

# Management of mid-line discrepancies: A review

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## ABSTRACT

Midline deviations are a common and persistent problem that all orthodontists must face. Skeletal tissue, soft tissue, and dent-alveolar asymmetries may be present alone or in combination in a patient with no coincident midlines. A proper understanding of the etiology and the contribution of the components in midline discrepancy is very essential in proper diagnosis and treatment planning. This article discusses the different treatment strategies in the diagnosis and correction of midline asymmetries.

**Key words:** Dento-alveolar asymmetries, diagnosis, midline asymmetries, skeletal asymmetries, treatment strategies

Midline discrepancies are the common problems encountered that pose both diagnostic and treatment difficulties. Midline discrepancy may be either skeletal or dental. Sometimes functional shift of the mandible may contribute to the midline discrepancy.<sup>[1]</sup>

It is crucial to determine whether the factor that cause the asymmetry are skeletal or dent-alveolar in origin or a combination of both. Miller et al indicates that the maxillary midline is situated in the exact middle of the mouth in approximately 70% of the individuals, but the maxillary and mandibular midline coincide in only one fourth of the population.<sup>[2]</sup> Midline deviations are a common and persistent problem that all orthodontists must face. They are found in all types of cases, but perhaps are seen most frequently in Class II malocclusions.<sup>[3]</sup>

Midline discrepancy is obvious in an esthetic point of view

from the patient's perceptive and hence demands correction. This article discuss the etiology, diagnosis and the possible treatment options available in the management of midline discrepancies.

## ETIOLOGY

Midline Discrepancies can be due to one of the common etiologic factor irrespective of the type of the midline shift is

Genetics — Due to the genetic imperfections in the mechanism which was meant to create symmetry and environmental factors producing decided right and left differences.

Examples: Multiple neurofibromatosis-familial incidence associated with dominant gene, Hemifacial microsomia, Cleft lip and palate.<sup>[4]</sup>

Lundstorm classified the etiological factors as

- Genetic and
- Non genetic combination.<sup>[5]</sup>

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**Local factors**

- Early loss of deciduous teeth.
- Ankylosis of primary molars.
- Ectopic eruption.
- Congenitally missing teeth (retained primary), supernumerary teeth.
- Caries.
- Habits.
- Size of teeth.

**EVALUATION OF MIDLINE POSITION**

Maxillary midline position relative to the facial midline is stressed as an important diagnostic feature in orthodontic treatment planning. Deviation of midline structures to the right or left, such as the nose, chin, or dental midline however is not considered to be normal. In patients presenting for orthodontic treatment, the maxillary and mandibular dental midlines often are not coincident with each other or with the facial soft tissue midline. This may be because of skeletal asymmetries in which the maxilla or mandible are malposition relative to the facial skeleton, or because of dental asymmetries resulting from displacement or distortion of the upper or lower dental arches, asymmetric crowding spacing, tooth rotations or tooth size discrepancies.<sup>[6,7]</sup>

Classification of Sarver evaluates the facial symmetry under the following reference planes Nasal tip to the mid sagittal plane. Maxillary dental midline to the mid sagittal plane. Maxillary dental midline to mandibular dental midline, Mandibular dental midline to mid symphysis, Mid symphysis to the mid sagittal plane.<sup>[8]</sup>

Midlines can also be classified as Dental midline — Related to the symmetry of the dentition of the maxilla and mandible, Functional midline — Related to the functions of the stomatognathic system, Skeletal midline — Related to the symmetry of the osseous structures of the craniofacial region, Soft tissue midline — Related to the symmetry of the soft tissue of the craniofacial region.<sup>[9]</sup>

In orthodontic diagnosis the extent to which the maxillary midline deviates from the facial soft tissue midline is commonly recorded, presumably because an objective will be for the two midlines and the mandibular midline to be coincident after the treatment.<sup>[10]</sup>

The facial landmarks such as the nose, philtrum, and chin are often used as references for maxillary midline positioning, may not themselves be centered on the face or with each other. Because the location of these midline landmarks are not generally altered as a result of orthodontic treatment, it would be useful to know their relative importance for determining optimum esthetic goals for positioning of the dental midline.<sup>[11]</sup>

Arnett and Beggman noted that the philtrum is usually a reliable midline structure and can in most instances, be used as the basis for midline assessment.<sup>[6]</sup>

