# CROSSBITE

*Crossbite* is a discrepancy in the buccolingual relationship of the upper and lower teeth. Under normal circumstances the maxillary arch overlaps the mandibular arch both labially and buccally. But when the mandibular teeth, single tooth or a segment of teeth, overlap the opposing maxillary teeth labially or buccally, a crossbite is said to exist.

## Classification of Crossbite

### Based on Etiological Structure

1. Dental crossbite.
2. Skeletal crossbite.
3. Functional crossbite.

### Based on Location

1. ***Anterior crossbite***
   - Single tooth crossbite (Instanding tooth).
   - Segmental crossbite.

2. ***Posterior crossbite***

   Posterior crossbites can also be further classified:

   *According to the number of teeth involved*
   - Single tooth crossbite.
   - Segmental crossbite.

   *According to the existence of the crossbite on one side or both sides of the arch*
   - Unilateral crossbite.
   - Bilateral crossbite.

   *According to the extent of the crossbite*
   - Buccal crossbite.
   - Lingual crossbite (scissor bite).

## DENTAL CROSSBITE

Crossbite which confined to the dentition is referred to as dental crossbite.

## SKELETAL CROSSBITE

It refers to a crossbite which is due to malposition or malformation of the jaws. Maxillary retrognathim, mandibular prognathism or a combination of both can result in skeletal crossbite, e.g. skeletal class III malocclusion.

## FUNCTIONAL CROSSBITE

Functional crossbites are usually caused due to the presence of occlusal interference leading to displacement of the mandible anteriorly or laterally to achieve maximum intercuspation.

Example; when there is an edge to edge incisors relationship in centric relation, the patient tends to habitually move the mandible forward, so as to achieve maximum intercuspation. This may lead to pseudo Class III malocclusion. If the patient moves the mandible laterally to achieve maximum intercuspation due to the presence of occlusal interference a unilateral posterior crossbite may appear.

## ANTERIOR CROSSBITE

It is a condition, where mandibular anterior teeth overlap the maxillary anteriors (reverse overjet). The condition is often due to lingual position of maxillary anterior teeth in relation to the mandibular anterior teeth.

It may be *single tooth crossbite* or *segmental anterior crossbite* depending on the number of teeth involved in crossbite. It may or may not be associated with forward displacement of the mandible.

## POSTERIOR CROSSBITE

It refers to a condition where there is an abnormal transverse relationship between upper and lower posterior teeth. It may be single tooth crossbite or segmental crossbite, unilateral or bilateral, buccal or lingual.

***Buccal crossbite:*** the buccal cusps of the lower posterior teeth occlude buccal to the buccal cusps of the upper teeth.

***Lingual crossbite:*** the buccal cusps of the lower teeth occlude lingual to the palatal cusps of the upper teeth. This is also known as a *scissors bite*.

## Posterior Crossbite Usually Seen As:

***Unilateral buccal crossbite with displacement:*** usually arises when the mandible displaced laterally due to the presence of deflecting contact either from a displaced tooth or because of narrowing of the maxilla which result in cusp-to-cusp relationship of posterior teeth in occlusion.

***Unilateral buccal crossbite without displacement:*** usually arises either due to displacement of tooth or due to underlying skeletal asymmetry of the arch when a greater number of teeth are involved.

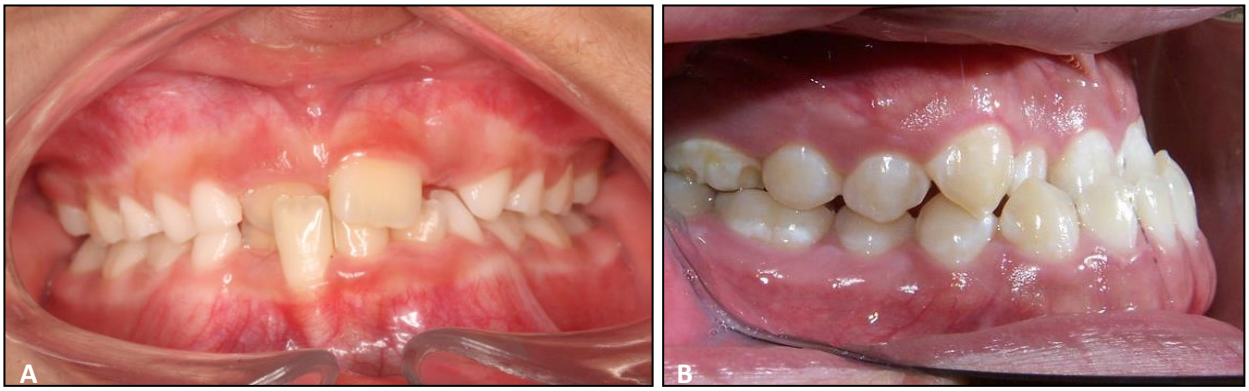
***Bilateral buccal crossbite:*** usually associated with skeletal discrepancy (Cl III).

