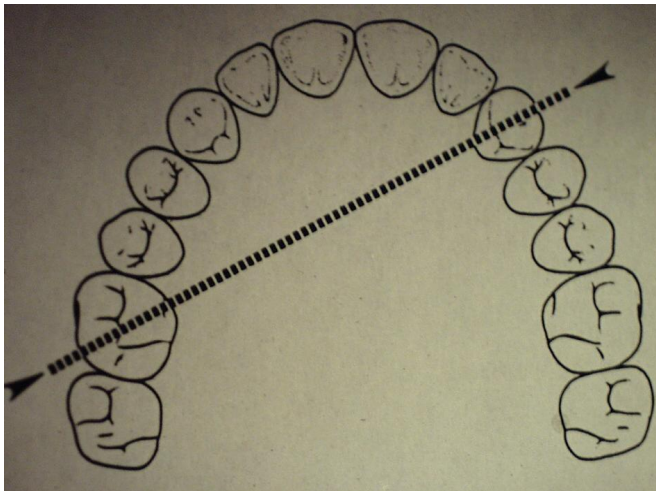


Diagnosis and treatment of mesially rotated upper 1st molars

Often, a Class II molar relationship develops because the upper 1st molars are mesially rotated. Recent studies show that mesial molar rotation exists in over 80% of Class II malocclusions (1). The importance of molar rotation in the development of Class II occlusion has been recognized for well over a century. In 1906 Angle wrote that the upper 1st molar is the key to development of good occlusion (2). Strang, the author of the 1950 edition of the Textbook of Orthodontics, writes, "Rotation of teeth often appears in the maxillary arch...and the mesio-lingual cusp on the maxillary molar resists displacement so strongly that the crown often rotates bodily around this ...root (3). In the June, 2003 issue of the Angle Orthodontist, authors Gunduz et al. described the etiology of upper molar rotation:

"The space between the buccal and lingual cortical plates becomes narrow anterior to the first-molar roots. When the upper first molar drifts mesially, the large lingual root contacts the lingual plate and allows the two buccal roots to rotate mesio-lingually. The occlusal surface of the first permanent molar is trapezoidal in shape, with the long diagonal from distolingual to mesiobuccal. Therefore, more mesio-distal space is used in the dental arch when this tooth rotates mesially with the lingual root as the axis. By correction of these rotations, one to two mm of arch length per side and partial Class II correction can be achieved. These corrections also are needed to provide good intercuspation. "(4)

Ricketts (5) proposed a method of diagnosing mesial rotation of the upper first molar. This method has been widely used for the last 30 years. To determine if mesial rotation exists, view the upper arch from the occlusal and draw a line from the distal buccal through the palatal cusp of the upper molar. That line should pass through the opposite canine.

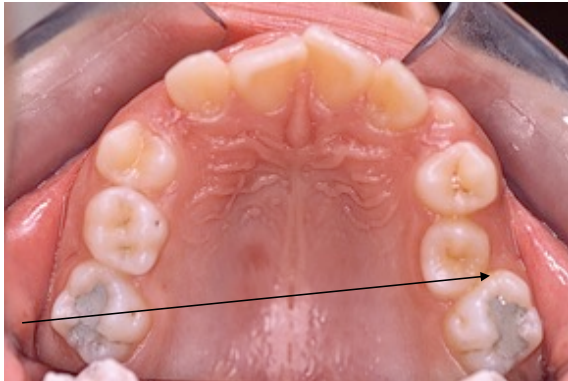


This figure shows a correctly rotated molar. The line as described by Ricketts passes through the canine on the opposite side of the arch.



Ricketts' line passes through the opposite bicuspid. The molars are mesially rotated. This results in a Class II molar relationship.



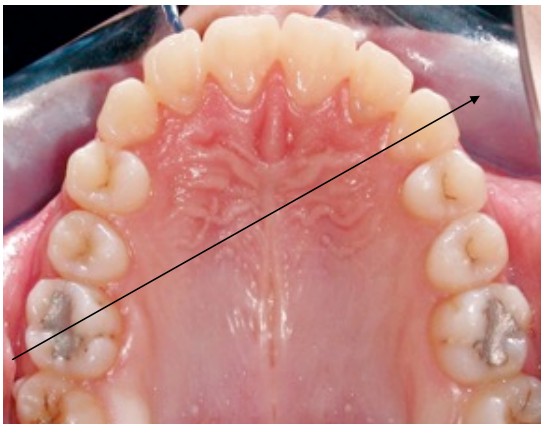


Ricketts' line passes through the opposite bicuspid. The molars are mesially rotated. This contributes to the Class II molar relationship.





