

Maxillary MIDLINE Diastema

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Overview

- Introduction
- Aetiology
- Treatment

Introduction

- Maxillary midline diastemas are an **aesthetic concern** for many patients and their parents.
- The diastema seen in many children as part of normal development **in the mixed dentition**, disappears naturally in most cases as dental development proceeds.
- It may however persist either because of its width or other associated factors. If it is to be closed satisfactorily by orthodontics an understanding of the aetiology is essential

Aetiology

Aetiology

COMMON CAUSES OF A MIDLINE DIASTEMA

- Physiological (normal stage of development)
- Tooth size or shape discrepancy
- Tooth tissue/arch size ratio discrepancy
- Mesio-distal angulation of incisors
- Missing maxillary lateral incisors
- Ectopic maxillary canines
- Proclination of anterior teeth
- Abnormal labial fraenum
- Pathology

LESS COMMON CAUSES

- Hypotonic lips
- Habits (thumb/digit sucking)
- Development (supernumerary mesiodens)
- Iatrogenic e.g RME

Physiological

- Most maxillary midline diastemas in the mixed dentition appear **as a consequence of the growth** in width of the jaws in preparation for the eruption of the larger permanent teeth.
- The **maxillary unerupted permanent canines** lie superior and distal to the apices of the lateral incisor roots, and as they erupt they tend to force the lateral and central incisors towards the midline closing the space.
- In most cases a diastema **of less than 2mm** will close spontaneously unless the patient has generalised spacing of the dentition.

Physiological

- The **incidence** of diastemas varies with the age group and the race studied.
- Richardson and colleagues (1973) found the incidence at **age 14** to be **12 % in white girls, 17 % in white boys, 19 % in black girls and 26 %** in black boys.
- Popovich and colleagues (1977) found that **83 %** of patients with a diastema at 9 years old in the mixed dentition had no diastema at 16 years

Physiological



Normal developmental processes
Broadbent's 'ugly duckling' stage

Tooth size or shape discrepancy

- The most commonly presenting of these are small lateral incisors.
- The **Bolton Analysis** may be used to compare tooth size discrepancies.
- This group are the most amenable to **restorative and prosthetic solutions**
- The associated shape discrepancies most frequently seen are central incisors that are excessively triangular or have mesial surfaces that are either concave or convex.

Distal drifting of centrals and midline diastema due to peg-shaped lateral incisors



Tooth tissue/ arch size ratio discrepancy

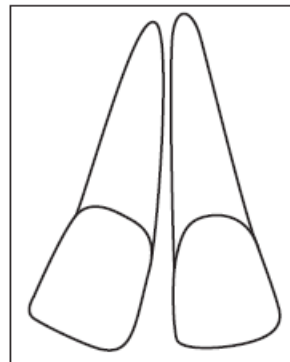
- Size discrepancy between teeth and jaws can result in **generalised spacing** in patients with otherwise good occlusions.



Mesio-distal angulation of incisors

Root convergence

- Distally inclined incisors (crowns)**
- Diastema with the space positioned towards the incisal edges of the incisors

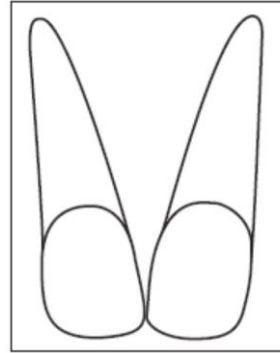


Root convergence

Mesio-distal angulation of incisors

Root divergence

- Mesially inclined incisors (crowns)
- Coronally positioned contact point
- ↓
- Gingivally placed diastema



Root divergence

Mesio-distal angulation of incisors

Root divergence

- This is often referred to as the **black triangle** and is associated with reduced papilla infill, so that in effect it is a diastema that is closed off at its incisal aspect by contact of adjacent teeth.
- Burke and colleagues (1994) in a study found that **40 % of crowded maxillary incisors** can be expected to produce a black triangular space at the midline after fixed appliance treatment unless something is done to close this space before appliances are removed and the case considered finished.