***Unilateral lingual crossbite:*** usually due to displacement of teeth as a result of crowding.

***Bilateral lingual crossbite (scissors bite):*** usually associated with skeletal discrepancy (Cl II).



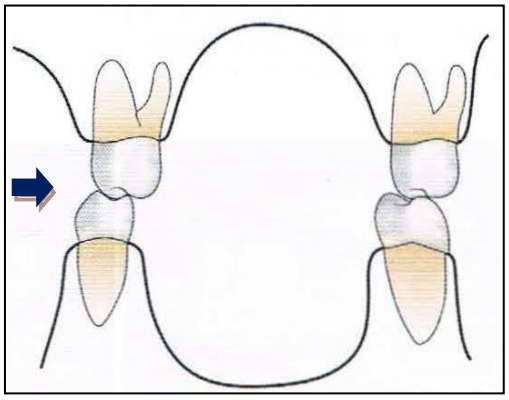
Anterior Crossbite



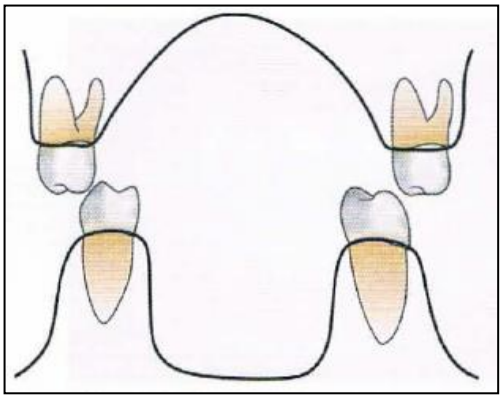

Anterior Crossbite. **A:** Dental single tooth crossbite. **B:** Skeletal segmental anterior crossbite




Functional Crossbite. **A:** Anterior displacement. **B:** Lateral displacement



Unilateral buccal crossbite



Bilateral lingual crossbite




**A:** Unilateral buccal crossbite. **B:** Bilateral buccal and anterior crossbite. **C** and **D:** Unilateral lingual crossbite

# Etiology of Crossbite

## Etiology of Dental Crossbite

1. Crowding: due to lack of space in the dental arch.
2. Anomalies of teeth number, size, and shape: like supernumerary teeth, macrodontia.
3. Premature loss or prolong retention of primary teeth: lead to crowding and displacement of permanent teeth into crossbite position.
4. Occlusal interference/prematurities.

## Etiology of Skeletal Crossbite

1. Hereditary or discrepancy in the size of the dental arches: skeletal Cl III and Cl II.
2. Habits: thumb sucking, mouth breathing, etc.
3. Cleft lip and palate: the scar tissue of the cleft repair restricts maxillary growth.
4. Trauma or pathology of the TMJ: it can restrict mandibular growth.

Generally, the greater the number of teeth in crossbite, the greater is the skeletal component of the etiology.

# TREATMENT OF CROSSBITE

Crossbites, anterior or posterior especially functional crossbite with mandibular displacement should be corrected as soon as they are detected. If the condition is left untreated it may develop into severe skeletal malocclusion.

## Correction of Anterior Crossbite

Anterior crossbites, in addition to be frequently associated with displacement, can lead to movement of a lower incisor labially through the labial supporting tissues, resulting in gingival recession. In this case early treatment is advisable.

### Dental Anterior Crossbite

1. ***Tongue blade therapy:*** used to treat the developing anterior crossbite by placing a wooden tongue blade behind the tooth erupting in crossbite and biting on it using the lower teeth as a fulcrum for a period of 5-10 minutes. Usually the tooth will erupt into normal position over a period of time.

