

CROWDING

Crowding affects approximately 60% of Caucasians. Both jaw size and tooth size are mainly genetically determined and appear to be reducing; however, environmental factors, for example premature deciduous tooth loss, can increase crowding. In evolutionary terms both jaw size and tooth size appear to be reducing. However, crowding is much more prevalent in modern populations than it was in prehistoric times. This may be due to the introduction of a less abrasive diet, so that less interproximal tooth wear occurs during the lifetime of an individual. Also, a change from a rural to an urban life-style can also apparently lead to an increase in crowding after about two generations.

CLASSIFICATION OF CROWDING:

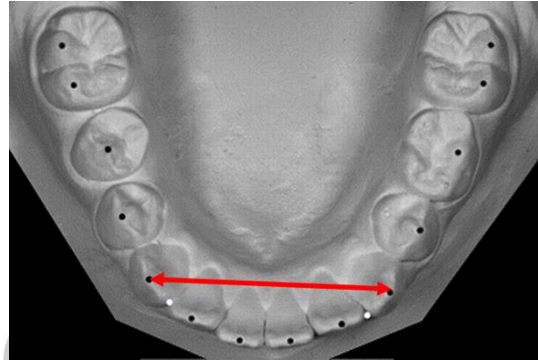
Considering the amount of space deficiency, crowding is divided into:

- Mild crowding (<4mm)
- Moderate crowding (4-8mm)
- Severe crowding (>8mm)

Considering its etiology, crowding is divided into:

- Primary crowding (hereditary): crowding is determined genetically and is caused by disproportionately sized teeth and jaws. The malalignment of the anterior teeth is characteristic of this type of crowding.
- Secondary crowding: it is an acquired anomaly caused by mesial drift of the posterior teeth after premature loss of deciduous teeth in the lateral segments.
- Tertiary crowding: occurs between the ages of 18 and 20 primarily of the lower anterior teeth. It may be attributed to:
 - ❖ mesial migration of the posterior teeth owing to forces from the erupting third molars. The third molar has a weak association with late lower incisor crowding. Furthermore, this crowding can still occur in patients with congenitally absent third molars. Therefore, prophylactic removal of lower third molars to prevent lower labial segment crowding cannot be justified.
 - ❖ uprightening of the lower incisors as a result of forward growth of the mandible when maxillary growth has slowed.

- ❖ soft tissue pressures being stronger from the lips and cheeks than from the tongue.
- ❖ reduction in lower intercanine width:
In most individuals 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.



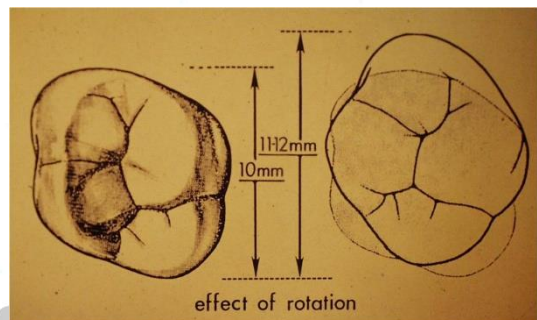
METHODS OF SPACE CREATION

The amount of space that will be created during treatment can also be assessed. The aim is to balance the space required with the space created. Space can be created by one or more of the following:

1- Derotation

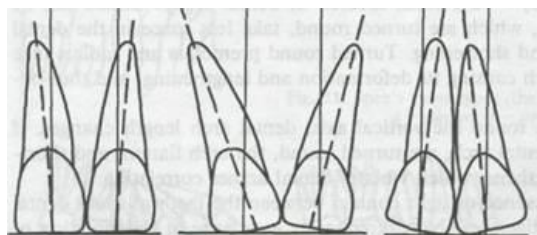
Derotating anterior teeth needs space because rotated incisors take up less space than aligned ones.

While, derotating posterior teeth creates space because rotated molars take up more space than aligned ones.



2- Uprighting

Uprighting tilted teeth creates space because mesially or distally tipped teeth take up more space than upright ones.



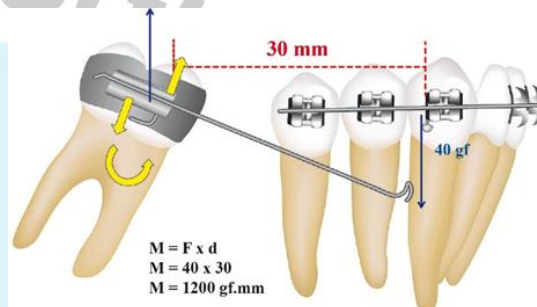
3- Distal movement of molars

Distal movement of molars in the upper arch can be achieved with headgear. Extra-oral traction using headgear will usually produce up to 2–3 mm per side (creating 4–6 mm space in total). It is used:

- when there is a mild space requirement where extractions may produce too much space
- in addition to extractions when there is a very high space requirement.

