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Relationship between Facial Parameters and Third Molar Impaction in Various Sagittal Malocclusions - A Radiographic Study

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Abstract

Introduction: The mandibular third molar impaction is due to the inadequate space between the distal of the second mandibular molar and the anterior border of the ascending ramus of the mandible.

Aim: To correlate the facial parameters with mandibular third molar impaction in various sagittal skeletal malocclusions.

Materials and Method: 100 Panoramic and lateral Cephalometric radiographs were included. The sample was then divided into 2 groups as Group 1 (N=49, Skeletal Class I malocclusion) and Group 2 (N=51, Skeletal Class II malocclusion). Third molar impaction was classified on the basis of winter's classification. Various skeletal facial parameters were recorded for both the groups and analyzed statistically.

Result: The mean value of Mandibular corpus length, Gonial angle and Ascending ramus length was increased in Group 1 than in Group 2 and was found to be statistically non-significant (p=0.25), (p=0.85) and (p=0.78) respectively whereas Occlusal plane angle and facial axis was found to be increased in Group 2 than in Group 1 and was found to be statistically non-significant (p=0.59), (p=0.80). When Winter's classification was compared between Group 1 and Group 2 it was found than Group 1 had increased Mesioangular impactions with 85.7% prevalence and Group 2 had Horizontal impactions with 14.2% and were found to be statistically non-significant. Further, regression model analysis predicted that the degree of correlation was very less (R=0.1) when winters classification was correlated with facial parameters.

Conclusion: Skeletal parameters did not affect the eruption of mandibular third molars.

Keywords: Third molar impaction; Class I and Class II Skeletal jaw bases; Winter's Classification; Skeletal parameters

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Introduction

The word impaction is originated from the Latin word "impact" means organ or structure, which because of an abnormal mechanical condition has been prevented from assuming its normal position. William stated impacted tooth as one which is completely or partially unerupted and is positioned against another tooth, bone, or soft tissue so that its further eruption is unlikely [1].

Failure of the wisdom tooth in the lower jaw to erupt completely is usually associated with lack of space in the alveolar arch, between the second molar and the ascending ramus. Insufficient space, therefore, has been considered the main cause of impaction [2]. It is hypothesized that during human evolution the jaw size has decreased more rapidly than the size of teeth and therefore, an increased impaction of third molars as last erupting teeth occurred. A similar observation was noted in craniodental allometric analysis of monkeys, where smaller craniums and jaw sizes were discussed to lead to third molars being crowded out of the jaws into an evolutionary loss. This crowding out was associated with a shortening of the face and the mandible. Even though dental eruption sequence may also be conserved phylogenetically in primates, it has been suggested that the dental eruption sequence could also be related to body and brain size [3]. Impaction is more common in the mandibles than in the maxilla, and its prevalence is higher in females. If third molars are not impacted, they erupt between the ages of 17 and 21 years. Inadequate retromolar space was found to be an important etiological factor for mandibular third molar impaction. Lack of retromolar space is due to an insufficient amount of mandibular growth. The prevalence of their impaction is highly variable and generally reported to be between 16.7 and 73.82% [4].

There are many causes of mandibular third impactions such as inadequate spacing, reduced mandibular growth, inadequate mandibular length, and varied facial growth. A short mandibular length is thought to be another etiologic factor in mandibular third molar impaction [5]. Broadbent believed that when a third molar became impacted, it was due to an inability of the mandible to achieve its full growth potential [6]. Forsberg demonstrated that failure of eruption and degree of arch crowding were proportional [7]. Patients with skeletal class II showed high probability of M3M impaction because they recorded a smaller mandible with more acute gonial angle [8]. Various studies have shown that in the subjects in Skeletal class I as well as those of the short face group, the mesioangular position was the most frequent position, followed by horizontal, vertical, and distoangular positioning while as in the patients in Skeletal class II, the mesioangular position had the highest prevalence, followed by horizontal, distoangular, and vertical positions [9].

Aim and Objectives

Correlation of facial parameters with third molar impaction in Skeletal Class I and Class II malocclusions in District Solan population.