2. ***Removable orthodontic appliance:*** can be used with:
   - *Z-spring* to correct single tooth in crossbite.
   - *Recurved Z-spring* to correct more than single tooth in crossbite.
   - *Screw* to correct single tooth or segmental crossbite.

   Removable appliances should incorporate *posterior bite plane* to open the bite anteriorly during correction of anterior crossbite. For treatment to be successful, there must be some overbite present to retain the corrected incisor position.

3. ***Fixed orthodontic appliance:*** indicated when bodily or apical movement is required.



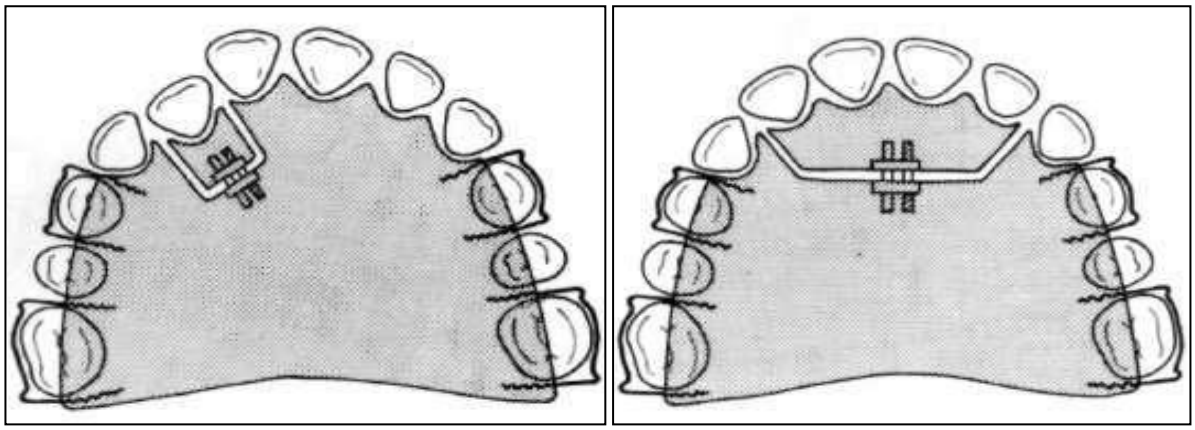
Tongue blade therapy



Recurved Z-spring



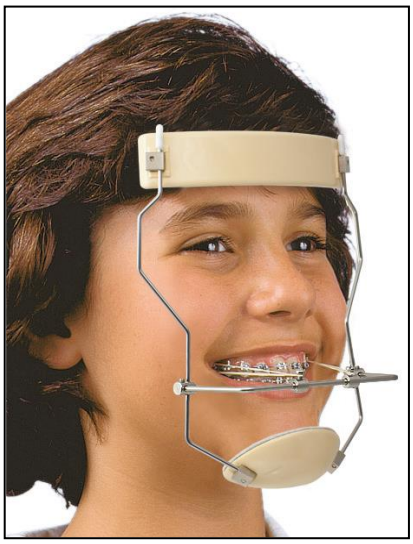
Hawley appliance with Z-spring and posterior bite plate



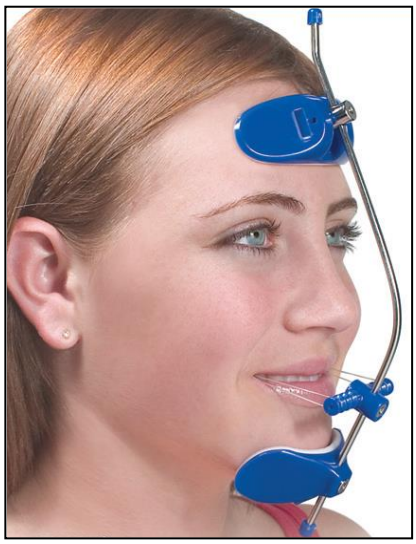
Screws for correction of single tooth and segmental anterior crossbite

## Skeletal Anterior Crossbite in Growing Patient

1. ***Orthopedic appliances***
   - *Facemask with rapid maxillary expander:* can be used in case of skeletal anterior crossbite due to maxillary retrognathism.
   - *Chin cup:* can be used in case of skeletal anterior crossbite due to mandibular prognathism.
2. ***Functional appliances:*** Frankel III appliance may be used to correct a developing Class III skeletal jaw relation with anterior crossbite.