Same patient after molar distal rotation has been accomplished. Ricketts' line passes through the opposite canine. The molar relationship is Class I.



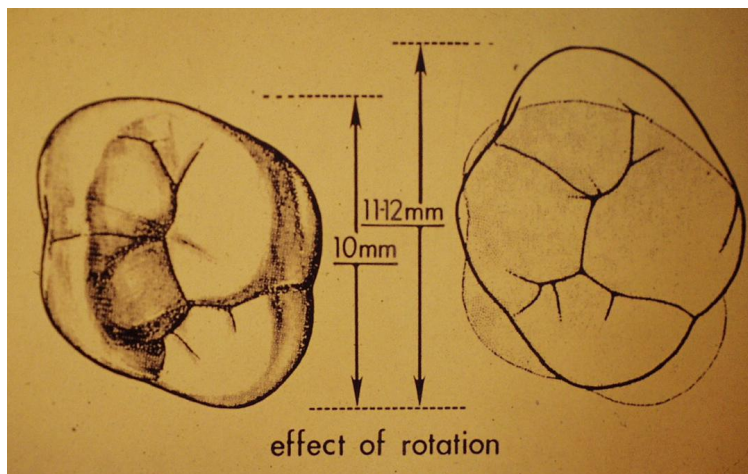
The same patient after molar distal rotation has been accomplished. Ricketts' line passes through the opposite canine. The molar relationship is Class I.

Why this is important

In normal occlusion, the palatal cusp of the upper 1st molar occludes with the central pit of the lower 1st molar. When the upper molar is mesially rotated, the palatal cusp is in a posterior position. This forces the mandible into a posterior (Class II) position. By distally rotating the molars the palatal cusp is positioned anteriorly. Upper palatal cusp/lower central fossa occlusion results in forward positioning of the entire mandibular dentition. This results in a more anterior (Class I) mandibular position. Therefore, proper molar rotation results in correction of many Class II malocclusions.

Many clinicians further encourage forward mandibular positioning by expanding the upper arch. The rationale for this is the wider maxilla will accept the mandible in a more forward (Class I) position. Expansion and distal rotation of upper 1st molars has been used to correct Class II malocclusions for over a century. Many appliances can be used to make this correction. Proper manipulation of the inner bow of a headgear has been one of the most often used methodologies. Today, since the use of headgear is declining in most treatment systems, many clinicians simply use arch wires.

There are other advantages to proper upper molar positioning. Correctly rotated molars occupy less space than do molars that are incorrectly rotated. Up to 2 mm of space per side can be gained by correctly rotating the upper molars.



Correct molar rotation (left) and incorrect rotation (right). Notice the amount of space required in each situation.

Bracket position and its effect on molar rotation

Bracket position is critical in the effort to achieve proper upper molar rotation. Whether a band or direct bond bracket is used, the position of the bracket is evaluated by viewing the bracket from the occlusal. If the most anterior portion of the bracket bisects the mesio-buccal cusp, the bracket is placed correctly. When the upper molar band fits well, the bracket is automatically placed in the correct position. Problems arise when a band that is too large is used. The most common reason for using too large a band is insufficient space for band seating. Lack of space is almost always caused by incorrect use of spacers. When the contacts are tight, the clinician is forced to “wiggle” the band through the contacts to

seat it. This is unnecessary when a correctly sized band is used. Bands that are too large result in poor bracket positioning-usually it is too distally positioned. Poor bracket positioning means that sufficient distal rotation cannot be accomplished with a straight arch wire. To ensure sufficient distal rotation, fit the bands correctly. Whether the molar bracket is bonded or banded, carefully evaluate the bracket position from the occlusal view. If the bracket is not in the correct position, reposition the band or the bonded bracket immediately.

The pictures below show an incorrectly placed band (top) and a correctly placed band (bottom).



Incorrect band position leads to incorrect bracket position. Proper molar position is impossible to attain with a straight wire.



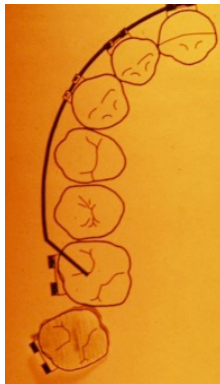
Correct band position leads to correct bracket position. A straight wire results in good molar position.

