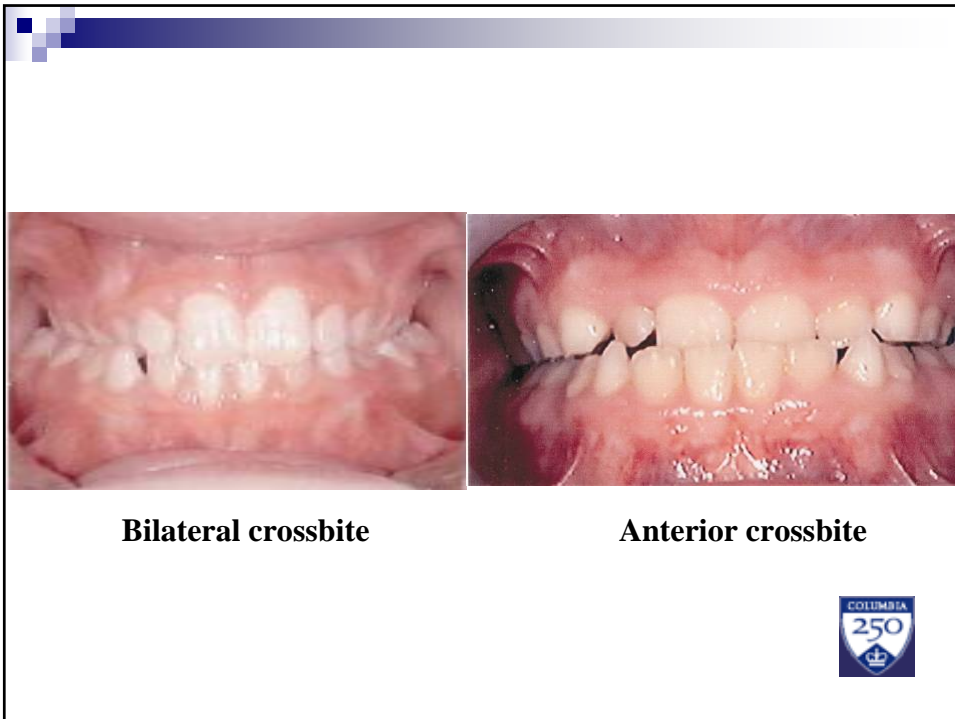


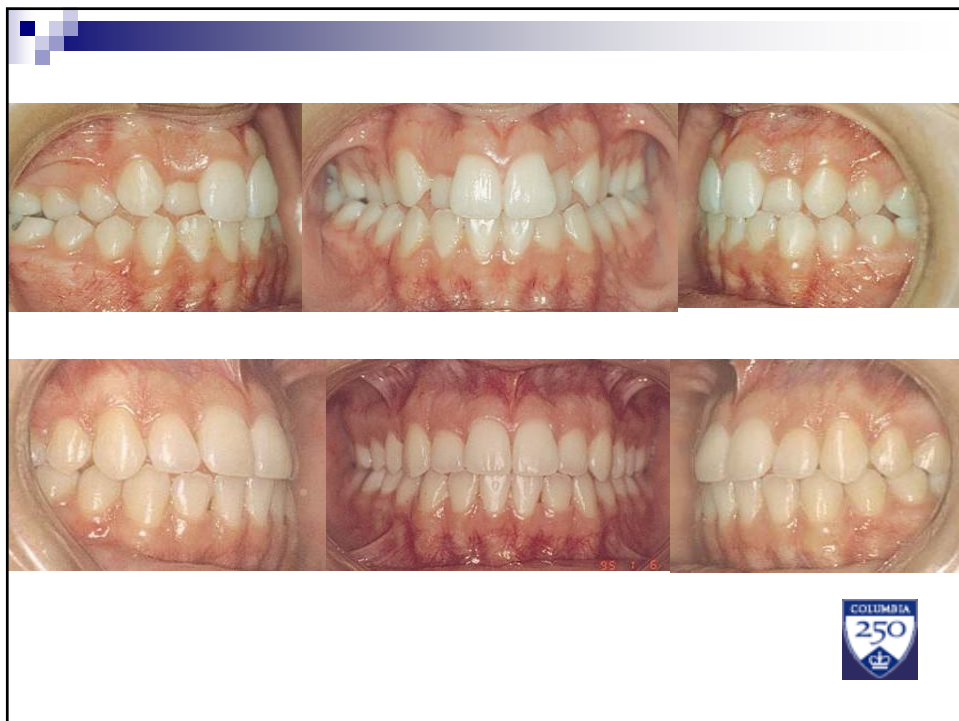
Crossbite

Normal

Telescopic or Scissors Bite





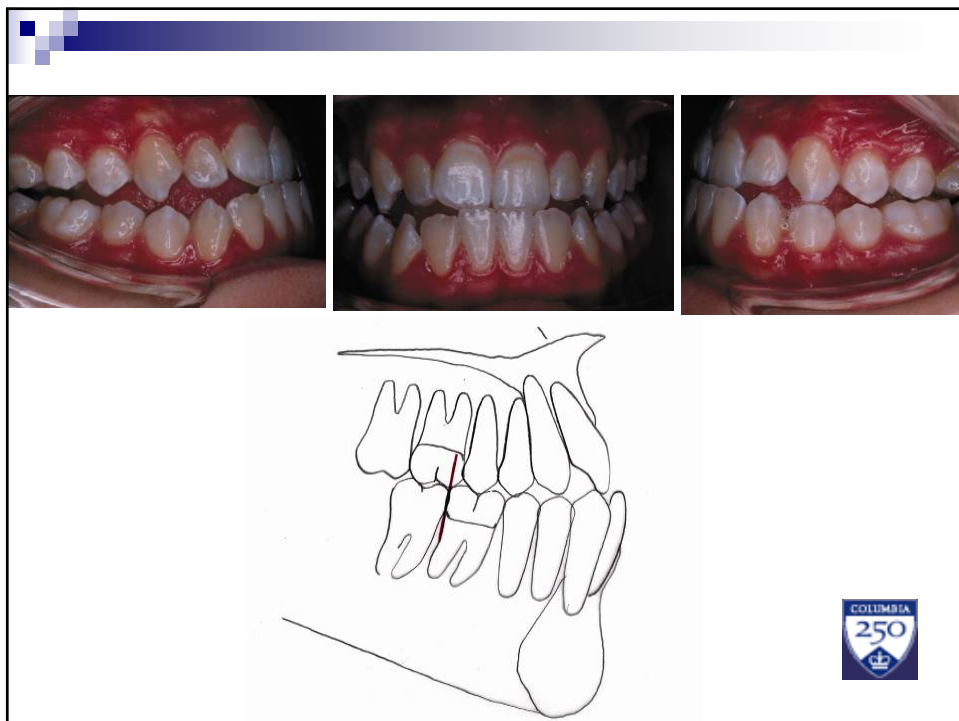


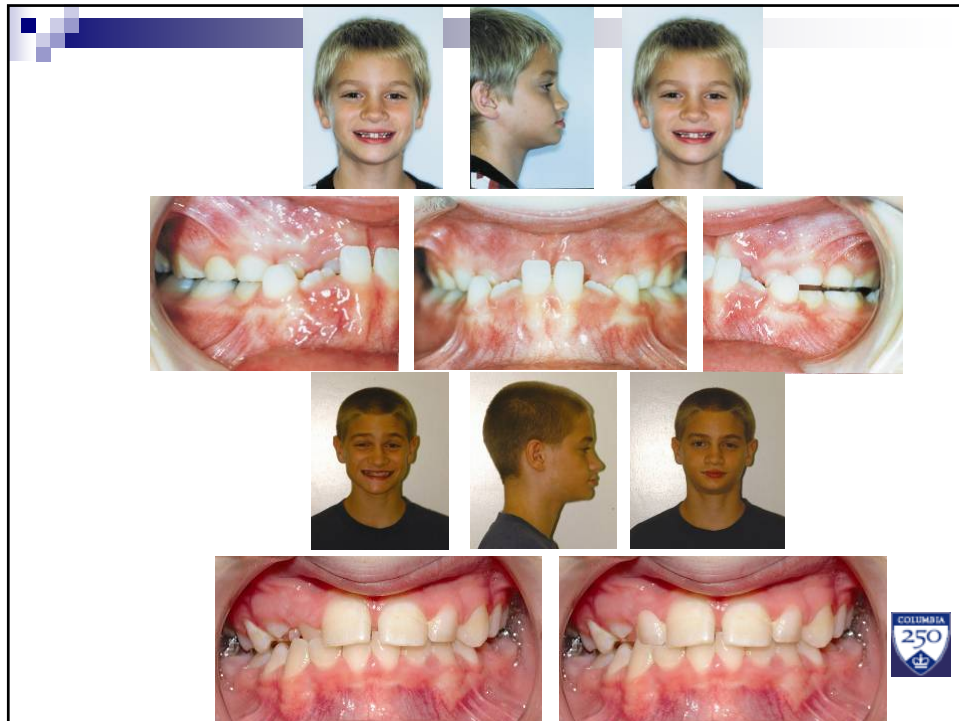


Functional Crossbite

is caused by an occlusal interference that requires the mandible