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An Assessment on the Impact of the Effective Length of Mandible on Retromolar Space

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Keywords
Retromolar Space, mandible, effective length.

Abstract
An impacted tooth is a tooth that fails to take its functional position in the dental arch during eruption period. Impaction most frequently occurs in lower third molars The deficiency of the space between the anterior border of the ramus and the distal surface of second molar (retromolar) is indicated as the main local factor that prevents the eruption of third molars. The purpose of our study is to assess the correlation between retromolar space, which is the factor that has the greatest impact on the eruption pattern of lower third molars, and the effective length of the mandible
127 patients, who applied to Istanbul Aydın University Faculty of Dentistry Orthodontic Clinic between 2016-2018, were included in our study. The retromolar was measured area via panoramic radiograph, and recorded. The obtained records were compared to the mesiodistal size of the third molars, and sufficiency of the retromolar space was classified. No statistically significant difference was found between the effective length of mandible and the retromolar space ($p>0.05$). In conclusion, more studies need to be carried out that assess and compare numerous factors including the findings of our study to establish the factor or factors affecting the retromolar space, which is considered to be the main determining factor of the eruption pattern of mandibular third molars

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1. Introduction

An impacted tooth is a tooth that fails to take its functional position in the dental arch during eruption period. Impaction most frequently occurs in lower third molars (Shokri et al. 2014). Lower third molars differ in shape, size and eruption time from other teeth (Shokri et al. 2014). There are multiple local and systemic factors affecting lower third molar teeth eruption into the dental arch, which occurs between the ages of 14 and 24 (Sapkota 2017). Diseases and syndromes that affect bone development can be given among the systemic factors (Kruger et al. 2001). The local factors include space deficiency, third molars differing from other teeth in terms of shape and size, and local pathologies (Kruger et al. 2001, Hattab and Alhaija 1999). The deficiency of the space between the anterior border

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of the ramus and the distal surface of second molar is (retromolar space) indicated as the main local factor that prevents the eruption of third molars. The retromolar space, on the other hand, is affected by multiple factors (Breik and Gruber 2008). These factors are the transverse bone width of the mandible, the effective length of the mandible, and the transverse development of the condyle. The purpose of our study is to assess the correlation between retromolar space, which is the factor that has the greatest impact on the eruption pattern of lower third molars, and the effective length of the mandible.

2. Material-Method

127 patients, who applied to Istanbul Aydın University Faculty of Dentistry Orthodontic Clinic between 2016-2018, were included in our study. The inclusion criteria for our study were presented to the patients.

The inclusion criteria are as follows:

- Volunteers must be between the ages of 19-32
- No history of orthodontic treatment or surgery
- No history of any systemic diseases or syndromes that affect the jaw-face development
- No loss in bilateral lower third molars
- No history of tooth loss or extraction
- Cephalomeric and panoramic radiographs being clear enough to allow monitoring of the entire dentition
- No local factors that lead to the impaction of the lower third molars

The space between the mandibular second molar and the anterior border of the ramus was measured as retromolar area via panoramic radiograph, and recorded (Figure 1). The obtained records were compared to the mesiodistal size of the third molars, and sufficiency of the retromolar space was classified. The classifications are shown in Table 1.

Table 1. Retromolar space classification

Class 1	Retromolar space is the same as or greater than the mesiodistal size of lower third molar
Class 2	Retromolar space is half or greater than half the mesiodistal size of lower third molar
Class 3	Retromolar space is smaller than half the mesiodistal size of lower third molar

Skeletal classification was done in accordance with the ANB angle as shown in Table 2. The effective mandible length was estimated by measuring the space between Co-Gn values (Figure 2). Cephalomeric radiographs of all individuals included in the study were obtained in İstanbul Aydın University Faculty of Dentistry Department of Dental and Maxillofacial Radiology using Planmeca 2011-05 Proline Pan/Ceph X-Ray unit (Planmeca, Helsinki, Finland). The distance between the ray source and radiograph was standardized as 160 cm, and the distance between the common plane and radiograph as 16 cm. During x-ray, teeth were set to centric occlusion and the rest positions of lips were checked to prevent any potential soft tissue distensions. The Frankfort Horizontal Plane (FH plane) of the head was positioned to be parallel to the ground, and was fixated via the ear

rods of cephalostat. Radiographs were obtained by adjusting the x-ray device to emit beams per second and in a way that kVp is in line with bone ages. Patient records were digitalized using NemoCeph NX (Nemotech, Madrid, Spain) computerized cephalometric analysis system and program. The anatomical points and measurements used in the study were selected from McNamara analyses.

