Treatment of Class I malocclusion

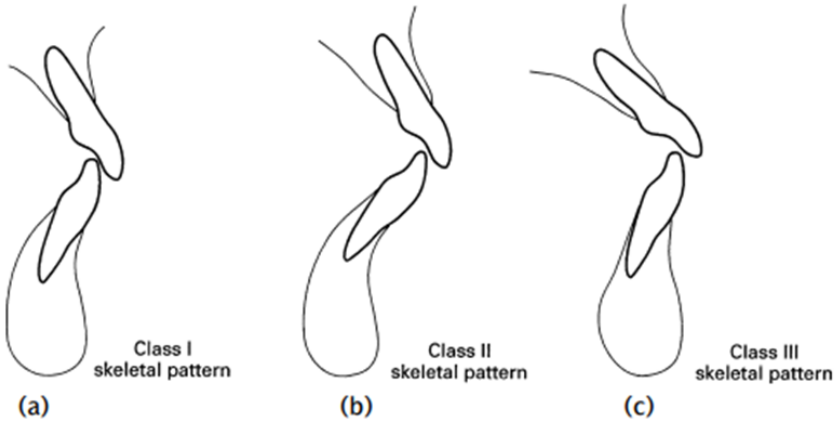
Definition

Class I malocclusion is the most common type of malocclusion observed in most population groups. Angle's class I malocclusion is a condition in which malalignment of teeth is present with a class I molar relationship (mesiobuccal cusp of permanent maxillary first molar occludes in the mesiobuccal developmental groove of mandibular first permanent molar). It may present with a variety of tooth malpositions such as crowding, spacing, rotations, bimaxillary protrusion, bimaxillary retrusion, crossbite and open bite. Therefore, Class I malocclusions may include those where the anteroposterior occlusal relationship is normal but there is a discrepancy either within the arches and/or within the transverse or vertical relationship between the arches.

Management of class I malocclusion is aimed to correct the malocclusion present, while maintaining the existing class I molar relationship which is considered to be the normal molar relationship.

Aetiology

1- **Skeletal:** In Class I malocclusions, the skeletal pattern is usually Class I, but it can also be Class II or Class III with the inclination of the incisors compensating for the underlying skeletal discrepancy.



(a) Class I incisor relationship on Class I skeletal pattern; (b) Class I incisor relationship on a Class II skeletal pattern with proclination of the lower incisors; (c) Class I incisor relationship on a Class III skeletal pattern with proclination of the upper incisors and retroclination of the lower incisors

Marked transverse skeletal discrepancies between the arches are more commonly associated with Class II or Class III occlusions, but milder transverse discrepancies are often seen in Class I cases. Increased vertical

skeletal proportions and an anterior open bite can also occur where the anteroposterior incisor relationship is Class I.

2- **Soft tissues:** In most Class I cases, the soft tissue environment is favourable and is not an aetiological factor. The major exception to this is bimaxillary proclination, where the upper and lower incisors are proclined. This may be racial in origin, but can also occur because of lack of lip tonicity, which results in the incisors being moulded forwards under tongue pressure.

3- **Dental factors:** Dental factors are the main aetiological influences in Class I malocclusions. The most common are tooth/arch size discrepancies, leading to crowding or spacing. The size of the teeth is genetically determined and so the size of the jaws is mostly affected. Environmental factors can also contribute to crowding or spacing. For example, premature loss of a deciduous tooth can lead to a localization of any pre-existing crowding and possible deviation of centre lines. Local factors also include displaced or impacted teeth, and anomalies in the size, number, and form of the teeth.

❖ Management of class I malocclusion with crowding

Crowding is the most common complaint for which patients seeks orthodontic treatment, especially that of the anterior region which compromises facial aesthetics.

Arch length to tooth material discrepancy occurs where tooth material is more than the arch length that can lead to crowding which may be seen in anterior or posterior regions of one or both the dental arches. It may be mild or severe, unilateral or bilateral, localized or generalized.