Materials and Method

100 pre-treatment panoramic and lateral cephalometric radiographs were retrieved from the archived records of the department of orthodontics and dentofacial orthopedics of Bhojia Dental College and Hospital, Baddi, H.P. The sample was divided into 2 groups on the basis of skeletal system of Classification. Group I (n=49, Skeletal Class I) Group II (n=51, Skeletal Class II) (Table 1).

All the lateral cephalograms were traced by the same operator manually. Various l and marks were identified and marked on lateral cephalograms (Table 2, Figure 1).

Various facial parameters were recorded (Table 3, Figure 2).

Third molar impaction was classified on the basis of Winter's classification.

Table 1: Grouping of sample.

Group 1 (N=49)	Group 2 (N=51)
Skeletal Class I	Skeletal Class II

The parameters were then measured for both the groups and values so obtained were subjected to statistical analysis (Figure 3).

Statistical Analysis

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) (Version 15) statistical analysis software. Mean, standard deviation was calculated. The independent T-test was applied to test the significance of means between two groups.

Results

The study consisted of 100 subjects grouped into Skeletal Class I (N=49) and Skeletal Class II (N=51), which were selected irrespective of gender. Various facial parameters were recorded and Winter's classification was calculated for both the groups. The values so obtained were subjected to statistical analysis. Mean standard deviation and comparisons were made and depicted in (Table 4).

When facial parameters were compared between Group 1 (Skeletal Class I) and Group 2 (Skeletal Class II) it showed that the mean value of facial axis was decreased in Group 1 (88.36 ± 5.37) than in Group 2 (90.51 ± 7.51) and was found to be statistically non-significant (p=0.08). The mean value of Mandibular corpus length was increased in Group 1 (58.54 ± 5.87) than in Group 2 (57.29 ± 4.96) and was found to be statistically non-significant (p=0.25). The mean value of Occlusal plane angle was found to be increased in Group 2 (14.37 ± 4.76) than in Group 1 (13.95 ± 3.09) and was found to be statistically non-significant (p=0.59). The mean value of Gonial angle in Group 1 (124.13 ± 6.43) was increased than in Group 2 (123.88 ± 6.72) and was statistically non-significant (p=0.85). The mean value of ascending ramus length was found to be increased in Group 2 (46.54 ± 4.54) than in Group (46.30 ± 4.79) and was statistically non-significant (p=0.78).

When winter's classification was compared between Group 1 and Group 2 it was found that Mesioangular impactions (Class IV): Was increased in Group 2 with 88.3% (45) prevalence than in Group 1 with 85.7% (42) and it was found to be statistically non-significant (p=0.70). Whereas Horizontal impactions (Class II) was found to be increased in Group 1 with 14.2% (7) prevalence than in Group 2 with 11.7% (6) and was found to be statistically non-significant (p=0.70) (Table 5).

According to the independent t test (Table 6), no facial parameters were found to be statistically non-significant according to the mandibular 3rd molar impaction.

Table 2: Cephalometric landmarks used for the study.

Parameters	Definition
Nasion (N)	The most anterior point on the frontonasal suture in the midsagittal plane.
Menton (Me)	The lowest point the symphyseal shadow of the mandible seen on the lateral cephalogram.
Pogonion (Pog)	The most anterior point on the chin.
Gonion (Go)	A point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible.
Anterior Nasal Spine (ANS)	The anterior tip of sharp bony process of maxilla in the midsagittal plane.
Posterior Nasal Spine (PNS)	The most posterior point at the sagittal plane on the bony hard palate.
Gnathion (Gn)	A point located by taking the midpoint between the anterior (Pogonion) and inferior (Menton) points of the bony chin.
Point A (Subspinale)	The most posterior midline point in the concavity of the maxilla between the ANS and the prosthion (the most inferior point on the alveolar bone overlying the maxillary incisors.
Orbitale (Or)	The lowest point on the inferior rim of the orbit.
Porion (Po)	The superior point of the external auditory meatus (the superior margin of the temporomandibular fossa, which lies at the same level, may be substituted in the construction of Frankfort horizontal plane (Bilateral).