to shift either anteriorly and/or laterally in order to achieve maximum occlusion.



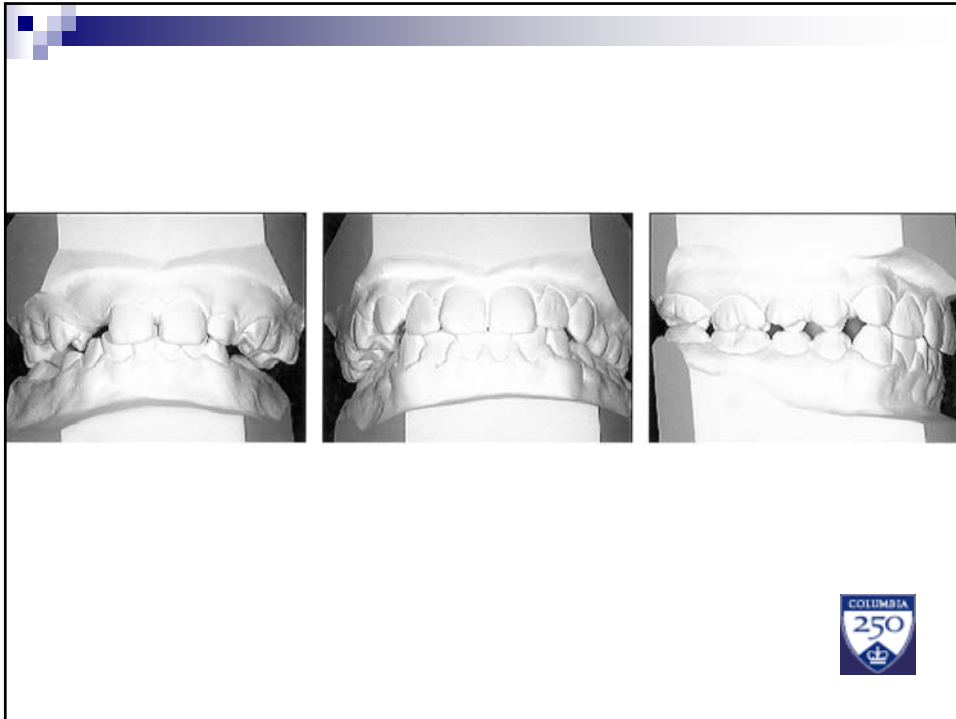




Buccal Crossbite

is due to the buccal displacement of the affected tooth or teeth as it relates to the antagonistic tooth or teeth in the posterior segments of the arch.





