

# Comparison of maxillary first molar rotation in hyper and hypo divergent patients

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## Abstract

**Introduction:** The diagnosis and treatment in orthodontics is effected by the position and occlusion of the first molars in a majority of cases. This study compared the prevalence and degree of Upper 1st Molar rotation in non-treated skeletal class I patients with hypo and hyper-divergent profile.

**Material and methods:** Cephalometric radiographs and maxillary casts of 80 skeletal class I patients with all permanent dentition and with no dental anomaly were selected. These eighty casts were evaluated in two groups; hyper-divergent and hypo-divergent pattern, determined on basis of cephalometric angle (SN-MP), was measured on the cephalometric tracings of the radiographs. Molar rotation was measured manually on cast, using Ricketts line.

**Results:** There was a significant positive relationship between SN/MP and degree of molar rotation ( $r=.45$ ,  $P>.01$ ). The result of independent sample t test revealed that there is a significant difference between the occurrence of right side molar rotation and left side molar rotation ( $F=2.90$ ,  $P>.005$ ). The mean and standard deviation of right side of molar rotation was 2.39 and 0.93 respectively which is greater than left side of molar rotation 1.81 and 0.78 respectively with a significance of 0.005. It was found that mesiopalatal rotation of U1<sup>st</sup> Molar was of 85% whereas distopalatal rotation occurred in only 15% of the total sample. The one sample t test was applied which revealed that the mean difference (MD=1.150) was significant with a mean difference ( $F=28.62$ ,  $p>.01$ ).

**Conclusions:** Mesiopalatal rotation of 1st M is more common than distopalatal rotation. Molar rotation is more often found on right side of upper arch than on left side. With an increase in SN-MP angle there was increase of molar rotation in skeletal class I patients.

**Keywords:** Ricketts line; mesiopalatal rotation; distopalatal rotation

## Introduction

The diagnosis and treatment in orthodontics is effected by the position and occlusion of the first molars in a majority of cases. The

significance of their place was primarily highlighted by Angle, who highlighted that the position of the first molars in the maxillary arch are said to be the most normal in comparison to any other tooth.<sup>1</sup> Angle's definition of normal occlusion which is further reinforced by Andrew's six keys of occlusion gives us the exact position of how the upper and lower molars should come together in occlusion.<sup>2</sup> Nevertheless, his definition only described the ideal molar relationship in one plane of space and did not deliberate on rotated or tipped position of molars.

Among molars, maxillary first molar is

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mostly presented with rotation due to long palatal root either in mesiopalatal or mesiobuccal direction. According to several studies 83 to 95% patients present with rotation of first molars mesiopalataly in the maxillary arch that had Class II malocclusion.<sup>1,3,4</sup> Rotation of molar not only alters intercuspal position but also the anteroposterior relationship of dental arches.<sup>1</sup> Derotation of Upper first molar (U1<sup>st</sup> M) to obtain space in the arch, also corrects intercuspal relationship.<sup>2</sup> U1<sup>st</sup> M derotation and its relationship to get maximum intercuspation with opposing arch is one of the keys to effective orthodontic treatment.<sup>2, 7</sup> It enhances the long-term stability of orthodontic treatment outcomes because of proper interdental contact points.<sup>5</sup> The rotated U1<sup>st</sup> M requires more area in the dental arch, owing to its graphical shape.<sup>4</sup> Correcting mesiopalatal rotation of molars provides space to accommodate erupting premolar in mixed dentition.<sup>6</sup>

Orthodontic treatment may be followed by a muscular and functional adaptation.<sup>7</sup> There is a multi-dimensional relationship which exists among the masticatory muscles and developing vertical facial pattern.<sup>8</sup> Different vertical facial patterns have different facial and dental-arch widths, with brachyfacial subjects having broader facial and dental arch widths and vice versa.<sup>9</sup> Additionally strong bite forces are observed in people with low vertical pattern while weaker bite forces are observed in patients with high vertical.<sup>10</sup> The musculature is weak in high angle patients which results in less dense bone, allowing increased rate of tooth movement as well as drift and rotation of first molar following early loss of primary teeth.<sup>11,12</sup>

There are various methods that have been proposed for measuring molar rotation, among them Ricketts developed a method of drawing a line on the occlusal surfaces of the maxillary casts for normal occlusion, the line extending from the tips of distobuccal and mesiopalatal cusps of maxillary first molar on one side should pass through the mesiodistal

dimension of the canine on the opposite side of same arch.<sup>13</sup>

As the significance of diagnosing and measuring molar rotation is an extremely important part during treatment planning, this study explored the rotation of the U1<sup>st</sup> M in Class I patients with hyper and hypo-divergent profile.