Mesio-distal angulation of incisors

Root divergence

- There is a high incidence of **concave mesial surfaces in crowded** maxillary incisors, which becomes more apparent as the teeth are decrowded orthodontically.
- Tarnow and colleagues (1992) in a study on the **effect of the distance from the contact point to the crest of the alveolar bone** on the presence or absence of an interproximal dental papilla found that:
 - When the distance was $\leq 5\text{mm}$ the papilla was usually present
 - When the distance was $= 6\text{mm}$ the papilla was present 56 % of the time
 - When the distance was $\geq 7\text{mm}$ the papilla was present 27 % of the time or less

Missing maxillary lateral incisors

- This can allow **maxillary central incisors to drift distally**.
- There are no physiological pressures placed on these teeth to close together as the canines erupt.

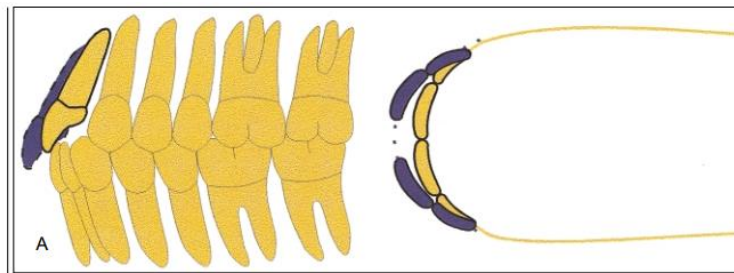


Ectopic maxillary canines

- The absence of the canines from their normal position can facilitate **distal drift and tilt of the incisors with space opening** and there is the associated lack of the physiological pressures to upright the lateral and central roots that normally closes the diastema.

Proclination of anterior teeth

- This results in **greater arch circumference** leading to anterior spacing.



Abnormal labial fraenum

- An abnormal fraenum might be defined as one exhibiting **excessive thickness** and alveolar attachment between the maxillary central incisors and apparent continuity with a **large incisive papilla**.
- A large persistent fraenum has been traditionally associated with midline diastema but the relationship between the two may have been overstated in the past.



Abnormal labial fraenum

- Edwards (1993) found a strong correlation between an abnormal fraenum, together with **vertical osseous cleft on x-ray** and the presence of a midline diastema.
- Popovich and colleagues (1977) , however, found no such relationship.
- Bergstrom and colleagues (1973) in a longitudinal evaluation of a group of 9 year olds with abnormal fraena revealed no difference in spontaneous closure whether or not a fraenectomy had been carried out.
- **There appears to be broad consensus, however, that when there is a v-shaped radiolucency ("notch") in the crestal bone, on x-ray combined with a large diastema (more than 2mm), and a thick fleshy fraenum, then a fraenectomy is indicated**

Abnormal labial fraenum

- Wide diastema with frenum extending on to incisive papilla
- Upper occlusal radiograph with V-shaped radiolucent notch on crestal bone.



Abnormal labial fraenum

Blanching of incisive papillae when pulled upward and outward



Pathology

- A **midline cyst** is a rare cause of a midline diastema in children.
- Adults, more commonly, present with spacing and diastema secondary to **periodontal disease** and bone loss.



Midline diastema due to pathologic migration of teeth.

Hypotonic lips

- Because of the **reduced lip pressure** on the labial aspect of the teeth
- In these patients the labial segments may procline and space.

Habits

- The most frequently implicated habits are **thumb, digit or soother sucking**.
- These have a tendency to procline the maxillary labial segment, which may lead to spacing and diastema in some patients.



Thumb sucking or tongue thrust
Associated with Class II
Proclined incisors
Generalized spacing

Development

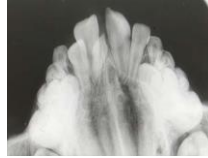
- A **maxillary midline supernumerary** is a rare cause of midline diastema in children.



Mesiodens causing rotation of the maxillary right central incisor and midline diastema

Development

- Unerupted mesiodens



- Erupted mesiodens



Iatrogenic/ Rapid Maxillary Expansion



Treatment

Treatment

- Many patients seek closure of a diastema for **aesthetic reasons, speech and following periodontal disease**
- Type of treatment will depend on the **aetiological factors**

Normal physiological development

- Diastemas of **< 2mm in nine-year-old** children generally close **spontaneously**.
- If they do not do so, small diastemas (< 2mm) can be closed with finger springs on a **removable appliance**.
- In adults with wider diastemas, **fixed appliances** are required for correction so that crown and root angulations are controlled