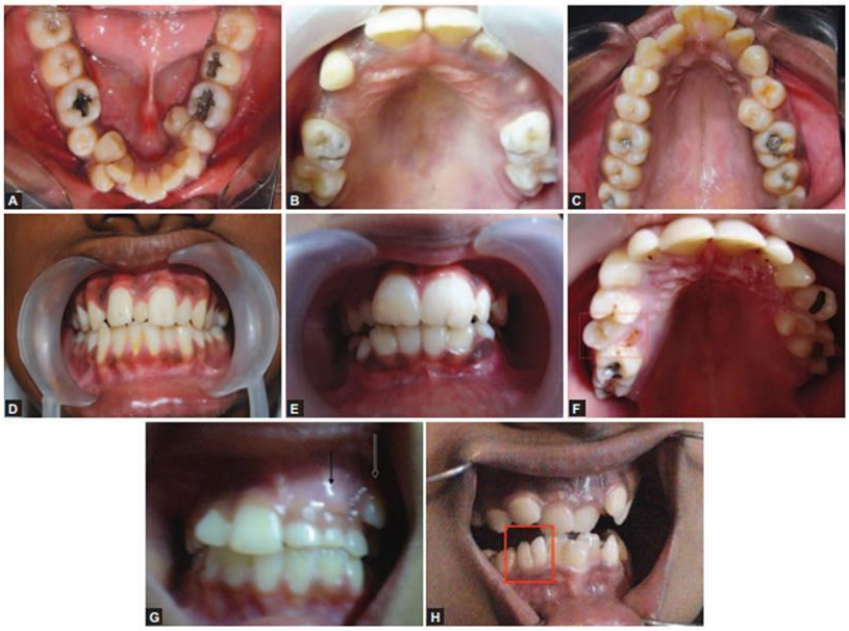
Different cases of Class I malocclusion with varying degrees of crowding. (A) Mild localized crowding; (B and C) Moderate and localized crowding; (D) Severe and generalized crowding

Etiological Factors

Crowding may be caused due to a number of reasons. Multiple factors act together in many cases.

1. Arch length—Tooth material discrepancy, where arch length is lesser than tooth material that leads to the crowding of teeth.

2. Premature loss of deciduous teeth.
3. Prolonged retention of deciduous teeth.
4. Presence of supernumerary teeth.
5. Macrodontic teeth.
6. Altered path of eruption.
7. Delayed eruption of permanent teeth.
8. Trauma.
9. Gemination of teeth.



Etiological factors of dental crowding: (A) Severe crowding in the maxillary and mandibular arches due to arch length—tooth material discrepancy. (B) Premature loss of deciduous teeth. (C) Crowding in the maxillary arch caused due to prolonged retention of right and left deciduous canines and second deciduous molar. (D) Intraoral frontal and occlusal view photographs showing crowding in the maxillary arch caused due to presence of supernumerary tooth (mesiodens), (E) Intraoral frontal view showing crowding in the arch due to macrodontic right and left permanent central incisors. (F) Altered path of eruption of right permanent second premolar due to retained root stumps of deciduous right second molar. (G) Delayed eruption permanent left anterior teeth due to over retained deciduous left central incisor, lateral incisor and canine. Note labially erupting permanent left canine and labial bulge of the erupting permanent left lateral incisor. (H) Gemination of left permanent lateral incisor.

Late lower incisor crowding

Physiologically, in most individuals, the intercanine width increases up to around 12 to 13 years of age, and this is followed by a very gradual diminution throughout adult life. The rate of decrease is most noticeable during the mid to late teens. This reduction in intercanine width results in an increase of any preexisting lower labial crowding, or the emergence of crowding in arches which were well aligned or even spaced in the early teens. Therefore, to some extent, lower incisor crowding can be considered as an age change.