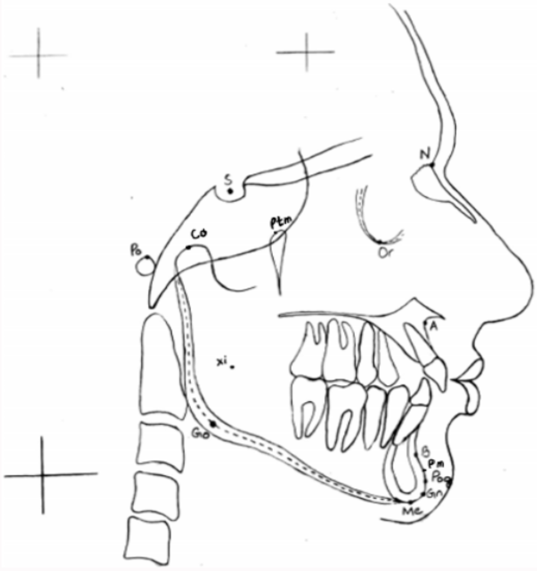

Figure 1: Cephalometric landmarks used in the study.

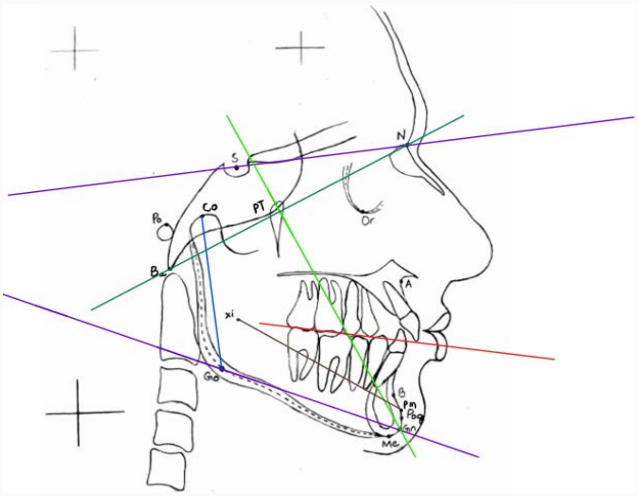

Figure 2: Facial parameters used in the study.

When winters classification was correlated with the facial parameters it was found that the degree of correlation was very less (R=0.1) as the dependent variables (winter's classification) were statistically non-significant (p=0.80) (Table 7).

Discussion

The third molars are the most frequently impacted teeth. Impacted teeth are a common problem affecting 18% to 32% population in world. The most common reason of impaction of the third molars is to be the last teeth and not enough space to continue. With the increasing need for orthodontic surgery, consensus is needed for the relationship of third molar with anatomical structures. In order to determine the appropriate treatment method of impacted teeth, to prevent complications that may occur during, or after treatment, the positions of impacted teeth in the jaw should be evaluated in detail with their adjacent anatomical structures [10]. This study was performed on pre-treated lateral cephalogram and orthopantamographic radiographs from 100 patients were retrieved from the archived records of the department of orthodontics and dentofacial orthopedics in Bhojia Dental College and Hospital. The sample was then divided into 2 groups on the basis of Skeletal system of classification as Group 1 (N=49, Skeletal Class I) and Group 2 (N=51, Skeletal Class II). Third molar impaction was classified on the basis of Winter's classification. Various skeletal facial parameters were recorded (facial Axis, Mandibular Corpus Length, Mandibular Plane Angle, gonial Angle and Occlusal Plane Angle) for both the groups and analyzed statistically. Since, Ledyard concluded that further growth in the retromolar area was negligible after 17 years of age [11], all the samples in this study were above the age of 17 years.

When facial parameters were compared between Group 1 and Group 2 it showed that the mean value of facial axis, occlusal Plane angle and ascending ramus length were increased in Group 2 than in Group 1 and were found to be statistically non-significant. Whereas, the mean value of mandibular corpus length and gonial angle were increased in Group 1 than in Group 2 and were found to be statistically non-significant. In case of mandibular impactions, it was found that Skeletal Class II had increased prevalence of mesioangular impactions and was statistically non-significant when compared between groups. Studies by Quek et al. also shows mesioangular impactions as the most prevalent (51%) [12]. However, the current study's result differs from studies published by Reddy and Prasad who found that vertical impaction was the most common type of third molar impaction [13]. Richardson ME in a longitudinal study of a group of 95 subjects observed that skeletal Class II cases, with a shorter in length, narrower in width and more acute angled mandible, were more prone in third molar impaction. There was also a reduced amount of mandibular growth in cases with impacted third molars, which also had a tendency, although non-significant, to be relatively larger in size. The developmental initial mesial angulation