Temporary anchorage devices (TADS) offer an alternative to headgear. Appliances attached to these anchorage devices can be used to distalize upper molars.

Distal movement of the lower first molar is very difficult and in reality the best that can be achieved is uprighting mesially tipped molars.



4- Expansion

Space can be created by expanding the upper arch laterally; approximately 0.5 mm is created for every 1 mm of posterior arch expansion. Expansion should ideally only be undertaken when there is a crossbite. Expansion without a crossbite may increase the risk of instability and the risk of perforation of the buccal plate.



Expansion of the lower arch may be indicated if a lingual crossbite (scissors bite) of the lower premolars and/or molars exists. Any significant expansion in the lower arch, particularly the lower intercanine width, is unstable.

5- Proclination of incisors

Space can be created by proclining incisors, but this depends on the aims of the treatment, so proclining upper incisors in Class III malocclusion and lower incisors in Class II malocclusion can help correct the incisor relationship and relief crowding at the same time. Each millimetre of incisor advancement creates approximately 2mm of space within the dental arch.

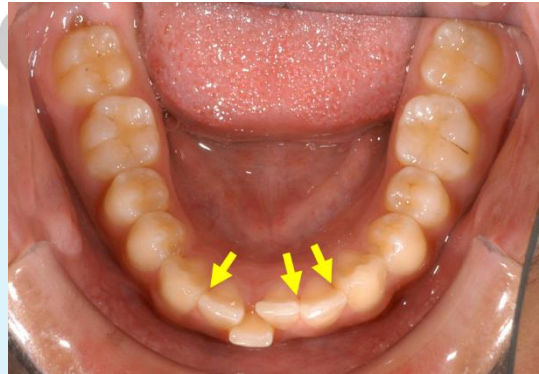


6- Enamel stripping

Enamel interproximal reduction or 'stripping' is the removal of a small amount of enamel on the mesial and distal aspect of teeth. In addition to creating space, the process can improve the shape and contact points of teeth, and possibly enhance stability at the end of treatment.

On the anterior teeth approximately 0.5mm can be removed on each tooth (0.25mm mesial and distal) without compromising the health of the teeth. Enamel can be carefully removed with an abrasive strip, then treated topically with fluoride.

A high-speed air-turbine handpiece can be used to remove enamel from the posterior teeth. However, both teeth and periodontium can be damaged unless care is taken. Removal of filling materials is preferred over sound enamel when applicable.



It is important that teeth are reasonably aligned before enamel reduction begins.

7- Extractions

Before planning extractions of any permanent teeth, it is essential to ensure that all remaining teeth are present and developing appropriately.

SPACING

Generalized spacing is not common and is due to either hypodontia or small teeth in well-developed arches. Orthodontic management of generalized spacing is frequently difficult as there is usually a tendency for the spaces to re-open unless permanently retained.

- In milder cases it may be wiser to encourage the patient to accept the spacing, or if the teeth are narrower than average, acid-etch composite additions or porcelain veneers can be used to widen them and thus improve aesthetics.
- Spaces can be closed by retracting protruded anterior teeth or by mesializing the posterior teeth.
- In severe cases of hypodontia a combined orthodontic–restorative approach to localize space for the provision of prostheses, or implants, may be required.



Localized spacing may be due to hypodontia; or loss of a tooth as a result of trauma or extraction. This problem is most noticeable if an upper incisor is missing as the symmetry of the smile is affected.

Upper central incisors are rarely congenitally absent. They can be lost as a result of trauma, or occasionally their extraction may be indicated because of dilaceration. Lost central incisors should be replaced to prevent adjacent teeth from drifting into the extraction site. The resulting midline shift will complicate later treatment.

Autotransplantation is the surgical repositioning of a tooth into a surgically created socket within the same patient. It is successful to transplant open apex premolars from crowded arches into the sockets of uvulsed central incisors.

MISSING UPPER LATERAL INCISORS

Hypodontia is defined as the congenital absence of one or more teeth. The prevalence hypodontia in a Caucasian population (excluding the third molars) is between 3.5 to 6.5%. One or more third molar is missing in approximately 25–35% of the population. The next most commonly missing teeth are the second premolars (3%) followed by the upper lateral incisors (2%). Both can occur unilaterally or bilaterally.

Whatever the reason for the absence of lateral incisors, there are two treatment options:

- 1- closure of the space and camouflage the canines (grinding the cusp tip and flattening the labial surface and adding composite when needed).



- 2- opening of the space and placement of a fixed or removable prosthesis.