The aetiology of late lower incisor crowding is recognized as being multifactorial: the following have been proposed as influences in the development of this phenomenon;

1. Forward growth of the mandible (either horizontally or manifesting as a growth rotation) when maxillary growth has slowed, together with soft tissue pressures, which result in a reduction in lower arch perimeter and labial segment crowding.
2. Soft tissue maturation.
3. Mesial migration of the posterior teeth owing to forces from the interseptal fibres and/or from the anterior component of the forces of occlusion.
4. The presence of an erupting third molar pushes the dentition anteriorly, i.e. the third molar plays an active role.

Clinical Features

1. Crowding may be present unilaterally or bilaterally in the dental arches.
2. Crowding may be localized or generalized.
3. There is often difficulty in maintenance of good oral hygiene due to inaccessibility of certain tooth surfaces in crowded areas to toothbrush.
4. Food impaction may occur.
5. Halitosis may be present
6. Gingivitis and periodontitis may occur.

Diagnosis

1. Clinical examination reveals the extent and location of crowding.
2. Model analysis is needed for determining the arch length and tooth material discrepancy.
3. Radiographic examination helps in evaluating any trauma, bony pathology and unerupted teeth.

Treatment

Relief of Crowding by Gaining Space

Space is required for the relief of crowding in the arch. The required amount of space may be gained by proximal stripping, arch expansion (e.g. Quad helix appliance), distalization of molars and proclination of anteriors or extraction of teeth.

When planning extractions for the management of crowding, the following should be considered:

- ✓ The position, presence, and prognosis of the remaining permanent teeth.
- ✓ The degree of crowding, which is usually calculated in millimeters.
- ✓ The patient's malocclusion and any orthodontic treatment planned, including anchorage requirements.
- ✓ The patient's age and the likelihood of the crowding increasing or reducing with growth.
- ✓ The patient's profile

Treatment using removable orthodontic appliance:

The following removable orthodontic appliances are used to relieve crowding in the arches:

A) Removable orthodontic appliances with Jack screw: the appliance incorporates a Jack screw in the midpalatal raphe region. On activation of screw, there will be opening up of mid-palatal suture and spacing in the midline between centrals, later this space can be utilized to relieve crowding in the dental arches.

B) Removable orthodontic appliances with canine retractor: appliance with canine retractors can be used in selected cases. Activation of canine retractor brings about distal movement of canine leaving behind space distal to lateral incisor and mesial to canine, this space later can be used to relieve crowding in the dental arches.

C) Removable orthodontic appliances with "Z"spring: Crowding in the anterior segments caused due to palatally erupted incisor can be managed with removable orthodontic appliance with "Z" springs. "Z" spring fabricated on incisor, on activation brings about labial movement of incisor to the final alignment on the dental arches.

Gaining space by using Quad helix expansion appliance

Arch expansion using removable orthodontic appliances with Jack screw

Removable orthodontic appliances with canine retractor

Removable orthodontic appliances with "Z" spring.

Treatment using fixed orthodontic appliance:

Fixed orthodontic appliance with NiTi arch wire or open coil spring can be used to relieve crowding in the arch. Therapeutic extraction of certain teeth may be needed to gain the required space.

❖ Management of class I malocclusion with spacing

Arch length to tooth material discrepancy where, tooth material is less than arch length can lead to spacing. Spacing may be seen in one or both dental arches. It may be localized or generalized, unilateral or bilateral in the dental arches.

Spacing may be caused by oral habits such as thumb sucking/digit sucking and tongue thrusting. Other causes of spacing include large tongue, relative microdontia and macrognathia.

