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Comparison of Second Molar Eruption Pattern in Skeletal Class I and Class III Malocclusions among 8 9 Years old Children

ROSHANAK GHAFFARI[1], ARMAN SALEHI[2] and NEGAR SALEHI[3]*

[1]Department of Oral and Maxillofacial Radiology, Dental School, Khorasgan (Isfahan) Branch, Islamic Azad University, Isfahan, Iran.
[2]Department of Operative Dentistry, Dental School, Rafsanjan University of Medical Sciences, Rafsanjan, Iran.
[3]Department of Oral Medicine and Orofacial pain, Dental School, Kerman University of Medical Sciences, Kerman, Iran.
*Corresponding author E-mail: Debonair_n@yahoo.com

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ABSTRACT

Timing and the position of second molar eruption are important factors in orthodontic therapy, which might be related to craniofacial morphology and malocclusion. This cross-sectional study was aimed to comparatively investigate the second molar position in skeletal Class I and Class III malocclusions. Pretreatment history of 60 orthodontic patients, 34 girls and 26 boys with an age range of 8 9 years, were studied. Approximately, 55% had skeletal Class I malocclusion, 23.3% had skeletal Class III malocclusion with maxillary retrognathism and 21.7% had skeletal Class III malocclusion with mandibular prognathism. Position of second molar eruption relative to the reference line and the second molar developmental stage, as well as the dental age, were determined using panoramic radiographs. Data was analyzed using chi-squared test and ANOVA. The relationship between malocclusion and Nolla developmental stage was significant ($P<0.0001$). The distance between the second molar and the reference line in Class III patients in comparison to Class I patients was significantly more occlusal. Position of maxillary and mandibular second molar eruption in Class I malocclusion in comparison to Class III malocclusion was more retrusive and more apical, which was significant on the left side. In patients with Class III mandible, the second molar had a more occlusal position on both the left and right sides.

Key words: Class I, Class III, Eruption, Molar, Malocclusion.

INTRODUCTION

Second molar eruption time is a clinically important factor, which is possibly associated with different types of craniofacial morphology and malocclusions. As the type of occlusion depends on the development and eruption of teeth in a normal eruption pattern, mandibular second molars typically erupt before the maxillary second molar[1]. Several factors can affect the normal pattern of second molar eruption. The most important environmental factor is premature extraction of deciduous molars[2]. Bjork indicated a relationship between eruption stage of teeth and arch development[3]. Vedtofte et al found an association between craniofacial morphology and eruption of the second molar[4]. Janson et al indicated that in the maturation period the eruption in patients with maxillary prognathism leads to easier eruption of the second molar[5]. Formation and eruption of maxillary teeth, especially molars, are delayed in patients with skeletal Class III malocclusion compared to those with Class I and Class II malocclusions[3]. However, there is no evidence of

relationship between the formation and eruption of maxillary teeth and skeletal pattern of maxilla, which might be useful in prediction of maxillary second molar eruption time[3]. Demirjian et al found that the correlation between skeletal maturity and dental development is quite low[6]. Since this association is not clear, racial and life style effects may have an impact on the development and pattern of tooth eruption[7]. It is expected that maxillary molars are situated in a more apical position in young patients with Class III malocclusion and retrusive maxilla compared to patients with other malocclusions. On the contrary, mandibular second molar erupts more occlusally in Class III patients with mandibular prognathism. This position is ascribed, first, to a retrusive and small maxilla and, second, to a protrusive and bigger mandible. On the other hand, there is a hypothesis that a retrusive and small maxilla my lead to a more apical position of maxillary second molars compared with mandibular second molars[6, 7].

Patients with skeletal Class III malocclusion have characteristic morphological features in the craniofacial complex, including short posterior cranial base, retrusive maxilla or protrusive mandible, large gonial angles, steep mandibular plane angle, increased lower vertical facial height, proclined maxillary and retroclined mandibular incisors[8, 9]. Sasaki *et al.,* evaluated a Japanese female population and reported that in patients with Class III malocclusion, teeth in the lower arch erupted earlier in comparison to other malocclusions[10]. Haruki *et al.,* indicated the differences between second molar eruption and calcification in Class II and Class III malocclusions, concluding that the eruption time and calcification rate in maxillary second molars were earlier than those in mandibular second molars in Class II patients. However, eruption time and calcification of mandibular second molars were earlier than maxillary second molars in Class III patients[11]. Brin et al compared second molar eruption time in Class I and Class II malocclusions and the results indicated that maxillary second molars were in a more occlusal position in Class II patients compared to Class I patients[7].

The present research was a survey of developmental stages and positioning of second molar eruption in Class III malocclusions compared to Class I malocclusion; in addition, we attempted to evaluate the theory of delayed eruption in maxillary second molars of Class III patients with maxillary retrognathism and early eruption in patients with mandibular prognathism.