## Material and Methods

The study was conducted at Orthodontics department of de'Montmorency college of dentistry/Punjab Dental Hospital, Lahore from June to August 2019. Informed consent for the use of dental casts for research was done at commencement of the treatment. Approval from the Committee of Ethics was acquired from Institutional Review Board of de'Montmorency College of dentistry/Punjab dental hospital, Lahore. After taking consent, a sample of 80 subjects with skeletal class I (having rotation of the first molars in the maxillary arch) were selected fulfilling criteria of inclusion and exclusion. The inclusion criteria of this research were patients having skeletal class I pattern, with permanent dentition present from right first molar to the first molar of the opposite side. Those with impeded molar eruption, grossly carious or restored, excessively tipped and those with various dental anomalies were not included in this study.

Eighty casts were evaluated in two groups; hyper-divergent and hypo-divergent pattern, determined on basis of cephalometric angle SN-MP, measured on tracings of the lateral cephalographs. Molar rotation was measured manually on cast, Ricketts line was used that crosses the tips of distobuccal and mesiopalatal cusps of the maxillary first molar on one side and should pass through the mesiodistal dimension of the canine on the opposite side, indicating normal molar mesiodistal position.

If Ricketts line passed mesial to mesial contact point of contralateral canine, the U1<sup>st</sup> M was considered distopalataly rotated. If Ricketts line passes distal to distal contact point of

contralateral canine, the U1<sup>st</sup> M was considered mesiopalataly rotated.

Degree of molar rotation was measured as linear distance perpendicular to adjacent contact point at one side to the Rickett's line. Greater the distance, greater will be the degree of respective rotation. The molars were assessed by one operator who marked the reference points and calculated the indicators while blinded to the cephalometric reading i.e. degree of SN-MP angle.

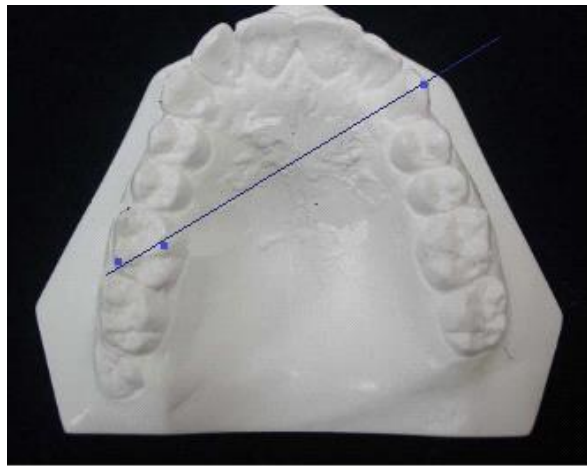


Figure: Rickett's line used for measurement of molar rotation.

## Results

After evaluating 80 casts, collected data was processed in SPSS for statistical analysis. Mean and standard deviation were evaluated by descriptive analysis. The result of Pearson Correlation showed that there is a substantial positive relationship between SN/MP and degree of molar rotation ( $r=.45$ ,  $P>.01$ ). This showed that the relationship was found to be directly proportional which means that if SN/MP increased, the degree of molar rotation also increased.

The result of independent sample t-test showed that there was a significant difference between the occurrence of right side molar rotation and left side molar rotation ( $F=2.90$ ,  $P>.005$ ).