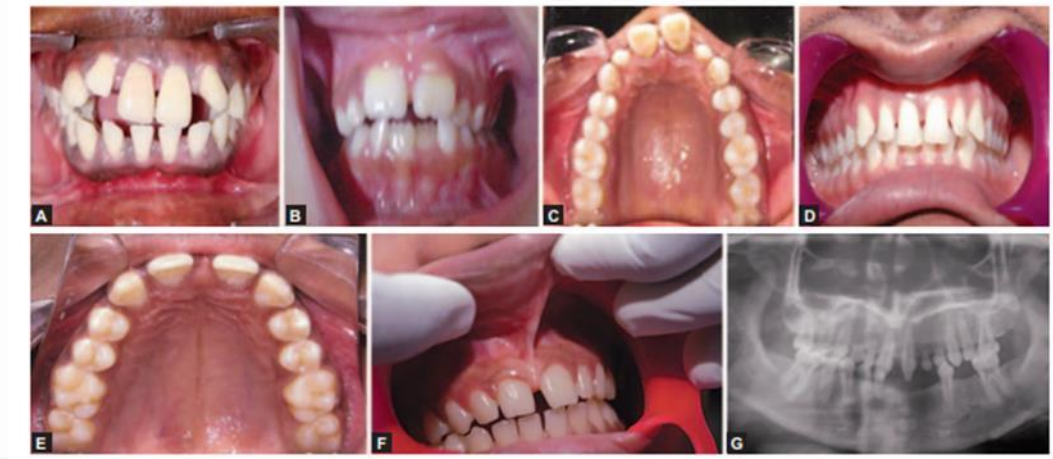
Correction of spacing involves identification and removal of etiological factors followed by consolidation of space using removable or fixed orthodontic appliance or by conservative approach.

Etiological Factors

1. Arch length—Tooth material discrepancy, where arch length is more than the tooth material can lead to spacing.
2. Oral habits:
   - Thumb sucking.
   - Tongue thrusting.
3. Abnormal tooth form:
   - Peg-shaped maxillary permanent lateral incisors.
4. Abnormally large tongue exerting pressure on teeth may cause spacing:
   - Macroglossia
5. Abnormal tooth size:

- Microdontia.

6. Anomalies in number of teeth:
   - Oligodontia
   - Partial anodontia.
7. Bony pathologies like cystic lesions, odontomes.
8. Congenitally missing teeth.
9. Premature loss of permanent teeth.
10. Soft tissue abnormalities:
    - Abnormal labial frenum attachment.
11. Prolonged retention of deciduous teeth.



Causes of spacing in the arches: (A) Spacing in the arches due to arch length –tooth material discrepancy. (B) Spacing in the maxillary anterior region due to thumb sucking habit. (C) Spacing in the maxillary anterior segment due to bilateral peg shaped lateral incisors. (D) Spacing in the maxillary and mandibular anterior segments due to microdontic teeth. (E) Bilateral congenitally missing lateral incisors causing spacing: Intraoral occlusal view. (F) Midline diastema caused by high labial frenum attachment. (G) Partial anodontia causing spacing in the arches.

Clinical Features

- Spacing may be present in one or both dental arches.
- Spacing may be localized or generalized.
- Spacing may be unilateral or bilateral.
- Spacing between two permanent maxillary central incisors in the midline is often referred to as midline diastema.

Clinical features of Class I malocclusion with spacing: (A) Spacing in both the arches. (C) Spacing in the maxillary anterior region. (B) Bilateral spacing in the arches. (D) Midline diastema

Diagnosis

A thorough examination should be supplemented with routine orthodontic diagnostic aids such as orthodontic study models to evaluate arch length—tooth material discrepancy and radiographic examination to rule out bony pathologies and unerupted teeth in the jaws.

Treatment

Removal of the etiologic causes

1. Oral habits such as thumb sucking, digit sucking, tongue thrusting treated by habit breaking appliance with crib or rake.
2. Bony pathologies such as cystic lesions, odontomes treated by surgical removal of the cystic lesion.
3. Soft tissue abnormalities such as
    a. Abnormal labial frenum attachment treated by frenectomy,
    b. Prolonged retention of deciduous teeth treated by extraction of retained deciduous teeth and facilitating the eruption of unerupted permanent teeth.

Using removable orthodontic appliances

Simple removable orthodontic appliance with labial bow or finger springs may be used to close the spacing in the arch.