METHODS

Panoramic radiographs of 60 patients (34 girls and 26 boys) in the age range of 8 9 years, with skeletal Class I malocclusion (33 patients) and skeletal Class III malocclusion (27 patients), were examined. A total of 28 samples of skeletal Class III, based on clinical profile examination and cephalometric survey, were divided into 2 groups: Class III with maxillary retrognathism as group 1 and Class III with mandibular prognathism as group 2.

Subjects with congenital anomalies, endocrine problems, dental anomalies, impacted teeth, missing teeth, supernumerary teeth, abnormal eruption of teeth, macrodontia, microdontia, mesial or distal restorations of the first permanent molar, extensive caries, open bite, abnormal horizontal or vertical eruption pattern, premature extraction of deciduous teeth, low quality of panoramic radiographs were excluded from the study.

The patients were categorized into skeletal Class I and Class III based on ANB angle as measured on lateral cephalograms. To differentiate between the two skeletal entities, patients with negative ANB angle were defined as skeletal Class III and those with 2d”ANBd”4 were categorized as Class I .

The skeletal Class III malocclusion cases were divided into 2 groups based on clinical profile examination and comparison of SNA and SNB: Class III with maxillary retrognathism and Class III with mandibular prognathism.

Class III malocclusion with maxillary retrognathism was defined as patients with SNA≤80 and SNB >78.5 and Class III malocclusion with mandibular prognathism was defined as patients with SNA≤83.5 and SNB not greater than 83.5 [2].

Dental age was determined based on developmental stages of root formation, erupted teeth in the oral cavity, number of erupted and non-erupted teeth, root formation, and Nolla developmental stage by analyzing panoramic radiographs. Then the eruptive position of the second molar was determined based on panoramic radiographs. The following steps were carried out under the supervision of a radiologist based on panoramic radiographs:

1. The most prominent points on the distal aspect of first molars were marked and connected in each jaw to produce a maxillary and a mandibular reference line.
2. The mesio-distal midpoint of the second molar crown was determined by bisecting the distance between the most prominent mesial and distal point on the crown contour and by drawing a vertical line from this point to the reference line for determining the distance of eruption position.
3. By using these landmarks and reference lines, the distance between the second molar and its corresponding reference line was measured in millimeters. Positive measures were used for occlusal positions and negative measures for apical positions (Fig. 1) [2, 7]. The records of 20 patients were randomly chosen for repeated measurements and re-evaluation, which did not reveal any significant differences (P>0.05).

Chi-square test, independent t-test and ANOVA were used for analysis of data with SPSS. The Chi-square test was used to analyze the correlation between the second molar developmental stages and the malocclusion type in the maxilla and mandible; ANOVA was used to compare the distances (position of second molar eruption). Duncan test was used to measure the distance between the mandible and the maxilla on the left side because the P-value of ANOVA test was significant (P<0.05).

RESULTS

The distribution of patients by chronologic and dental age and gender is shown in Table 1. The range of chronologic age in various groups was 8 9 years and according to dental age it was 4 7 in the upper arch and 3 8 in the lower arch.

The means of chronologic and dental ages in the upper and lower arches were somewhat more advanced in girls than in boys. Results of independent t-test were not statistically significant;

Table 1: Mean of chronologic age and dental age in boys (26) and girls (34)

	Maximum	Minimum	SD	Mean	Maximum	Minimum	SD	Mean
Chronologic age	9	8	0.4	8.3	9	8	0.35	8.6
Dental age in the maxilla	7	4	0.9	5.3	7	4	0.7	5.7
Dental age in the mandible	8	3	1.2	5.1	8	3	1.2	5.7

Table 2: Comparison of second molar crown midpoint distance to the reference line in the maxilla

Malocclusion Second molar	Class I		Class III with retrusive maxilla		Class III with protrusive mandible	
distance to the reference line (mm)	Right molar	Left molar	right molar	Left molar	Right molar	Left molar
Mean ± SD	10.8±2.5	11.1±2.8	9.8±2.02	9.5±2.3	10.2±1.4	9.9±1.6
Minimum	6.8	6.5	6.3	5	7.8	7.3
Maximum	17.9	19.2	12.5	12.5	4.5	12.2

therefore, they were considered as one group for further evaluations (P=0.12 for chronologic age, P=0.52 for dental age in the upper arch and P=0.6 for dental age in the lower arch).

Chi-squared test indicated a significant relationship between malocclusion type and developmental stage of the second molar in the upper and lower arches; in other words, malocclusion type affects the dental age (P=0.02 for the upper arch, P=0.007 for the lower arch).

ANOVA showed a relationship between malocclusion type and the mean position of second molar eruption in the maxilla and mandible. According to Table 2, the mean distance of the midpoint of the second molar crown on the right side to the reference line in the maxilla was longer in Class I compared with Class III malocclusion with maxillary retrognathism and Class III malocclusion with mandibular prognathism; however, the differences were not statistically significant (P=0.15).