Tooth size or shape discrepancy

- In treatment of patients with **small maxillary laterals**, restoration of these teeth is best aided by **movement of the laterals mesially in the space** so that most of the restorative build up takes place on their distal aspect to simulate the morphology of normal lateral incisors
- Similarly, in cases where build up of **small central incisors** is also needed, **mesial crown and root movement** will facilitate restorative build up on the distal aspect for better aesthetics.
- **Tooth shape discrepancies** require modification of crown morphology. This may involve **disking of the mesial surfaces** or **restorative measures** to modify the defect

Tooth tissue/ arch size ratio discrepancy

- In those patients who have generalised spacing, **co-operation between the orthodontist and dentist** is advised so that the teeth can be positioned for maximum restorative effect.
- This may mean, for example, the **closing of some spaces and the opening of others** so that good aesthetic crown contour can be established.
- Prolonged retention is a requirement in these patients.

Mesio-distal angulation of incisors-root convergence

- Correcting this is usually a matter of **angulating the crowns and roots** optimally to eliminate the diastema

Mesio-distal angulation of incisors-root divergence

- Dramatic aesthetic and functional effects may be achieved by **moving the crown contact point gingivally**, controlling movement of crowns and roots to the optimal position.
- **The central incisor roots are uprighted towards each other**, shortening the vertical height of the gingival embrasure.
- The unsightly **black triangle can be eliminated** and papillary growth stimulated.
- **The contact point between the central incisors is orthodontically moved closer to the crest of the alveolar bone between the teeth.**

Abnormal labial fraenum

- Ideally, a fraenectomy should be carried out **at the end or near the end of orthodontic treatment**.
- It is an error to surgically remove the fraenum and delay orthodontic treatment in the hope that the diastema may close.
- Early fraenectomy may cause scar tissue that might subsequently prevent space closure.
- **Occasionally, however, the surgery may be required in the course of treatment** if the fraenum tissues become swollen and inflamed as the teeth approximate.
- Edwards (1993), in a study of patients with abnormal fraena and wide diastemas pretreatment, found **a strong potential for relapse after orthodontic closure**. His study included diastemas wider than 2mm and the mean diastema width of his sample was 3.2mm.

Abnormal labial fraenum

- Sullivan and colleagues (1996) in a study of patients with smaller diastemas (>0.9mm with a mean of 1.4mm) found that
 - The presence of abnormal fraenum combined with an intermaxillary osseous cleft to be of minor significance in long-term stability.
 - **Proclination of maxillary incisors** was the only post-retention change that showed an association with diastema relapse in their patients.
 - The key to successful fraenectomy is the removal of the interdental fibrous tissue. Because the elastic interdental fibre network does not cross the midline in these patients, the normal mechanism to keep teeth in contact is missing. To avoid relapse in fraenectomy cases, the authors prefer to bond a palatal retaining wire immediately following appliance removal. Patients should be advised of this pre-treatment.

Retention

- **A bonded palatal fixed retainer** is advisable in the majority of cases to stabilise the result post treatment.
- In wider diastemas this retention **should be permanent**.
- As with all bonded retainers patients should be instructed in **good oral hygiene**, including the use of floss threaders.
- Also its generally recommended to provide patients who have bonded retainers with **a removeable Hawley-type retainer** to be worn at night for the first few years.

Restorative treatment

- It is important to mention that there are restorative solutions to these cases **without orthodontic intervention**.
- However, restorative measures are more likely to be **appropriate in adults** and are also subject to on-going **maintenance issues**.
- **Care must be taken that the emergence profile** of any restoration is not over-contoured creating hygiene problems.
- Care must also be taken with the **crown width/length ratio**.

Restorative treatment

- Maxillary midline spacing can also be reduced or **temporarily closed with composite resin directly** on the proximal surfaces of teeth adjacent to the space without bonding agent prior to orthodontics. It may then be removed as tooth movement proceeds.
- When combined orthodontic-restorative treatment is planned, **collaboration between the orthodontist and the restoring dentist should begin at the diagnostic phase**.

Conclusion

- The orthodontic management of diastema closure is determined by the size of the diastema and the underlying causes.
- Following active treatment, retention by bonded lingual retainers is often needed in association with removable retainers.
- Any relapse of a midline diastema post-treatment is of concern to patients.