Archwire manipulation in distal molar rotation

When a patient presents with severely mesially rotated molars, good bracket position may not be enough to gain proper rotation. Toe-in bends are routinely used to correct severely mesially rotated molars. A 2X4 set-up with 30° bends mesial to the molars is an effective molar rotator. This also promotes upper arch expansion, as a toe-in close to the molar not only distally rotates the molar but also expands it by moving the crown buccally. Remember, for these mechanics to be effective, the bend must be an off-center bend. This means that the lateral segments must be bypassed (either left unbracketed or bypassed with a utility arch type bend).

Toe in close to molar

- Result-molar expansion and distal rotation
- Very useful in the correction of Class II malocclusions

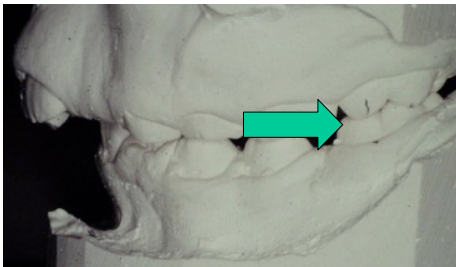


Note: the shaded molar in the picture shows the movement that the 1st molar will experience.

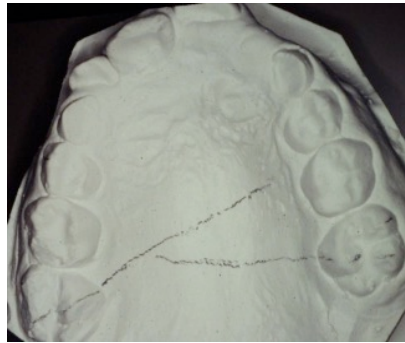
An additional benefit of lateral segment bypass is arch development. This is due to the “Frankel effect”. Frankel appliances, which were developed in East Germany immediately after World War II, correct malocclusions by upsetting muscle balance. They consist of flanges that push soft tissue away from the arches in an effort to develop the arches(6). For instance a Frankel appliance to correct a Class III occlusion has flanges in the anterior vestibule on the upper arch. These flanges push the upper lip away from the teeth. The created muscular imbalance encourages the arches to develop into the void. The “Frankel effect” has proven to be reliable, especially in young patients. When using an arch wire in an early treatment case, the wire pushes the cheeks away from the arch. This allows lateral development of the arches into the void created by the wire.

Here is an example of how distal molar rotation is used to achieve a Class I molar relationship:

Pretreatment

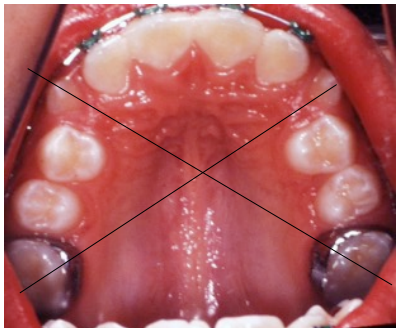


4mm Class II molar relationship



Note mesially rotated molars

After 6 months of toe-in bends
mesial to the molars



Note- molar rotation



Note- molar relationship

Toe-ins result in Class I molars.

Ready for phase 2



Treatment description:

The phase 1 treatment consisted of a 2X 4 set up in both arches. After leveling and aligning, expansion (using an expanded arch wire) and distal rotation (using bilateral toe-in bends) of the upper molars was accomplished. This corrected the ClassII molar relationship. These arch wires were kept in until the

canines and premolars erupted. At this point the patient is ready for phase 2, which consists of leveling and aligning, then using Class II elastics if necessary to correct any lingering ClassII relationship.

Because the lateral segments must be bypassed for toe-ins to be effective, this set-up is ideally suited for early treatment. Establishing the correct distal rotation of the upper molars is one of the most important benefits of early treatment. Proper rotation of the upper molars is an essential aspect of a Class I relationship. By establishing the correct molar relationship in the mixed dentition, a child's development can proceed optimally.

In conclusion, proper distal rotation of the upper 1st molar is critical in the development and maintenance of a Class I molar relationship. Mild mesial rotation can be corrected by proper bracket positioning. Severe rotations call for more aggressive intervention. Bypassing the lateral segments and using toe-in bends mesial to the molars can correct even the most severe rotations. Proper upper molar position is one of the most important features of a Class I molar relationship.

References

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- 3) Strang, R.H. : *Textbook of Orthodontics*, Third Edition, 1950.
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- 5) Ricketts RM. Occlusion-the medium of dentistry. *J Prosthet Dent* 1969; 21:39-60.
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