

ASSESSING THE MAXILLARY FIRST MOLAR ROTATION IN CLASS 2, DIVISION I MAL OCCLUSION IN ADULT PATIENTS: A CLINICAL TRIAL

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Abstract

Objectives: The main aim and objectives of our study were to evaluate permanent maxillary first molar rotation in class II division I malocclusion in adult patients.

Methodology: We selected one hundred and fifty patients between ages 12 to 21 years, irrespective of gender. We collected Maxillary and mandibular casts of these patients. An angle was made on the photographs of study models. This angle was formed by the lines passing through the tips of the buccal cusps of the upper molars of both left and right sides to the mid palatal line respectively. The mid palatal line was identified by an anterior and posterior point along mid palatal raphe.

Results: There were 32% males and 68% females with mean±SD of age was 16.55±2.61 years. 21.3% have left side positive angles for rotation. 66.7% patients have right side positive angles for rotation. Regarding rotation of the first molar in class II division I, 118 patients (78.7%) have rotations and 32 patients (21.4%) have no rotations.

Conclusion: The individuals with class II division I malocclusion present greater mesio palatal rotation of the maxillary first molars. Molar rotation was more on the right side as compared to the left and in class II cases.

Introduction:

The relation of the maxillary first permanent molar to mandibular first permanent molar has been considered important in the description of occlusal relationships, since Angle in 1899 defined it as the "key to occlusion" [1]. After him Andrews defined "no rotations of the teeth in the dentition" as one of the six keys to normal occlusion in 1972 [2].

Angle considered the maxillary first molars because they occupy a normal position more frequently than any other tooth and their anatomical location within a fixed bone structure (maxilla) relative to the skull base [3].

In normal occlusion the mesio buccal cusp of the maxillary first molar occludes in the buccal groove of the mandibular first molar

while in Class II malocclusion the sagittal relationship is not ideal between the dental arches, with the lower arch is relatively distally placed than the upper arch to varying degrees [3]. It is observed that in Class II malocclusion there is high prevalence of mesio palatal rotation of the maxillary first molars, ranging from 83 to 95% [3]. It occurs because of early extraction or proximal carries of primary second molar [5], as well as in tooth size and jaw size discrepancy [6].

It can also occur because of mesial drifting of teeth due to attrition at interproximal contacts of teeth due to the aging process [5]. This rotation of mesial drifting of upper first molars can be clinically manifested by the lack of molar buccal offset (the facial surface is normally more prominent than the primary molar or premolars) and an end-to-end permanent molar relationship [5, 6]. This is of great clinical importance because the maxillary first molar has trapezoidal shape [7, 8], and it occupies additional space of 2 mm on the arch as it rotates in the mesio palatal direction [6].

Many investigators have studied that there was a positive correlation between the severity of Class II division I malocclusion and the magnitude of mesio palatal rotation of the maxillary first molars [3]. They also found that maxillary first molar rotation is more present on the right side as compared to the left side [5, 9]. In class II treatment derotation of rotated maxillary first molars can be done

with a trans palatal lingual arch and an auxiliary labial arch or the inner bow of a facebow [11].

The advantages of correcting maxillary first molar rotation are improvement of molar relation in the sagittal plane [12], gain in arch perimeter [4] and enhancement of long-term stability of orthodontic treatment outcomes because of better interdental contact points [4, 12].

Different studies regarding molar rotation were mainly conducted in developed countries, so we cannot conclude that the same results apply to our population, as well. Therefore, we conducted this study in our orthodontic centre as no other study has been done on molar rotation before.

Materials and Methods

Study Design:

After obtaining Hospital Ethical Committee approval and patient's informed consent, one hundred and fifty patients from orthodontic outdoor de 'Montmorency College of Dentistry/ Punjab Dental Hospital, Lahore, of 12 to 21 ages, irrespective of gender, and according to the selection criteria were randomly selected.

Maxillary and mandibular casts of these patients were collected. Photographs of maxillary plaster casts were taken with a hand-held Nikon D-5200 DSLR camera by the same individual. Photos were printed with 1:1 size models.

One angular was made on the photographs of study models. This angle was formed by the lines passing through the tips of the buccal cusps of the upper molars of both left and right sides to the midpalatal line respectively. The midpalatal line is identified by an anterior and posterior point along mid palatal raphe. The normal value is 10.3 ± 4 degrees.

Outcome variable i.e. mesiopalatal rotation was labeled as per operational definition. All data were recorded by researchers themselves to minimize bias in the study.

Data analysis:

Statistical analysis was performed with Statistical Package for Social Sciences (SPSS) version 18. Mean and standard deviation was calculated for quantitative variables, like age of patient.