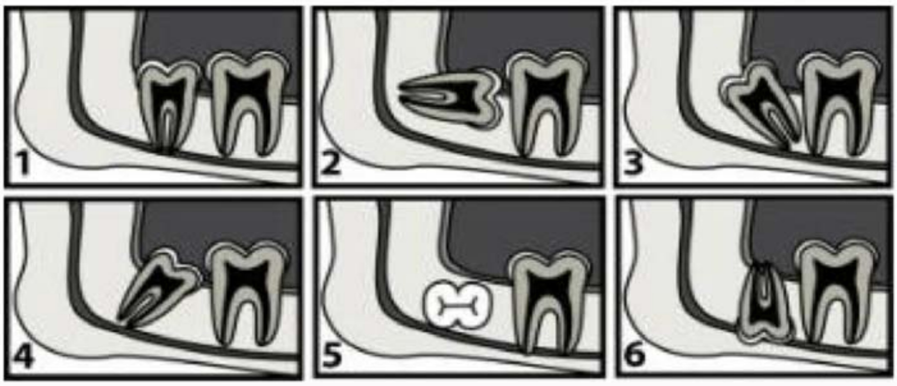

Figure 3: Third molar impaction classified on basis on winter's classification.

Table 3: Facial parameters used in the study.

Facial Axis	It's the angle formed between Basion-Nasion plane and Foramen Rotundum- Gnathion plane.
Mandibular Corpus Length	It's the length of the mandibular body measured from the xi point and to the anterior point on the mandibular symphysis.
Ascending Ramus Length	It's the distance between the Gonion and the Mandibular Condylion.
Occlusal Plane Angle	It's the angle formed between the occlusal plane (Line passing through the cusps of posterior teeth) and Sella-Nasion plane.
Gonial Angle	It's the angle formed between the articulare-gonion plane and gonion- menton plane.

Table 4: Comparison of facial parameters between the two groups.

Skeletal Classification	Facial Parameters	Mean ± SD	P Value
Group 1 (Skeletal Class I)	Facial Axis	88.36 ± 5.37	0.08
Group 2 (Skeletal Class II)		90.51 ± 7.51	
Group 1 (Skeletal Class I)	Mandibular Corpus Length	58.54 ± 5.87	0.25
Group 2 (Skeletal Class II)		57.29 ± 4.96	
Group 1 (Skeletal Class I)	Occlusal Plane Angle	13.95 ± 3.09	0.59
Group 2 (Skeletal Class II)		14.37 ± 4.76	
Group 1 (Skeletal Class I)	Gonial Angle	124.13 ± 6.43	0.85
Group 2 (Skeletal Class II)		123.88 ± 6.72	
Group 1 (Skeletal Class I)	Ascending Ramus Length	46.30 ± 4.79	0.78
Group 2 (Skeletal Class II)		46.54 ± 4.54	

Note: Non-significant comparison of facial parameters between the Group 1 and Group 2

Table 5: Comparison of Winter's classification between the two groups.

GROUPS	Winters Classification			
	Class II (%)	Class IV (%)	N	P value
Group 1 (Skeletal Class I)	7 (14.2%)	42 (85.7%)	49	0.7
Group 2 (Skeletal Class II)	6 (11.7%)	45 (88.3%)	51	

Note: Non-significant comparison of Winter's classification between the two groups

of third molars in relation to the mandibular plane was also increased in subjects with impacted third molars [8]. Studies by Björk et al. suggested that a short mandibular length as seen in Skeletal Class II patients predispose to mandibular third molar impaction. The small mandibular length in these subjects that may have limited the up righting of third molars during development. These studies were in concordance to our study which also has short mandibular length in skeletal class II subjects with increased prevalence of impaction [2]. Ades et al. after studying the data from cephalometric radiographs and study models from 97 patients, found no significant differences in mandibular growth between those who had impacted or fully erupted mandibular third molars [14].