Lingual Crossbite

is due to the lingual displacement of the mandibular affected tooth or teeth as it relates to the antagonistic tooth or teeth.



Palatal Crossbite

is due to the palatal displacement of the maxillary affected tooth or teeth as it relates to the antagonistic tooth or teeth.



Complete Crossbite

is found when all teeth in one arch are positioned either inside or outside to the all teeth in the opposing arch.



Complete Mandibular Buccal Crossbite

is present when all the mandibular teeth are buccally positioned to all the maxillary teeth if the mandibular arch is wide and a complete maxillary buccal crossbite when the maxillary dental is wide.



Complete Mandibular Buccal Crossbite

is present when all the mandibular teeth are lingually positioned to the maxillary teeth due to a narrower mandibular arch than the maxillary arch.

Complete Maxillary Palatal Crossbite

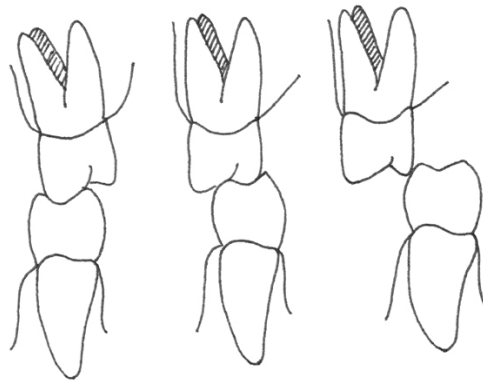
is present when all the maxillary teeth are palatal to the mandibular arch due to the narrower maxillary arch. Both could be referred as a *scissors bite*.



Scissors-bite

is present when one or more of the adjacent posterior teeth are either positioned completely buccally or lingually to the antagonistic teeth and exhibit a vertical overlap.





Crossbite

Normal

Telescopic or Scissors Bite



Centric occlusion

A static reproducible position of the mandible in which there is maximal contact of the inclined planes of the opposing teeth with balanced, unstrained relationship in the temporomandibular articulation.



Centric Relation (CR)

A gnathologic term, signifying optimal condyle-articular eminence–glenoid fossa relationships, determined by muscle balance and not by tooth intercuspatation. Changing concepts no longer accept the most retruded, rear-most or hinge axis definition, originally derived from prosthetic articulators.

To the orthodontist, the condylar position can vary somewhat, but is generally recognized as high on the posterior surface of the articular eminence.

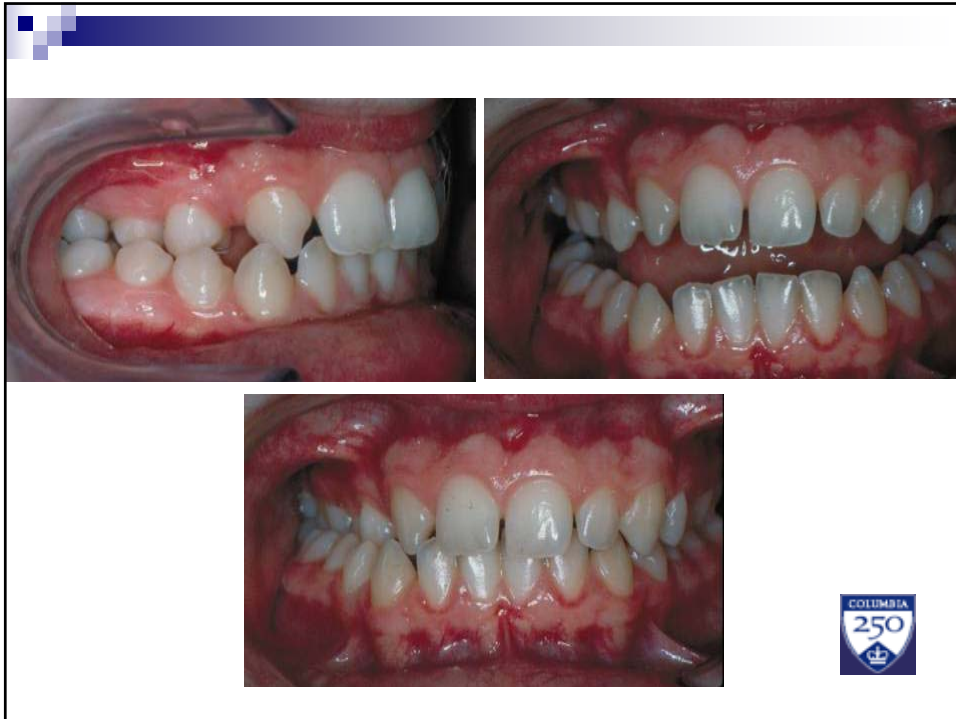
Lack of harmony of centric occlusion and centric relation status is particularly important in diagnosis of TMD problems.



Posterior Crossbite

One or more posterior teeth locked in an abnormal relation with the opposing teeth of the opposite arch; can be either buccal or a lingual cross-bite and may be accompanied by a shift of the mandible.