Qualitative data like gender and mesiopalatal rotation as frequencies and percentage. Data was stratified for age and gender to address effect modifiers. Post-stratification Chi square test was applied taking $p\text{-value} \leq 0.05$ as significant.

Results:

This study was carried out over a period of six months. One hundred and fifty patients of rotation of maxillary first molar in class II division I malocclusion were included in our study. There were 48 (32%) males and 102 (38%) females with male to female ratio of 1:2.1 (Table 1).

Gender	n (%)
Male	48 (32)
Female	102 (68)
Male to Female Ratio	1:2.1

Table 1: Frequency & Percentage of genders

Regarding age groups, there were 62 patients (41.3%) between 12-15 years, 51 patients (34%) between 16-18 years and 37 patients (24.7%) between 19-21 years. The mean $\pm$ SD of age was 16.55 ± 2.61 years (Table 2).

Age	n (%)
12-15	62 (41.3)
16-18	51 (34.0)
19-21	37 (24.7)
Mean $\pm$ SD	16.55 $\pm$ 2.61

Table 2: Frequency & Percentage of Age

According to angles of the patients, 23 patients (21.3%) have left side positive angles, 72 patients (66.7%) have right side positive angles and 13 patients (12%) have left/right side positive angles (Table 3).

Angles	n (%)
Left +ve	23 (21.3)
Right +ve	72 (66.7)
Left/Right +ve	13 (12.0)

Table 3: Frequency & Percentage of angles

Regarding rotation of the first molar in class II division I, 118 patients (78.7%) have rotations and 32 patients (21.4%) have no rotations (Table 4).

Mesiopalatal Rotation	n (%)
Yes	118 (78.7)
No	32 (21.3)

Table 4: Frequency & Percentage of rotation of first molar in class II division I patients

When the mesiopalatal rotation of the first molar in class II division I was stratified with gender, statistically the difference between gender and mesiopalatal was found significant ($p < 0.05$) (Table 5).

Gender	Yes	No
	n (%)	n (%)
Male	32 (21.4)	16 (10.65)
Female	86 (57.3)	16 (10.65)

Table 5: Stratification of mesiopalatal rotation according to gender

When the mesiopalatal rotation of the first molar in class II division I was stratified with age, statistically the difference between age and mesiopalatal was found not significant ($p > 0.05$) (Table 6).

Age	Yes	No
	n (%)	n (%)
12-15	45 (30.0)	17 (11.3)
16-18	43 (28.7)	8 (5.3)
19-21	30 (20.0)	7 (4.7)

Table 6: Stratification of mesiopalatal rotation according to age**Discussion:**

The effectiveness of orthodontic treatment is closely related to proper therapeutic planning. In order to establish an effective treatment plan, attention must be paid to the detailed methods employed and diagnostic criteria [26].

Careful analysis of dental casts and assessment of molar rotation is very important prior to the Orthodontic treatment. The occlusal arch length and width is affected by molar rotation. It is estimated that due to mesio lingual rotation, 2mm of mesio distal arch space occupied by upper first molar increases and for 3 degrees of derotation, there is a net gain of 0.25mm arch width [27].

Maxillary molar rotation assessment and its correlation with different variables were evaluated in this study. Strong correlation was found between maxillary molar angles of rotation on left and right sides.

In this study, we took photographs of the casts for measuring the angles. Other methods used previously included manual measurements and digital measurements with scanned images [28, 29]. However, it is unlikely that a major difference exists in the measurements of each of these methods [30]. Molar rotation was also assessed in class II division 1 subjects at mixed dentition stage in another study [31]. Dental cast measurements were performed in a sample of 150 Class II Division 1 subjects (48 males and 102 females and mean age 16.55 ± 2.61 years). Subjects with Class II malocclusion in the mixed dentition present with mesial upper molar rotation in about 78.7% of the cases.

Based on the present results, the greater mesiopalatal rotation of maxillary first molars in the Class II division 1 malocclusion was confirmed. This highlights the need for careful analysis of dental casts and investigation of the involvement of molar positioning in the malocclusion.

When the rotation of molars is diagnosed, the treatment plan should be directed to this problem, which may be solved by the utilization of different appliances like headgear, trans palatal bar or even dentition distalizers that may correct the rotation of molars and reach the Class I molar relationship which is essential and desired in the orthodontic treatment.

Conclusion:

The results of our study showed that the class 2 division 1 malocclusion presented greater mesiopalatal rotation of the maxillary first molar occlusion. The diagnosis of this rotation may be helpful for a more accurate treatment planning. Class 2 division I maxillary first molar rotation was more on the right side, as compared to the left side.

Conflict of Interest: The authors declare that they have no conflicts of interest.

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