Reverse pull headgear
(Delaire facemask)



Reverse pull headgear
(Petit type facemask)



Chin cup

## Skeletal Anterior Crossbite in Adults

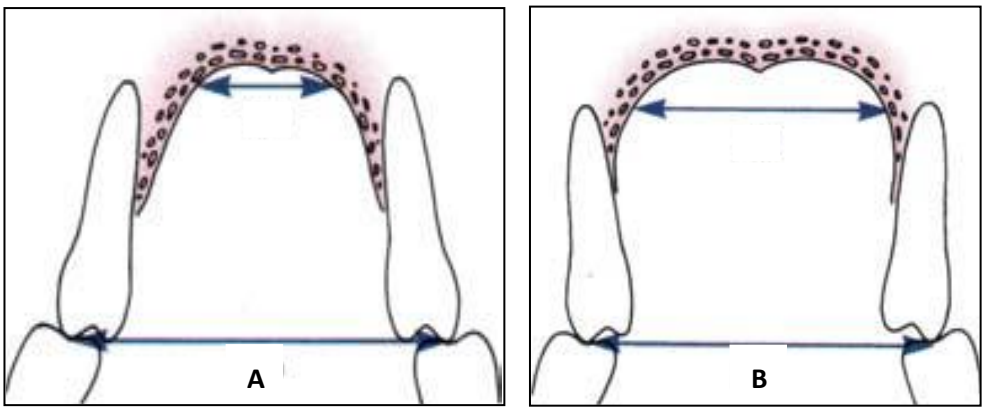
Non-growing patients with severe skeletal anterior crossbite can be treated by either mandibular set back or maxillary advancement surgical procedures.

# Correction of Posterior Crossbite

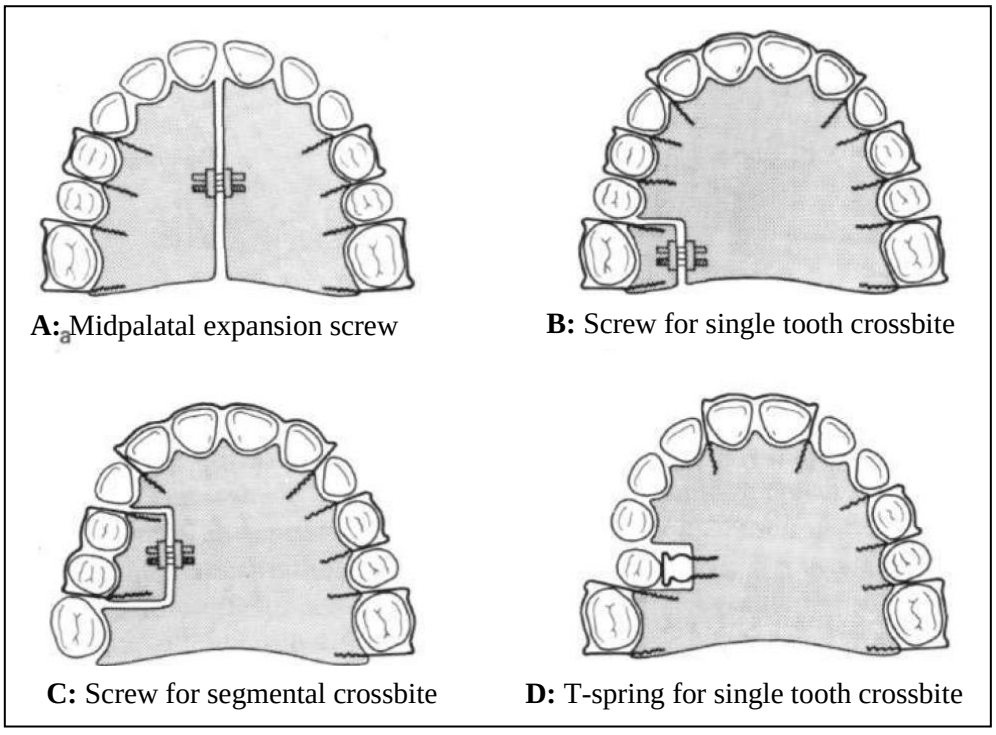
Correction of posterior crossbite is usually achieved by expansion of the arch or segment of the arch. The inclination of the affected teeth should also be evaluated. Upper arch expansion is more likely to be stable if the teeth to be moved were tilted palatally initially.