Anterior crossbite

A malocclusion in which one or more of the upper anterior teeth occlude lingually to the mandibular incisors; the lingual malpositions of one or more maxillary anterior teeth in relation to the mandibular anterior teeth when the teeth are in centric relation occlusion.



Centric Occlusion (CO)

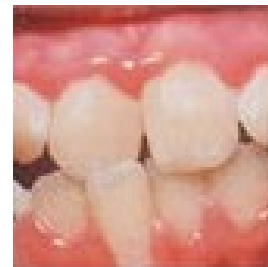
Mandibular position dictated by maximum and habitual intercuspation of the upper and the lower teeth; variously referred to as intercuspal position (IC), habitual centric, usual occlusion position. The condylar position may or may not be in harmony with centric relation (CR).

Because of this, the term habitual occlusion is preferable. Historically, a gnathologic and articulator oriented term.



Anterior Crossbite

- **Involves one or more incisors or canines**
- **Usually involves single tooth**
- **Either of dental or skeletal origin**
- **Pseudo-Class vs. true Class III**



Pseudo-Class III

- Class I skeletal relationship
- Insufficient maxillary overjet and incisor interference
- Multi-tooth anterior crossbite may result from a functional shift of the mandible in an effort to avoid anterior interference in centric relation and to achieve maximum intercuspation



Pseudo-Class III

- A pseudo-Class III due to a deficient maxilla in concert with a constriction of the palate



Posterior Crossbite

- May involve single tooth or multiple teeth
- Unilateral
 - True maxillary arch constriction
 - Functional crossbite
- Bilateral



Posterior Crossbite



Prevalence

- **Varies significantly from one ethnic group to another**
 - **Prevalence of posterior crossbite**
 - **Asians or Africans < Caucasians**
 - **Prevalence of Class III malocclusion**
 - **Asians > Africans or Caucasians**
 - **Anterior crossbite**
 - **in 10% of Japanese population**
 - **in 3% of US population**
- **Gender difference?**



Etiology

- **Skeletal, muscular or dental factors, or a combination of these factors**
- **Multi-factorial phenomena related to genetic, congenital, environmental, functional, or habitual origins**



Etiology

- **Class III skeletal relationship**
 - May present as anterior crossbite
- **Severe Class II skeletal relationship**
 - May present as posterior crossbite
- **Insufficient maxillary arch width may cause**
 - Unilateral posterior crossbite
 - Bilateral posterior crossbite



Etiology

- **Skeletal crossbites may be caused and/or influenced by habits and other localized deforming factors**
 - Stomach sleeping posture
 - Digit or pacifier sucking habits
 - Oral respiration
 - Low tongue position
 - Tongue thrusting



Etiology

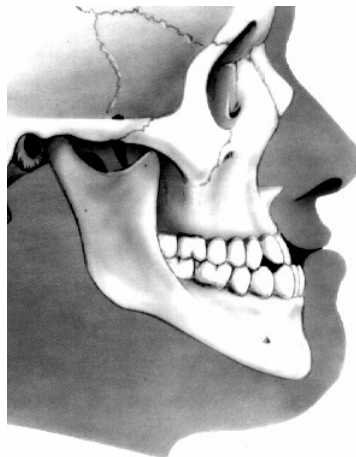
- **Pseudo-Class III**
may result from an
acquired muscular reflex
pattern during closure of
the mandible in an effort to
avoid incisor interference



Etiology

- **Inheritance of
Class III malocclusion**

**Hapsburg family
33/40 members with
prognathic mandibles**



Skeletal Crossbite

A malocclusion with maxillary posterior teeth occluding lingual to the mandibular due to malposition of the entire skeletal segments(s).



Etiology

- **The majority of anterior crossbites a single tooth or a few teeth and are caused by dental factors:**
 - **A congenitally-caused eruption pattern of the maxillary anteriors**
 - **Trauma to the primary dentition which leads to the displacement of the primary or permanent tooth bud**
 - **Trauma to permanent teeth that result in their being displaced by luxation**



■ **Delayed eruption of the primary dentition**

- ☐ **Supernumerary teeth**
- ☐ **An over-retained, necrotic, pulpless primary tooth or root**
- ☐ **A sclerosed bony or fibrous tissue barrier caused by premature loss of a primary tooth**
- ☐ **Biting of the upper lip**
- ☐ **A repaired cleft lip or palate**
- ☐ **Inadequate arch length**