Using fixed orthodontic appliances

Fixed orthodontic appliance can be used to close the spaces by employing

- E-chain (short or long)
- Closed coil spring
- Elastics
- Elastic thread.

By conservative approach

In cases of minor spacing in the arch, conservative approach can also be employed using appropriately shade-matched composite resin restorations.

❖ Management of class I malocclusion with rotation

Rotation is the movement of teeth around their long axis. It may involve a single tooth, multiple teeth and one or both the arches. It may be mild or severe.

Rotated anterior teeth occupy less space, whereas rotated posterior teeth occupy more space in the arch. Thus, some amount of space is gained followed by de- rotation of posterior teeth; while correction of rotated anterior teeth requires space creation.

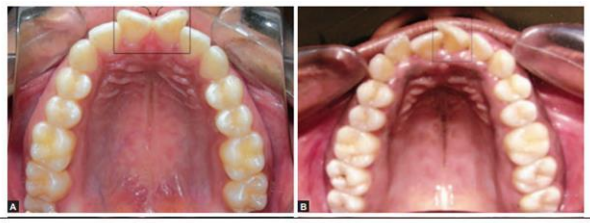
Correction of rotated teeth can be done by using removable orthodontic appliances or fixed mechanotherapy. There is high risk of relapse associated with de-rotated teeth due to stretching of the supra-alveolar and trans-septal gingival. Thus pericision (circumferential supra-crestal fiberotomy) followed by long-term retention is often required to achieve stability of the treatment.

Types of Rotations

Rotations are essentially of two types:

- ✓ Mesiolingual or distobuccal rotation

- ✓ Distolingual or mesiobuccal rotation



Types of rotations: (A) Mesiolingual or distolabial rotation of maxillary right and left central incisors. (B) Distolingual or mesiolabial rotation of a maxillary central incisor

Clinical Features

Rotation may involve anterior or posterior teeth; single tooth/multiple teeth, one or both the arches. It may be mild or severe.

- Unesthetic facial appearance when anterior teeth are involved.
- Food impaction.
- Prone for dental caries.
- Difficulty in maintaining good oral hygiene.

Diagnosis

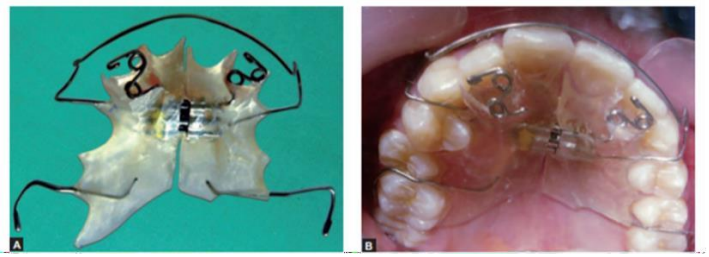
Diagnosis of rotation of teeth can be easily done by proper clinical examination. However, orthodontic study models may be needed to evaluate the extent of rotation and they also aid in treatment planning.

Treatment

De-rotation of rotated teeth requires application of a force couple. Rotations are often easier to treat than to retain. Retention should be carefully planned to prevent future relapse.

<u>Using Removable Orthodontic Appliance</u>

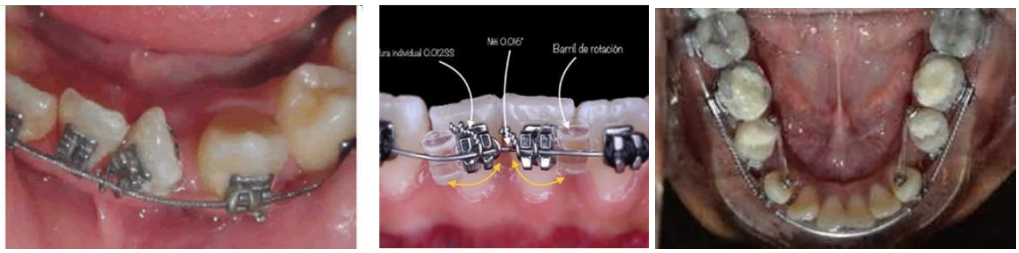
Appliance incorporating "Z" spring (double cantilever spring) along with labial bow can be used to treat mild rotations. Only upper helix of the Z spring is activated for achieving derotation of tooth or teeth.