In addition, based on Table 2 the mean distance of the second molar crown midpoint on the left side to the reference line in the maxilla was not equal in all the three groups (P=0.04); meanwhile, Duncan test indicated that the mean distance of the second molar crown midpoint on the left side to the reference line in Class I malocclusion was significantly greater than that in the two other groups (P<0.05); however, it was not significantly different between the two other groups.

According to Table 3 the mean distance of the second molar crown midpoint on the right side to the reference line in the mandible was not equal in all the three groups (P=0.002). Duncan test showed that in Class I patients the mean distance of the second molar crown midpoint on the right side to the reference line in the mandible was significantly more than that in the two other groups (P<0.05); however, in the two other groups the difference was not significant (P>0.05). In addition, the mean distance of the second molar crown midpoint on the left side to the reference line in the mandible was not equal in the three groups (P=0.01). Duncan test indicated that the mean distance of the second molar crown midpoint on the left side to the reference line in the mandible was significantly more than that in the two other groups (P<0.05); however, the difference was not significant between the two other groups (P>0.05).

Table 3: Comparison of second molar crown midpoint distance to the reference line in the mandible

Malocclusion Second molar	Class I		Class III with retrusive maxilla		Class III with protrusive mandible	
distance to the reference line (mm)	Right molar	Left molar	right molar	Left molar	Right molar	Left molar
Mean ± SD	5±1.3	4.8±1.4	3.7±1.4	3.6±1.4	3.5±1.3	3.8±1.4
Minimum	2	2.1	1	1.6	1	2.5
Maximum	7.8	8	6	6.3	6	0.8

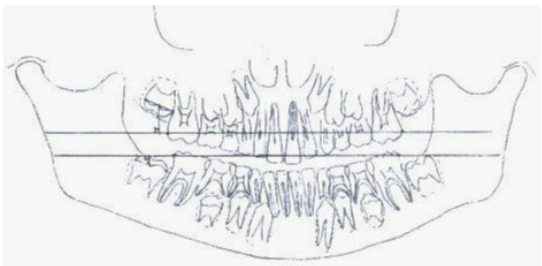

Fig. 1: Schematic representation guidelines used by calculating the eruption of the second molars

DISCUSSION

The timing and positioning of second molar eruption are important clinical factors in orthodontic patients. In some orthodontic treatments the patients with asymmetric arch need arch growth and also a guided eruption pattern of teeth[12].

Our findings showed that the position of second molar eruption in Class I malocclusion compared to Class III was more apical and more retrusive. While the difference was significant on the left side, it was not significant on the right side. In Class III malocclusion with mandibular prognathism the results indicated that the distance of the midpoint of the second molar of the lower arch on the right and the left sides to the reference line was less than that in skeletal Class I malocclusion; in other words, it was more occlusal and erupted earlier.

Lo et al reported that the eruption of maxillary second molar before the mandibular second molar is indicative of Class III malocclusion. Although there was an apical position of the second molar in the mandible of Class I patients, there was an increase in occlusal positioning of the second molar in Class III patients[13]. Therefore, the data supported reports by Lo et al about mandibular second molar, but the results of the present study did not support findings reported by Suda et al on maxillary second molar because second molar eruption in patients with maxillary retrognathism was delayed in comparison to the control group (Class I) in that study[3].

Haruki *et al* reported differences between second molar eruption and calcification in Class II and Class III malocclusions, indicating that the eruption time and calcification rate in maxillary second molars were earlier than those in mandibular second molars in Class II patients, while eruption time and calcification of mandibular second molars were earlier than those in maxillary second molars in Class III patients[11].

Sasaki et al in their study on a Japanese female population found that in patients with Class III malocclusion teeth in the lower arch erupted earlier in comparison to other malocclusions[10].

Brin et al compared second molar eruption time in Class I and Class II malocclusions and the results indicated that maxillary second molars in Class II patients were in a more occlusal position in comparison to Class I patients[7].

Khojastepour et al supported findings reported by Brin and indicated a more apical position of mandibular second molars in Class II patients with mandibular retrognathism compared to Class I patients[2].

Contrary to the findings reported by Heravi et al about11 12 year-old patients with Class I, Class II and Class III malocclusions, there were no significant differences between the second molar distance to the occlusal plane in the upper and lower arches and on the left or the right sides of the jaw[14].

In the present study except for the maxillary right side, in other parts there was a significant difference between second molar distances to the reference line in Class I in comparison to Class III malocclusion . This difference might be attributed to different age ranges (8 9 range in this study) and racial and geographic differences.

These findings indicate that the position of second molar eruption in the upper arch of Class I malocclusion is more apical than that in Class III malocclusion. There were no significant differences on the right side. In the lower arch of Class III patients with mandibular retrognathism, the second molar was in a more occlusal position and had an earlier eruption in comparison to skeletal Class I. These findings can be used in developing alternative treatments based on non-pharmaceutical agents for the treatment of musculoskeletal disorders of occlusal plane[14, 15].

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