Further, in our study Winter's classification was correlated with facial skeletal parameters and it was found that mean value of facial axis, mandibular corpus Length and Ascending ramus length were increased in Horizontal impaction cases than in Mesioangular impaction cases and it were found to be statistically non-significant. The mean value of Gonial Angle and Occlusal Plane Angle were increased in mesioangular impaction cases than in Horizontal impaction cases and were found to be statistically non-significant. A study conducted by Demirel O found that no statistically significant difference was observed between angulations of third molar impaction and gonial angle which was in concordance with our study [15]. However, study by Behbehani et al. was not in same line who stated that patients with lower gonial angle values have higher risk of third molar impaction [16]. Kaplan RG [17], and Dierkes [18], in their study did not show significant differences in mandibular length between subjects with impacted and erupted third molars which was seen in our study also. However, study carried out by Breik O, Grubor D [19], and concluded the incidence of mandibular third molar impaction is greater in patients with a facial axis angle that is <87. Another study carried out by Bjork et al. noted that in cases of mandibular third molar impaction, the alveolar arch space behind the second molar was reduced in 90% of cases. It was also demonstrated

Table 6: Relationship of Winter's classification and facial parameters using independent t test.

Winter's Classification	Facial Parameters	Mean ± SD	T Value	F value	P Value
Class II (Horizontal)	Facial Axis	89.76 ± 4.49	0.194	0.218	0.84
Class IV (Mesioangular)		89.39 ± 6.68			
Class II (Horizontal)	Mandibular Corpus Length	58.53 ± 6.76	0.415	3.875	0.67
Class IV (Mesioangular)		57.86 ± 5.27			
Class II (Horizontal)	Occlusal Plane Angle	13.07 ± 3.14	-1.044	0.64	0.29
Class IV (Mesioangular)		14.32 ± 4.13			
Class II (Horizontal)	Gonial Angle	121.84 ± 8.70	-1.298	0.847	0.19
Class IV (Mesioangular)		124.37 ± 6.18			
Class II (Horizontal)	Ascending Ramus Length	47.15 ± 5.55	0.581	1.327	0.56
Class IV (Mesioangular)		46.34 ± 4.54			

Note: Non-significant association in correlating Winter's classification with facial parameters

Table 7: Correlation between facial parameters and Winter's classification using regression model analysis.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.155	0.024	-0.028	0.68534

Model	Sum of Squares	Df	Mean Square	F	P Value
Regression	1.089	5	0.218		
Residual	44.151	94	0.47	0.464	0.80
Total	45.24	99			

	Unstandardized Coefficients		Standardized Coefficients	T Value	P Value
	B	Std. Error	Beta		
Constant	2.25	2.154		1.045	0.29
Facial Axis	0	0.011	0.003	0.028	0.97
Mandibular Corpus Length	-0.003	0.013	-0.026	-0.239	0.81
Occlusal Plane Angle	0.013	0.019	0.079	0.702	0.48
Gonial Plane Angle	0.012	0.011	0.114	0.067	0.28
Ascending Ramus	9.03E-05	0.016	0.001	0.006	0.99

Note: The degree of correlation was very less (R=0.1)

that the space necessary for the third molar was diminished by three separate skeletal factors. These are a short mandibular length, vertical direction of condylar growth, and by backward directed eruption of the dentition [2]. Hassan AH in a retrospective cephalometric study of 121 Saudi patients concluded that third molar impaction was more likely to occur when the retromolar space is inadequate. The latter was attributed to different skeletal and dental features, including an increased width of the mandibular ramus and a backward rotation of the posterior teeth [20].

Thus, in our study when Winter's classification was correlated with the facial parameters it was found that the degree of correlation was very less (R=0.1)

Conclusion

- Comparison of facial parameters between Skeletal Class I and Class II did not show any significant difference.
- Comparison of Winter's classification between Skeletal Class I and Class II did not show any significant difference with Mesioangular impactions prevalence found to be increased in Skeletal Class II malocclusion.
- When winter's classification was correlated with facial skeletal parameters, the degree of correlation was very less (R=0.1).

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