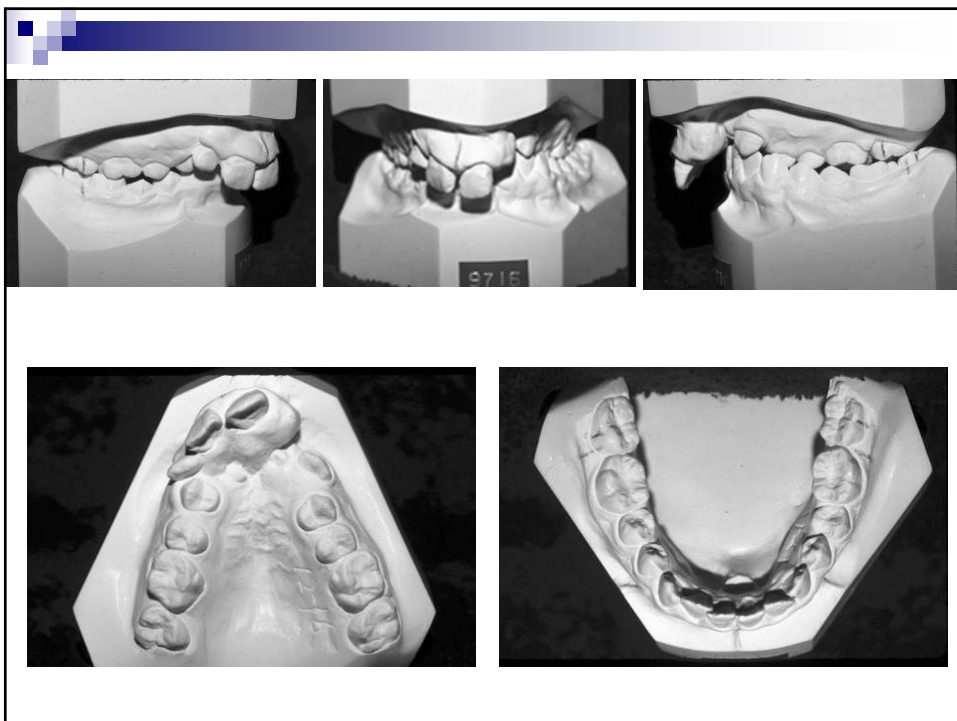
Etiology

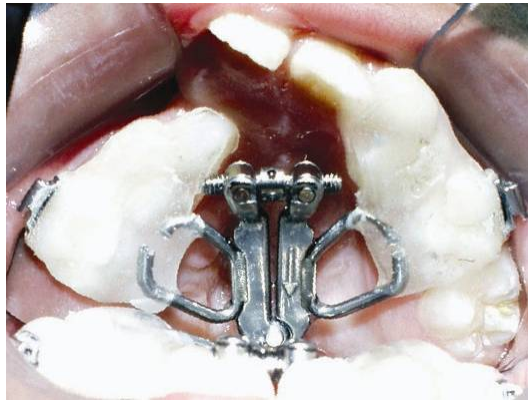
A crossbite may be associated with a pathological condition

- ☐ **A cleft palate patient may present both anterior and posterior crossbites with a narrow palate**
- ☐ **Arthritis, acromegaly, Duchenne's muscular dystrophy, condylar hyperplasia and osteochondroma**









Rationale for Early Interceptive Treatment

- **Little possibility for self-correction**
- **A crossbite in the primary dentition is believed to transfer to the permanent dentition.**
- **Postponing treatment results in prolonged treatment of greater complexity**



Rationale for Early Interceptive Treatment

- If left untreated, it can cause growth modifications and dental compensations
- May eventually lead to a permanent deviation and craniofacial asymmetry as well as potentially deleterious masticatory patterns
- Associated with an increase in condylar deviation and temporomandibular joint sounds



Rationale for Early Interceptive Treatment

- **Interference with growth of the middle third of the face**
- **Abnormal speech patterns**
- **Loss of arch integrity**
- **Periodontal disease**
- **Undesirable esthetics**
- **Root resorption of central incisors**



Diagnosis

- **Study models and PAN or a complete periapical series of radiographs**
- **If skeletal discrepancy suspected, a lateral cephalometric radiograph**
- **Taken in centric relation as skeletal changes that accompany growth can alter centric occlusion significantly**



Diagnosis: Anterior Crossbite

- **Differentiate: different treatment modes**
 - ☐ True Class III skeletal malocclusion
 - ☐ Pseudo-Class III malocclusion
 - ☐ Compensated Class III malocclusion
- **Determine etiology**
 - ☐ Dental?
 - ☐ Skeletal ?



Diagnosis: Posterior Crossbite

- **Same modes of treatment for posterior crossbites for both skeletal and dental etiologies**
- **Therefore, it is not as crucial to differentiate between the specific types of crossbites in posterior crossbites as in anterior crossbites**



Treatment of Anterior Crossbite

- Those that deliver rapid-heavy-intermittent forces
- Those that deliver slow-light-continuous forces
- Those that may correct skeletal problems in growing patients
- Those that may correct skeletal problems in adults



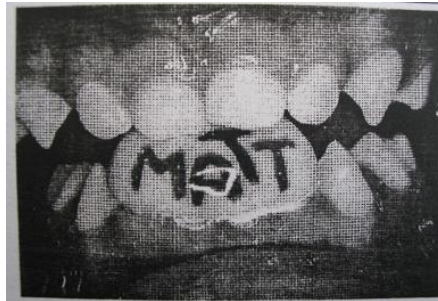
Those that deliver rapid-heavy-intermittent forces

- Fixed inclined bite planes
 - ☐ Constructed of acrylic
 - ☐ Placed onto the mandibular incisors
 - ☐ Treat linguallly locked maxillary incisors
 - ☐ Do not require patient compliance
 - ☐ May open the bite, create a temporary speech defect, or traumatize the dentition
 - ☐ No significant long-term side effects?