The choice for a particular patient will depend upon a number of factors:

- 1- Skeletal relationship: space closure by incisor retraction may be preferable in Class II division 1 as it will aid overjet reduction, but unfavorable in Class III malocclusion.
- 2- Presence of crowding or spacing: where the space of the missing lateral incisors can be used to resolve crowding of adjacent teeth. On the other hand, generalized spaces can be collected in the lateral incisor area for prosthetic replacement.
- 3- Colour and form of adjacent teeth: if the permanent canines are much darker than the incisors and/or pointed in shape, modification to make them resemble lateral incisors will be difficult. Also, if a lateral incisor is to be brought forward to replace a missing single upper central incisor, an aesthetically pleasing result will only be possible if the lateral is fairly large and has a broad gingival circumference.
- 4- The inclination of adjacent teeth: as this will influence whether it is easier to open or close the space. It is easier to retract a mesially inclined canine and open the space, while distally inclined canines are more readily protracted to close the space.
- 5- The buccal segment occlusion: if the buccal segment relationship is Class I space opening is preferable because closing the space by mesial movement of the buccal segment will result in a Class II molar relationship.
- 6- The patient's wishes and ability to co-operate with complex treatment: some patients have definite ideas about whether they are willing to proceed with appliance treatment, and whether they wish to have the space closed or opened for a prosthetic replacement.
- 7- Long-term maintenance/ replacement of a prosthesis.

Closing the space	Opening the space
Class II division 1 malocclusion	Class III malocclusion
Crowded dentition	Spaced dentition
Good form and colour of canine	Dark coloured or pointed canine
Distally inclined canine	Mesially inclined canine
Not class I molar relationship	Class I molar relationship
Patient does not want a prosthetic replacement	Patient accepts a prosthetic replacement
Patient does not want any long-term maintenance/ replacement costs	Patient accepts long-term maintenance/ replacement costs

SPACE CLOSURE

It is carried out by:

- 1- **Molar protraction:** early extraction of any deciduous teeth allows forward movement of the first permanent molars, but fixed appliances are required to complete alignment and correct the axial inclinations. Temporary anchorage screws may be helpful where large spaces need to be closed.
- 2- **Incisor retraction** where there is an increased overjet
- 3- **Conservative closure of the space:** If any masking procedures (for example contouring a canine incisally, palatally, and interproximally to resemble a lateral incisor) or acid-etch composite additions are required, these should be carried out prior to the placement of appliances to facilitate final tooth alignment (although definitive restorations e.g. crowns or veneers, are best delayed until treatment is completed).

Placement of a bonded retainer post-treatment is advisable.

SPACE OPENING

In cases with congenitally absent upper lateral incisors early extraction of the deciduous lateral incisors may be indicated to encourage the permanent canine to erupt mesially achieving a greater volume of alveolar bone. Later the canine is retracted during active space opening. This bone will aid in implant placement.

Definitive treatment when the permanent dentition is established will require fixed appliances to open the space. Whenever space is opened prior to bridgework, it is important to retain with a partial denture for at least 3 to 6 months, particularly if an adhesive acid-etch retained bridge is to be used. Acid-etch bridges placed immediately after the completion of tooth movement, have a greater incidence of failure than those placed following a period of retention with a removable retainer.

Implants are commonly use but require root parallism. Since orthodontically repositioned roots may show some relapse, prolonged retention may be necessary to prevent the roots from contacting the implant.



MEDIAN DIASTEMA

As median diastemas tend to reduce or close with the eruption of the canines, management can be subdivided as follows.

- Before eruption of the permanent canines intervention is only necessary if the diastema is greater than 3 mm and there is a lack of space for the lateral incisors to erupt. Care is required not to cause resorption of the incisor roots against the unerupted canines.



- After eruption of the permanent canines space closure is usually straightforward. Fixed appliances are required to achieve uprighting of the incisors after space closure. Prolonged retention is usually necessary as diastemas exhibit a great tendency to re-open, particularly if there is a familial tendency, the upper arch is spaced or the initial diastema was greater than 2 mm. Alternatively, if the central incisors are narrow a restorative solution by composite or veneers can be considered.

A U- or V-shaped radiographic appearance of the interproximal bone between the maxillary central incisors is a diagnostic key to the persistent midline diastema. The patient should be informed before orthodontic treatment of the need for long-term retention with bonding of the central incisors after treatment to prevent return of the maxillary midline diastema.

If it is thought that the frenum is a contributory factor, then frenectomy should be considered. Opinions differ as to whether this should be done before treatment; during space closure; or following completion of closure of the diastema. Generally, surgical removal of a maxillary labial frenum should be delayed



until after orthodontic treatment unless the tissue prevents space closure or becomes painful and traumatized. Removal may be indicated after treatment to change irreversible hyperplastic tissue to normal gingival form and to enhance posttreatment stability.

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- Proffit WR, Fields HW, Larson BE, Sarver DM. (2019): Contemporary orthodontics 6th ed. Philadelphia: Mosby.
- Singh G. (2015): Textbook of orthodontics. 3rd ed. JP Medical Ltd.

YouTube LINKS:

Channel: www.youtube.com/c/akramadp

Spacing Lecture: <https://youtu.be/7SdALA5tYXo>

Crowding Lecture: https://youtu.be/bCgwk2pcZ_U