**DATABASE FOR DIAGNOSIS OF MIDLINE DISCREPANCIES**

In each patient an appropriate database for detection of midline asymmetries should be assembled to aid in making an appropriate diagnosis of the nature; extent; and location of the midline asymmetry. This should include a detailed facial and intra-oral examination; intra and extra oral photographs or video; dental models trimmed to centric relation occlusion; an occlusogram; a lateral cephalogram; a posteroanterior cephalogram; panoramic radiograph; and a submentovertex radiograph. The facial and intra-oral examination aids in the visualization of the facial and the dental midlines; as well as their inter-relationship.<sup>[12]</sup>

There are at least six important midlines that must be determined and these include the facial midline; the skeletal midline; the maxillary and mandibular apical base midlines; and the maxillary and mandibular dental midlines.<sup>[13]</sup>

**DETERMINATION OF TREATMENT PLAN**

The first decision in planning treatment and mechanics is the selection of a treatment midline. This midline represents the final goal. The treatment midline may coincide with either the upper or lower dental midlines or in sudden instances both upper and lower midlines may have to be moved to make them coincident with the facial midline. If the dental midlines are coincident while the upper and lower soft tissue/skeletal midlines are not and this is due to growth pathology or trauma; the determination of a treatment midline should be assessed along with surgical alternatives.<sup>[14]</sup>

Apical base midline asymmetries require careful attention during the treatment planning process, apical base discrepancies are often associated with asymmetric left and right molar occlusion. If the apical base discrepancy is up to 2.0mm; it is advisable to select either the upper or lower midline; whichever is closest to the facial midline as a treatment midline for larger apical base discrepancies; both upper and lower midlines may need correction.<sup>[14]</sup>

Apical base midline discrepancy may be present with or without tipping of the incisors if both apical base midline discrepancy and tipped incisors are involved; the treatment mechanics should make adjustments for the treatment of two separate problems.<sup>[15]</sup>

**TREATMENT STRATEGIES FOR THE CORRECTION OF MIDLINE DISCREPANCIES: DETERMINATION OF TREATMENT MECHANICS**

Appropriate use of biomechanically oriented appliances will minimize undesirable side effects the following

recommended mechanics can be used to correct midline and asymmetric molar problems.<sup>[1]</sup>

## BRACKET PLACEMENT

In patients with apical base midline discrepancies; the incisor brackets can be angulated at the time of bonding. In such a way the placement of a straight wire would change the axial inclinations of the incisors towards the desired midline this method results in tipping of the incisors.<sup>[1]</sup>

## CANTILEVERS

It is ideal for up righting tipped incisors. It can also be used to change axial inclinations in patients with apical base discrepancies. The use of cantilevers is ideal because the side effects are minimal and the application of the force is localized. The cantilever also delivers small forces due to the long inter attachment distance and a low load deflection rate.<sup>[1,16]</sup>

## ASYMMETRIC MECHANICS

Asymmetric mechanics such as retraction on only one side in extraction patients is sometimes an option used to correct midlines. The use of elastics with a continuous wire is often the most popular method to place asymmetric forces to correct the midlines. This method is satisfactory for minor midline problems restricted to tipped teeth.<sup>[2,17]</sup>

## ASYMMETRIC EXTRACTION

One creative approach for managing dental asymmetry is to extract a combination of teeth that will simplify inter-arch and intra-arch mechanics.<sup>[18]</sup>

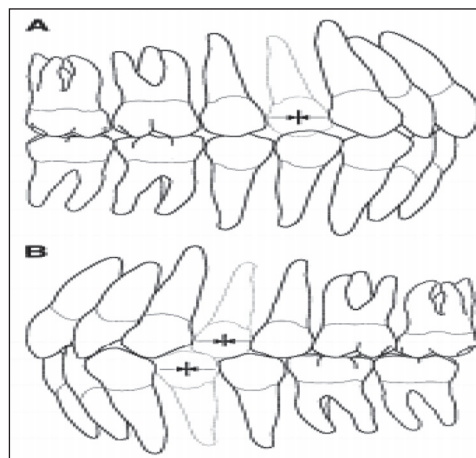
## MANDIBULAR DENTAL MIDLINE DEVIATION WITH SKELETAL SYMMETRY

Figure 1 shows Class- II sub-division malocclusion, with distally positioned mandibular molars on the class- II side, mandibular canine positioned distally on the mandible, maxillary midline coincident with the facial midline. A three premolar extraction may be the treatment of choice. The extraction of the mandibular pre-molar on the class- I side relocates the canine in a more distal position to match the contra-lateral canine.<sup>[18]</sup>