Those that deliver rapid-heavy-intermittent forces

- Fixed inclined bite planes



Those that deliver rapid-heavy-intermittent forces

- Tongue Blades
 - Usually employed as a follow up to treatment with inclined plane
 - Simplest but least successful approach
 - Works best if the bite is normal and the involved tooth is newly erupted



Those that deliver rapid-heavy-intermittent forces

■ Tongue Blades

- ☐ Patient is instructed to bite on the wood incline with a constant pressure and simultaneously exert a slight but constant pressure with his or her hand on the blade
- ☐ Must be done for one to two hours a day for a period of one to two weeks
- ☐ Highly unpredictable results because requires patient compliance



Those that deliver rapid-heavy-intermittent forces

■ Reversed stainless steel crowns

- ☐ Anterior stainless steel crowns cemented backwards on the maxillary teeth
- ☐ Stainless steel crown needs to open the bite 2 to 3 mm and establish at least a 25 percent overbite for successful treatment
- ☐ If they worsen or fail to treat the crossbite, add crown



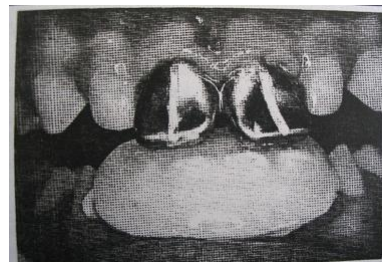
Those that deliver rapid-heavy-intermittent forces

- Reversed stainless steel crowns
- May be used in combination with an inclined bite plate
- Independent of patient compliance and easy to apply
- Reduced costs
- May appear unesthetic



Those that deliver rapid-heavy-intermittent forces

- Reversed stainless steel crowns



Those that deliver rapid-heavy-intermittent forces

■ Composite bonding

- ☐ Convenient - bond composite to the labial surface of the maxillary anterior tooth in crossbite
- ☐ Select a shade that is different from that of the tooth being treated
- ☐ Utilized to successfully correct single-tooth anterior crossbites



Those that deliver rapid-heavy-intermittent forces

■ Composite bonding

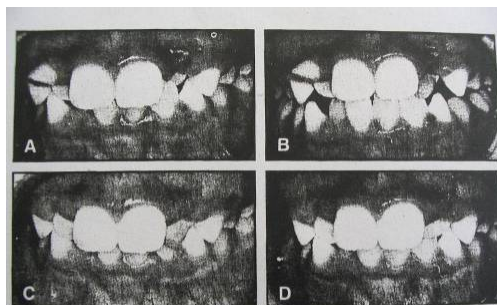


Fig. 1 A. 7-year-old female with maxillary left lateral incisor in crossbite. B. Composite bonded to labial surface of tooth to form inclined plane. C. Crossbite corrected in three weeks. D. Composite removed.



Those that deliver slow-light-continuous forces

- **Removable: Hawley retainer with auxiliary springs**
 - The most frequently used appliance for minor anterior crossbite treatment
 - Acrylic palatal coverage and wire clasps
 - The auxiliary or finger springs activated to exert labial forces on and move the maxillary incisors



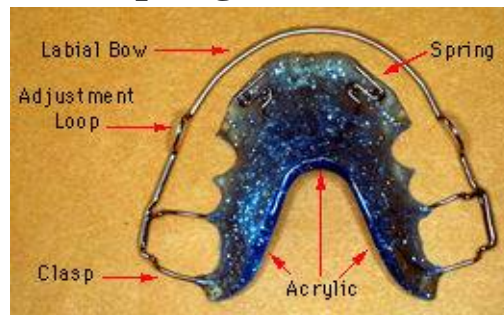
Those that deliver slow-light-continuous forces

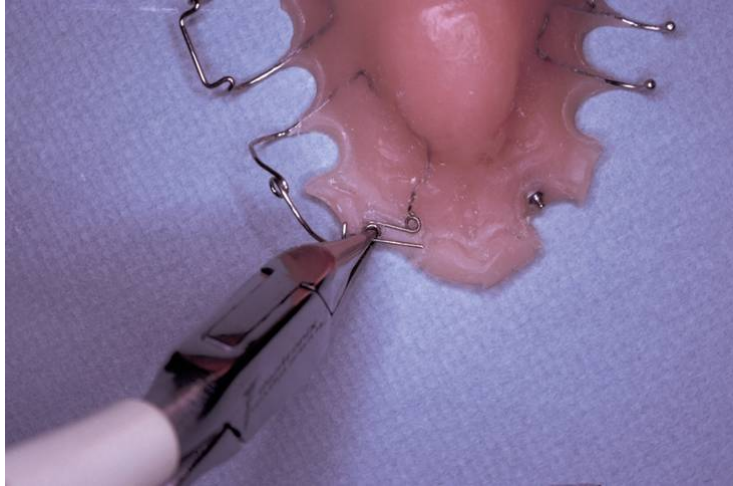
- **Removable: Hawley retainer with auxiliary springs**
 - The acrylic can be extended to create posterior bite plates to reduce the overbite and raise the bite.
 - Patient compliance is key to successful treatment.



Those that deliver slow-light-continuous forces

- **Removable: Hawley retainer with auxiliary springs**





Those that deliver slow-light-continuous forces

■ Fixed appliance

- ☐ **Light arch wire combined with maxillary lingual arch with auxilliary springs**
- ☐ **Indicated for a very young child or preadolescent with whom patient compliance is a concern**
- ☐ **Treats severely displaced incisors**
- ☐ **Should be over-corrected by at least 1-2 mm**
- ☐ **Distortion and breakage of the appliance and poor oral hygiene**



Those that deliver slow-light-continuous forces

- Fixed appliance



Those that may correct skeletal problems in growing patients

- **Functional regulator (FR-3) of Fränkel**
- **Chin cup appliance**
- **Protraction headgear with a palatal expansion appliance**



Those that may correct skeletal problems in growing patients

- **Functional regulator (FR-3) of Fränkel**
 - **Designed to activate muscle function to guide anterior growth of the maxilla and redirect growth of the mandible posteriorly**
 - **Must be worn at least 14 hours/day**
 - **Effectiveness in controversy**
 - **Not the ideal choice for treatment of skeletal Class III**



Those that may correct skeletal problems in growing patients

- **Functional regulator (FR-3) of Fränkel**



Those that may correct skeletal problems in growing patients

- **Chin cup appliance**

- ☐ Designed to reduce a prognathic mandible by redirecting the growth of the mandible downward and backward
- ☐ Shows mixed results