Removable orthodontic appliance incorporating "Z" spring (double cantilever spring) along with labial bow can be used to treat mild rotations

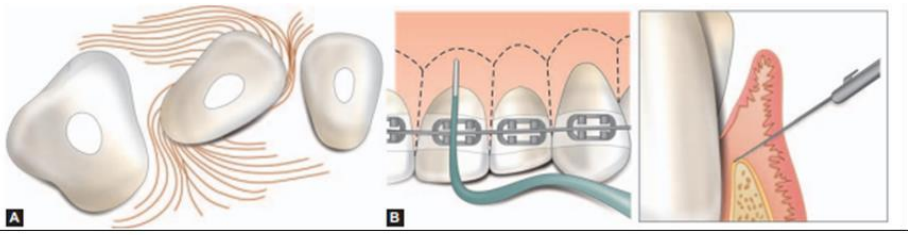
Using Fixed Orthodontic Appliance

When there is severe rotation of a single or multiple teeth, fixed orthodontic appliance is the treatment of choice. Space required for derotation of anterior teeth can be obtained by arch expansion, proximal stripping, etc. depending on the case. With fixed appliance NiTi arch wire and derotation springs are often used for derotation of teeth.

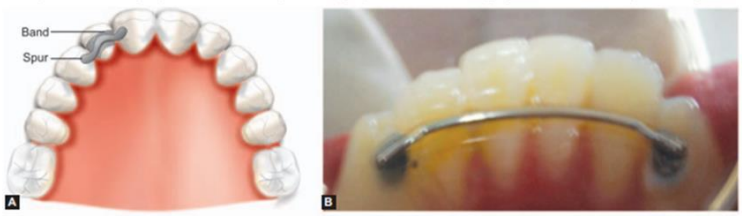


Retention Following Correction of Rotation

A high risk of relapse is seen among these cases due to the resiliency of gingival fibers. The supracrestal gingival fibers take relatively longer time to reorganize after derotation of the tooth. Therefore, the importance of proper retention following treatment of such cases cannot be overemphasized. Long-term retention is required and circumferential supracrestal fiberotomy or pericision is a useful adjunctive surgical procedure where the gingival fibers are incised to prevent relapse. The recommended retention following derotation of single tooth is band and spur whereas, in cases of correction of multiple rotations, banded canine-to-canine or bonded canine-to-canine lingual retainer can be used.



(A)Supracrestal gingival fibers take longer time to reorganize after orthodontic derotation of the tooth. (B)Circumferential supracrestal fibrotomy or precision is a useful adjunctive surgical procedure in which the gingival fibers are incised to prevent relapse.



Retention following derotation of teeth: (A) Band and spur is the retainer of choice in cases of correction of single tooth rotation. (B) Bonded canine to canine lingual retainer

❖ Management of bimaxillary protrusion

Bimaxillary dentoalveolar protrusion is a malocclusion characterized by dentoalveolar flaring of both the maxillary and the mandibular anterior teeth, with resultant protrusion of the lips and convexity of the face.

Clinical features

Extra-oral Features

A patient with bimaxillary protrusion may exhibit the following features:

- Decreased nasolabial angle due to proclined maxillary anterior.
- Shallow mentolabial sulcus due to proclined mandibular anterior.
- Lips may be potentially incompetent.
- Convex facial profile.

Intra-oral Features

Intra-oral examination may reveal the following features:

- Maxillary and mandibular anterior proclination.
- Class I molar relationship.
- Class I canine relationship.
- Class I incisor relationship.
- Bimaxillary protrusion may be seen.