## Single Tooth Crossbite

- *Extraction:* if the tooth in crossbite is severely displaced.
- *Movement of the displaced tooth into the line of the arch using:*
  - Removable appliance with *screw* or *T spring*.
  - Fixed appliance if bodily movement is required.
- *Fixed orthodontic appliance with cross-elastics:* if correction of a crossbite requires movement of the opposing teeth in opposite directions.




Narrow palate with normal inclination of posterior teeth. **B:** Normal width of palate and palatally tilted posterior teeth (indicated for expansion)



**A:** Midpalatal expansion screw

**B:** Screw for single tooth crossbite

**C:** Screw for segmental crossbite

**D:** T-spring for single tooth crossbite



Cross-elastic

**Unilateral Segmental Buccal Crossbite**

- *With displacement:* bilateral expansion of the arch using:
  - Removable appliance with expansion screw.
  - Quad helix appliance.
  - Fixed orthodontic appliance: mild degree of arch expansion can be brought about by using arch wires or appliances like transpalatal arch.
- *Without displacement:* unilateral segmental expansion of the arch.

**Bilateral Buccal Crossbite**

- Acceptance with no treatment
- In severe skeletal cases, rapid maxillary expander (HYRAX) can be used for growing patient. For adults surgically assisted rapid palatal expansion (SARPE) with HYRAX can be used.
- Bilateral buccal crossbite in patients with a repaired *cleft palate*: expansion of the upper arch by stretching of the scar tissue is often indicated using a Quad helix appliance

Treatment for a bilateral crossbite without displacement should be approached with caution, as partial relapse may result in a unilateral crossbite with displacement. In addition, a bilateral crossbite is probably as efficient for chewing as the normal buccolingual relationship of the teeth.

*Note:* Miniscrew assisted rapid palatal expansion **(MARPE)** and surgically assisted rapid palatal expansion **(SARPE)** are frequently used modalities of RME preferred in skeletally mature individuals to overcome potential suture resistance.

**Lingual Crossbite**

Fixed orthodontic appliance.

## Dental Expansion (Slow Maxillary Expansion Devices)

Slow expansion has been also termed dentoalveolar expansion. The most commonly used appliances are:

**Removable Appliance with Jackscew:** it can be used in both arches, usually activated by turning the screw 1-2 quarter turn (0.25-0.5 mm) /week.

**Coffin Spring:** it is removable type, ideal to treat unilateral crossbites, and usually activated by pulling the two parts of the appliance apart manually or by using special pliers at the base of Omega wire.

**Quad Helix Appliance**: it can be used as a removable or fixed expansion appliance. The quad-helix consists of two anterior and two posterior helices. The appliance is capable of producing differential expansion, i.e. it can be activated to produce different expansion levels in the premolar and molar regions.

**Fixed Orthodontic Appliance:** mild degree of arch expansion can be brought about by using arch wires or appliances like transpalatal arch.

## Skeletal Expansion (Rapid Maxillary Expansion Devices)

1. The Rapid maxillary expander is essentially a dentofacial orthopedic appliance, which tends to produce its changes by splitting the mid-palatine suture. The rationale is being that if extreme forces are applied on to the palatal shelves, the interlying suture splits and results in true skeletal changes. The teeth are generally used for the purpose of transmitting the forces onto the maxillary bone proper. The most commonly used type is **HYRAX RME appliances** and **Miniscrew assisted rapid palatal expansion (MARPE)**. There are also different types of RME like **Isaacson RME appliances**, **Hass RME appliance**.

### Acivation of the RME Appliance

Rapid expansion typically is done by turning the screw 1-2 quarter turn (0.25-0.5 mm) daily especially for HYRAX which most commonly used. With rapid or semi-rapid expansion, a diastema usually appears between the central incisors as the bones separate in this area. Expansion usually is continued until the maxillary lingual cusps occlude with the lingual inclines of the buccal cusps of the mandibular molars.

### Retention Following RME Therapy

When expansion has been completed, a 3-month period of retention with the appliance in place is recommended. After the 3-month retention period, the fixed appliance can be removed, but a removable retainer that covers the palate is often needed as further insurance against early relapse. Traspalatal arch provides retention if further treatment is being accomplished immediately.