Those that may correct skeletal problems in growing patients

- Chin cup appliance

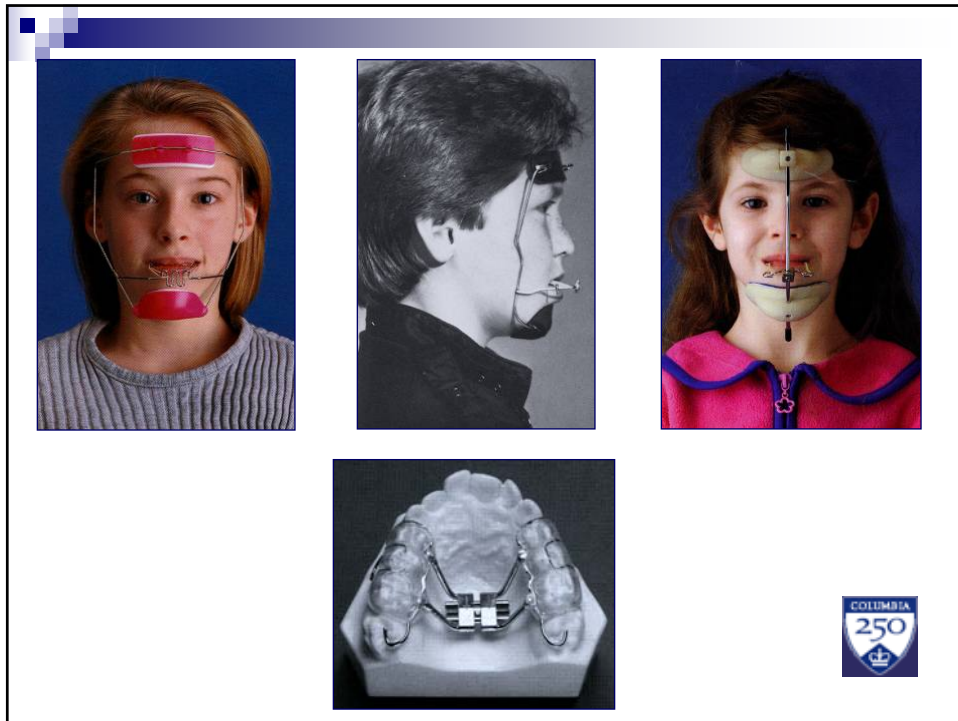


Those that may correct skeletal problems in growing patients

- Protraction headgear with a palatal expansion appliance

- An effective treatment method for maxillary deficiency and/or mandibular prognathism
- Anterior movement of the maxilla, downward and backward rotation of the mandible, increased lower facial height, and overall improvement of facial profile





Those that may correct skeletal problems in adults

- Comprehensive appliance therapy and/or surgical correction
- Ramus osteotomy, mandibular inferior border osteotomy, and/or LeFort I osteotomy
- Confirm completion of mandibular growth before taking surgical measures



Those that may correct skeletal problems in adults



Treatment of Posterior Crossbite

- Selective grinding of teeth
- Elastics
- Palatal expansion
 - Fixed rapid palatal expansion (RPE)
 - Fixed slow palatal expansion
 - Removable split plate



Selective grinding of teeth

- For slight maxillary constriction due to primary canine interferences
- Functional shift of the mandible eliminated and the mandible allowed to assume its natural position
- Usually contraindicated for permanent teeth

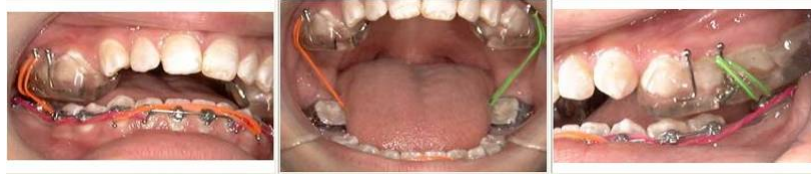


Elastics

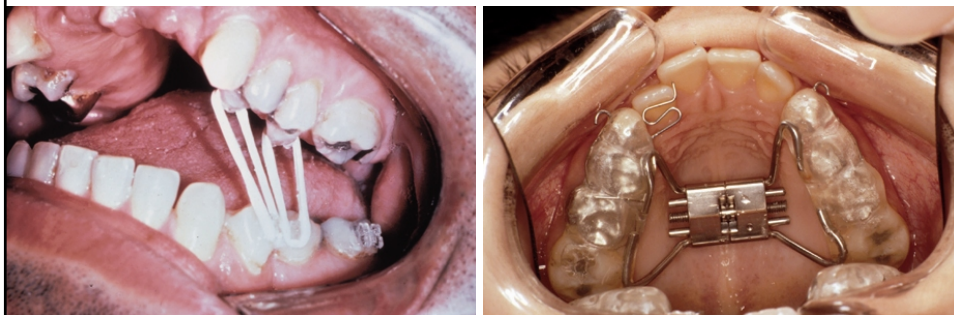
- When only few posterior teeth in crossbite and crossbite is caused by a mere tipping
- Use cross elastics if both arches contribute to the crossbite problem
- Overcorrect and leave the bands in place right after active treatment
- In case of relapse, reinstate the elastics
- The major problem - patient cooperation



Elastics



RPE-BP with crossbite elastics and first molar extraction space closing elastics.