The extraction of the two upper pre-molars would maintain the maxillary midline symmetry to the facial midline. A significant benefit of such an extraction pattern would be to minimize if not obviate the dependence on inter-maxillary elastics to complete the treatment.<sup>[19]</sup>

## MAXILLARY DENTAL MIDLINE DEVIATION WITH SKELETAL SYMMETRY

Deviation of the maxillary dental midline from the facial



**Figure 1: Asymmetric extractions in Class II subdivision malocclusion with acceptable maxillary midlines can result in predominantly Class I space closure, titrated with interarch mechanics**

midline in Class- II subdivision malocclusions can be caused by multiple factors, including permanent loss of a primary maxillary second molar, leading to mesial drift of the permanent first molar on the Class- II side. A patient with a Class- II subdivision left malocclusion with minimal intra-arch crowding and maxillary midline position assessed to be deviated to the right of the facial midline. The upper left first premolar can be extracted as part of the treatment plan. A trans palatal arch can be used to supplement maxillary molar anchorage resulting in solely class- I space closure, obviating any inter arch elastics.<sup>[18]</sup>

Angle used a Class III elastic with a tandem anterior diagonal elastic in conjunction with arch expansion for the correction of midline discrepancies.<sup>[20]</sup>

Profit admits that minor discrepancies in midline coordination can be handled in the finishing stages with asymmetric Class II and Class III elastics as opposed to unilateral elastics or by using unilateral Class II or Class III intermaxillary elastics in tandem with an anterior diagonal elastic. He also notes that it is quite difficult to correct large discrepancies after extraction spaces have been closed.<sup>[20]</sup>

Alexander advocates use of a heavy anterior diagonal elastic supported by a Class II or Class III elastic, depending on whether the original malocclusion was a Class II or Class III. This is done during the finishing stages, except in an extraction case in which it may be performed during space closure if there is a significant midline discrepancy. The anterior diagonal elastic is then attached to the closing loops.<sup>[20]</sup>

Begg and Kesling states that the proper balancing of space-closing elastics coupled with appropriate Class II traction during stage II keeps the midlines coordinated with one another. One may also augment a unilateral Class II elastic, an anterior diagonal elastic, and a Class III elastic with up righting springs to “walk the teeth” and effect midline changes.<sup>[20]</sup>

Gianelly and Paul advocated a biomechanical system for midline correction with second-order bends used to move teeth on one side distally and create a space for shifting the midline. Class II and Class III elastics “enhanced” the activity of the couple force systems.<sup>[20]</sup>

Strang and Thompson introduced a double vertical spring loop assembly to move the four incisors “en masse”.<sup>[20]</sup>

Gulhane introduced an asymmetric pre-maxillary distractor for the correction of the mid-line shift in the maxillary arch.<sup>[21]</sup>

## CORRECTION OF FUNCTIONAL MIDLINE DEVIATION<sup>[22]</sup>

The functional midline shift can be corrected by:

- Unlocking the mandible.
- Removal of the occlusal prematurities.
- Expansion of the upper arch.
- Functional appliances.
- Inter arch elastics.

## SURGICAL OPTIONS<sup>[23]</sup>

- Rhinoplasty.
- Camouflaging grafting.
- Maxillary dental midline subapical procedure to rotate midlines.
- Mandibular dental midline to symphysis -Subapical procedures to rotate the mandible.
- Two or three piece maxillary expansion via Le fort I osteotomy.
- Surgically assisted maxillary expansion.

## MINI-SCREW ANCHORAGE FOR THE CORRECTION OF MIDLINE DISCREPANCIES

Mini screw anchorage can allow seemingly impossible midline discrepancies to be easily corrected without the use of compliance-dependent intermaxillary elastics or adverse side effects. The screws can be implanted either unilaterally or bilaterally, in one or both the arches, depending on the midline deviation.<sup>[24, 25]</sup>

The C-implant (Cimplant Co., Seoul Korea) is a unique titanium device that provides absolute anchorage mainly through oseointegration. This oseointegration therefore creates resistance to rotational force which will occur during torque control as in the correction of midline discrepancies.<sup>[26,27]</sup>

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