2. Surgically assisted rapid palatal expansion (SARPE) using the HYRAX can be used to correct skeletal posterior crossbite in *adults*.

Although *Coffin spring* and *Quad helix* appliances are mainly used for dental expansion, but they are capable of producing slight skeletal changes when they are used in mixed dentition stage (preadolescent or growing patient).

## Notes:

- Unilateral buccal crossbite with displacement may be associated with a centreline shift in the lower arch in the direction of the mandibular displacement on closure, and this differentiates it from unilateral buccal crossbite without displacement which may occur due to skeletal asymmetry.
- Expansion of the upper buccal segment teeth will result in some tipping down of the palatal cusps. This has the effect of hinging the mandible downwards leading to an increase in lower face height, which may be undesirable in patients who already have an increased lower facial height and/or reduced overbite. If expansion is indicated in these patients, buccal capping or buccal root torque to the buccal segment teeth is required to resist this tendency.
- For correction to be successful there should be a good post-treatment overbite for stability. Over correction and prolong retention after expansion is mandatory for a stable result.
- Crossbites in the deciduous or mixed dentition may result from premature contact between the deciduous canines with a resultant lateral mandibular displacement. These maybe treated by grinding the canines tips (just the enamel) to eliminate the premature contact.

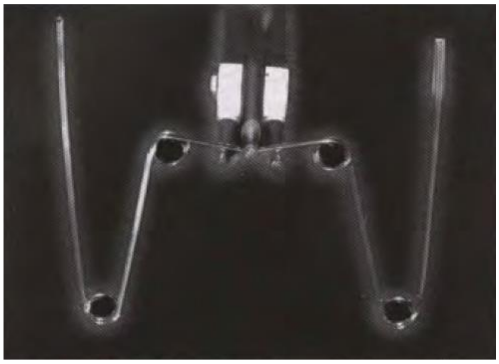


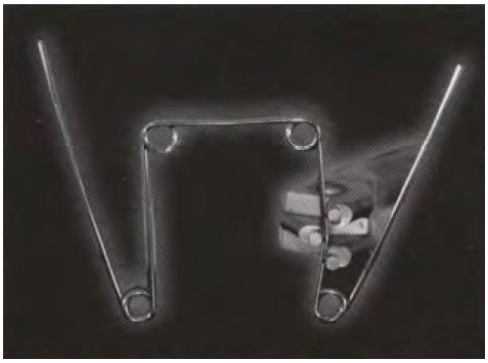
Removable appliance with expansion screw and buccal capping of posterior teeth



Coffin spring





Quad helix appliance

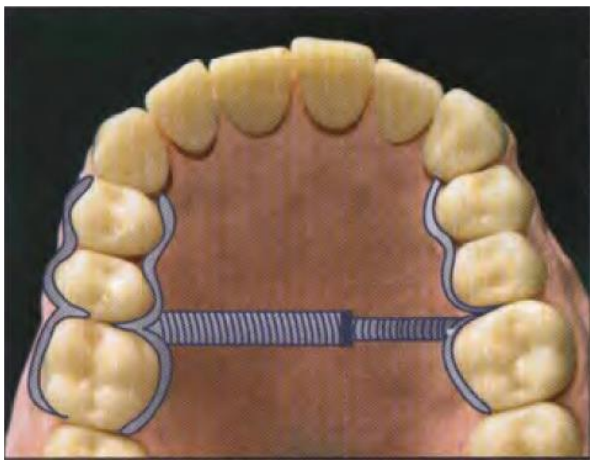
Activation of quad helix appliance. *Left:* activation at the anterior bridge produces expansion in the molar region. *Right:* activation of the outer arm produces expansion in the premolar and canine region



Transpalatal arch



HYRAX RME appliance



Issacson RME appliance



Hass RME appliance



MARPE

## References


- Littlewood SJ, Mitchell L. *An introduction to orthodontics*. 5th edition. Oxford University Press. 2019.
- Phulari BS. *Orthodontics principles and practice*. 2nd edition. Jaypee. 2017.
- Cobourne M, DiBiase A. *Handbook of orthodontics*. 2nd edition. Elsevier. 2016.