Palatal expansion

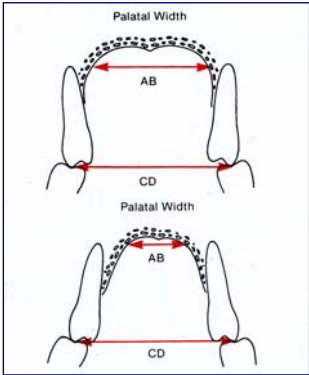
- Opening of the midpalatal suture is possible until about age 16 or 17 before the maxillary sutures fuse
- After fusion, the suture may be opened with a surgical assist and a fixed rapid palatal expander (RPE)




Fixed rapid palatal expansion (RPE)

- Hyrax type and Haas type
- Equal amounts of skeletal and dental changes
- Expansion rate of 0.2 mm to 0.5 mm/day - increase intermolar width up to 10 mm
- May worsen open bite conditions – contraindicated in patients with open bites or open bite tendencies.
- Other possible side effects - blurring of vision, dizziness, headaches, nosebleeds and pain in the zygoma







skeletal crossbite




Schwarz expansion appliance



Rapid Palatal Expander



Bonded Rapid Palatal Expander
3 mm thick



Haas Palatal Expander
10.5-11 mm buccal crossbite

Fixed rapid palatal expansion (RPE)



RPE (standard design):
The RPE (rapid palatal expander) is a fixed metal expander soldered to bands on the first molars and first bicusps with an .036 lingual wire connecting the bands.

It provides rapid expansion of the mid-palatal suture through daily activation of the expansion screw. 1/4 turn of the screw results in 1/4mm of expansion



Haas Expander:
A fixed maxillary expander that uses acrylic pads and heavy lingual wires to apply pressure to both the teeth and the palatal tissue during expansion.



Fixed slow palatal expansion

- Quad Helix and W arch
- Produce greater sutural stability and less relapse potential than rapid palatal expansion
- Relapse can be prevented by both overexpanding during the active treatment period and by prolonging the retention period
- 0.5 mm and 1.0 mm per week – increase intermolar width of up to 8 mm



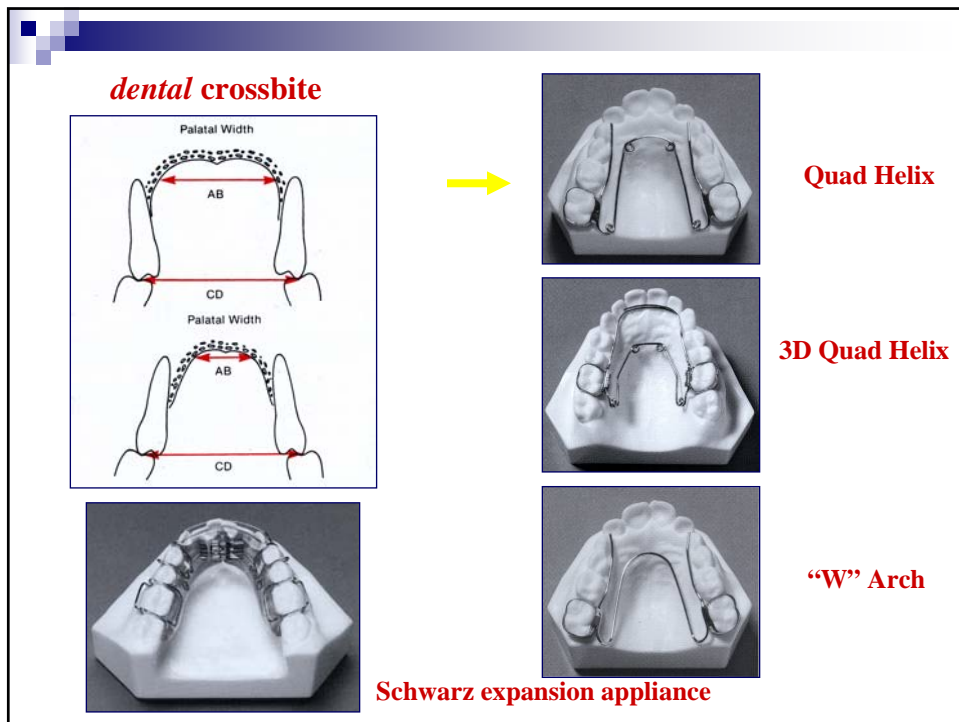
Fixed slow palatal expansion



Quad Helix:
This fixed metal expander (also available as a fixed/removable) is capable of applying forces in numerous directions depending upon how it is activated.

The four helical loops (two in the first bicuspid region and two in the second molar region) can be activated in unison or individually to achieve the desired results. The appliance is soldered to bands on the first molars and lingual arms run from the bands forward to the cuspids or first bicuspid as desired.





Removable split plate

- Facilitates oral hygiene
- Exerts a direct effect on both teeth and alveolar processes during the initial phase of treatment
- Not compatible with comprehensive treatment
- Should be used for the mixed dentition or adjunctive treatment only



Summary

Most facial asymmetries appear by age 7

“Bite Down Early” brochure outlines the six warning signs

- 1- overjet?
 - 2- deep bite?
 - 3- anterior / posterior crossbite?
 - 4- openbite?
 - 5- spacing / crowding?
 - 6- upper / lower midlines?
- growth-modification appliances
 - expansion
 - elimination of habits



Summary

Timing of treatment

Class I: tooth-size/arch-size discrepancy, 8-9 year old, L inc. and U centrals in
*serial extraction or
orthopedic expansion*

Class III: eruption of the upper permanent central inc.
earlier than Cl I
*orthopedic facial mask
chin cup
FR-3*



Thank you for your attention



ue2101@columbia.edu