Cephalometric Findings

- Decreased interincisal angle
- Increased incisor mandibular plane angle
- Increased SNA and SNB angle, if there is prognathism of the jaws.
- Increased S-N-Pr and S-N-Id angle in cases associated with bimaxillary prognathism.

Treatment

Management is considered difficult because the upper and lower incisors need to be retroclined to reduce the overjet. Retroclination of the lower labial segment will encroach on tongue space and therefore has a high likelihood of relapse following removal of appliances. For these reasons, treatment of bimaxillary proclination should be approached with caution and consideration should be given to accepting the incisor relationship. If the lips are incompetent, but have a good muscle tone and are likely to achieve a lip-to-lip seal when the incisors are retracted, the chances of a stable result are increased. However, the patient should still be warned that the prognosis for stability is guarded. Where bimaxillary proclination is associated with competent lips or with grossly incompetent lips which are unlikely to retain the corrected incisor position, permanent retention is advisable.

For these patients, it is accepted that extraction of the four first premolars is the most viable and effective means of reducing their facial convexity. The maxillary and mandibular anterior are retracted while maintaining the existing Class I molar and canine relationships. Closure of the extraction sites can occur by retraction of the anterior segments, protraction of the posterior segments or a combination of the two. In such cases, anchorage is believed to be the most critical part of the treatment plan. When extraction is indicated to prevent mesial movement of the posterior segments in the anteroposterior dimension, this is termed as maximum anchorage.

❖ Management of bimaxillary retrusion

Bimaxillary retrusion is a condition characterized by retrusion of both upper and lower anterior teeth resulting in a concave facial profile.

Clinical Features

Extraoral Features

- Increased nasolabial angle due to retruded maxillary anteriors.
- Deep mentolabial sulcus due to retruded lower anteriors.

- Mild concave facial profile.

Intra-oral Features

- Maxillary and mandibular anterior retroclination.
- Class I molar relationship.
- Class I canine relationship.
- Retrognathic bimaxillary arches may be seen.

Cephalometric Findings

- Increased interincisal angle.
- Decreased incisor mandibular plane angle.
- Decreased SNA and SNB angles in cases with retrognathic bimaxillary arches associated with bimaxillary retrusion.
- Decreased S-N-Pr and S-N-Id angles in cases associated with retrognathic bimaxillary arches

Treatment

Fixed or removable orthodontic appliance can be used. Removable orthodontic appliances with incorporated expansion screw can be used. Activation of expansion screw by turning the screw up to 90º twice in a week in growing patient brings about forward placement/labial placement of anteriors thereby correcting of bimaxillary retrusion. Also removable orthodontic appliance with modified double cantilever spring can also be used. Activation of modified double cantilever spring by opening the helices brings about labial movement of anteriors, thereby correcting of bimaxillary retrusion.

❖ Management of scissor bite

Scissor bite is the buccal crossbite where, the upper posterior teeth are placed completely buccal to their lower counterparts. It may involve a single tooth or group of teeth and may be unilateral or bilateral.

Scissors bite: (A) Scissors bite in relation to right permanent second premolar. (B) Scissor bite in relation to right permanent first premolar. (C) Segmental scissors bite on left side.

Diagnosis

Diagnosis of scissors bite is done by thorough clinical and study model examination.

Treatment

The treatment of scissors bite is done by placement of cross elastics placed across the bite. The cross elastic is stretched from buccal aspect of upper tooth to the lingual of lower tooth involved in scissor bite. Lingual attachments such as lingual button are used to engage the elastic on the lingual aspect of lower tooth involved in scissor bite. Bite blocks are needed to provide occlusal clearance for jumping/ clearing the bite.

The treatment of scissors bite is done by placement of cross elastics placed across the bite (encircled). Bite blocks are needed to provide occlusal clearance for jumping the bite (arrow)

References:

1- Littlewood SJ, Mitchell L. (2019): *An introduction to orthodontics*. 5th edition. Oxford University Press.

2- Phulari BS. (2017): *Orthodontics: principles and practice*: 2nd edition. Jaypee. 2017.