The mean and standard deviation of right side of molar rotation was 2.39 and 0.93 respectively which is greater than left side of

**Table I: Association between Sn/MP and degree of molar rotation**

	Sn/MP	Degree of Molar Rotation
SN/MP	1	.448**
Degree of Molar Rotation		1

Note: \*\*P= 0.01

molar rotation 1.81 and 0.78 respectively with a significance of .005. The mean difference was 0.58 between prevalence of molar rotation of right and left side. Non-significant result for Levene's test showed the variance of sample which fulfill the assumption of independent sample t test.

**Table II: Mean and Standard deviation for Molar rotation**

	N	Mean	Std. Deviation	Std. Error Mean
Molar Rotation				
right	48	2.3958	.93943	.13560
left	32	1.8125	.78030	.13794

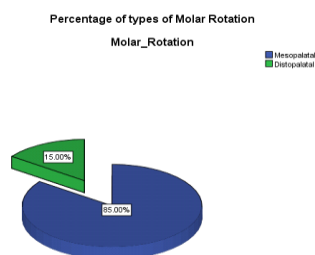
**Table III: Comparison of Molar rotation for right and left side**

	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Molar Rotation	2.906	78	.005	.58333	.20075	.18367	.98300

The percentage acquired by applying descriptive statistics revealed that there is a difference in the occurrence of mesiopalatal and distopalatal rotation. It was found that mesiopalatal rotation was of 85% whereas distopalatal rotation occurred in only 15% of the total sample. For exploring the significance of the result, one sample t test was applied which revealed that the mean difference (MD=1.150) was significant with a mean difference ( $F=28.62$ ,  $p>.01$ ).

**Table IV: Prevalence of types of molar rotation**

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Molar Rotation	28.626	79	.000	1.15000	1.07000	1.23000



## Discussion

In order to achieve the perfect occlusion there should be absolutely no rotation of any tooth in the entire dentition as presented by Andrew.<sup>2</sup> Correction of the molars should always be a part of initial leveling and alignment phase as it can cause buccal flaring of the U2<sup>nd</sup> Molars and palatal inclination of the U2<sup>nd</sup> Premolars if not done at the proper time.<sup>2</sup>

Observations made on dental casts are vital in Orthodontic diagnosis and treatment planning.<sup>12</sup> Assessment of molar rotation is one of important observation, as correcting rotation of U1<sup>st</sup> M is first step in Class II correction of almost every type.<sup>2</sup> The major effect of molar rotation is change in arch length and width due to derotation and more buccal position respectively.<sup>12</sup> Assessment of Maxillary molar rotation and its relationship with vertical facial pattern was assessed in this study. The correlation between degree of rotation on both left and right side of maxillary molars was found to be significant. As current study revealed that mesio palatal rotation of U1<sup>st</sup> M on right side is more prevalent which is quite similar to Naushad H study.<sup>12</sup>

A moderate correlation was found between degree of molar rotation and hyper-divergent pattern in our study. The anteroposterior

relationship of U1<sup>st</sup> M is highlighted in previous reports where Class II division 1 malocclusion has more mesio palatal rotation of the maxillary first molar compared to the group with normal occlusion.<sup>13</sup> Furthermore, no previous study has inspected prevalence and degree of rotation in relation to vertical facial patterns.

In this study, we found a high mesial rotation in hyper-divergent patients. Mesio palatal rotation was found to be more frequent than distopalatal rotation.<sup>15</sup> Early extraction or proximal carries of primary 2<sup>nd</sup> molar can lead to variety of consequences such as mesio palatal rotation around palatal root of the permanent 1<sup>st</sup> molar, tipping of the permanent 1<sup>st</sup> molar, crowding of dental arch and malposition of adjacent teeth.<sup>14</sup> As it is observed that due to light muscular forces in high angle individuals, 1<sup>st</sup> M can mesialise and rotate in hyper-divergent individuals.<sup>9</sup> Other aspects, which include the shape of the upper arch, the occlusal morphology and symmetry of the first molar, anatomical variability in the size and position of the canines and premolar crowns may further describe these variances more elaborately in future studies.

## Conclusions

It was concluded that Mesio palatal rotation of Upper 1<sup>st</sup> M is more common than distopalatal rotation. Molar rotation is more often found on right side of upper arch than on the left side. With an increase in SN-MP angle there was increase of molar rotation in Skeletal Class I patients.

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