Table 2. Skeletal classification

Skeletal class 1	ANB: 0^0-4^0
Skeletal class 2	ANB> 4^0
Skeletal class 3	ANB<0^0

The data obtained in the study were analyzed using SPSS 21 package program. The data were analyzed using Kruskall-Wallis H test. And the correlation between categorical variables was studied using Chi-Square analysis. The level of significance was established as 0.05, and p>0.05 indicates no significant difference while p<0.05 indicates significant difference.

3. Results

Of the 127 patients who were included in the study, 56 (44.09%) were females and 71 (55.9%) were males. The skeletal occlusion classification and Co-Gn values are shown in Table 3. The effective length of mandible was found to be statistically significant (p<0.05) in individuals with Class 3 skeletal occlusion.

Table 3. Results

		Skeletal Classification						Kruskall-Wallis H test		
		n	Mean	Median	Minimum	Maximum	ss	Mean Rank	H	p	Paired Comparison
Co-Gn	Class 1	61	113.6	115.0	11.0	140.0	16.2	60.66	5.5	0.044	2-1
	Class 2	50	115.4	115.5	98.0	133.0	6.7	61.64			
	Class 3	16	122.1	125.0	105.0	135.0	10.2	84.09			
	Total	127	115.4	115.0	11.0	140.0	12.7				

The effective length of mandible and the right retromolar space values are shown in Table 4. No statistically significant difference was found between the effective length of mandible and the right retromolar space (p>0.05).

Table 4. Results

		right retromolar space						Kruskall-Wallis H test		
		n	Mean	Median	Minimum	Maximum	ss	Mean Rank	H	p
Co-Gn	Number 1	46	117.6	115.0	99.0	140.0	8.6	68.22	0.961	0.619
	Number 2	57	115.1	115.0	93.0	135.0	9.3	61.36		
	Number 3	24	111.7	115.0	11.0	130.0	22.6	62.19		
	Total	127	115.4	115.0	11.0	140.0	12.7			

The effective length of mandible and the left retromolar space values are shown in Table 5. No statistically significant difference was observed between the effective length of mandible and the left retromolar space (p>0.05).

Table 5. Results

		left retromolar space						Kruskall-Wallis H test	
		n	Mean	Median	Minimum	Maximum	ss	Mean Rank	H	p
Co-Gn	Number 1	34	115.8	115.0	99.0	132.0	7.8	61.35	0.245	0.885
	Number 2	67	116.3	115.0	93.0	140.0	9.8	65.11		
	Number 3	26	112.5	116.0	11.0	130.0	21.8	64.60		
	Total	127	115.4	115.0	11.0	140.0	12.7			

Skeletal class relationships and the right and left retromolar space values are shown in Table 6. No statistically significant difference was observed between the skeletal class relationships and the right and left retromolar space (p>0.05).

Table 6. Results

		Skeletal Classification								Chi-Square analysis	
		Class 1		Class 2		Class 3		Total			
		n	%	N	%	n	%	n	%	Chi-Square	p
Right retromolar space	Number 1	21	34.4	15	30.0	10	62.5	46	36.2	8.05	0.091
	Number 2	25	41.0	27	54.0	5	31.3	57	44.9		
	Number 3	15	24.6	8	16.0	1	6.3	24	18.9		
	Total	61	100.0	50	100.0	16	100.0	127	100.0		
	Number 1	18	29.5	10	20.0	6	37.5	34	26.8	-	0.306
	Number 2	28	45.9	30	60.0	9	56.3	67	52.8		
	Number 3	15	24.6	10	20.0	1	6.3	26	20.5		
	Total	61	100.0	50	100.0	16	100.0	127	100.0		

4. Discussion

The eruption pattern of mandibular third molars is known to be affected by numerous factors (Kruger et al. 2001). These factors can be categorized generally such as congenital anomalies and diseases affecting bone metabolism, and locally such as late mineralization or early mutation of third molars, and the lack of sufficient eruption space in the dental arch (Yassaei et al. 2014, Quek et al. 2003). There are numerous studies that present sufficient eruption space as the main factor (Broadbend 1943, Breik and Grubor 2008). Sufficient eruption space is defined as the space between the distal surface of the second molar and the

anterior border of the ramus (Sevendsen and Maertens, 1997). Sevendsen and Maertens, 1997 stated that sufficient eruption space depends on multiple factors. These factors are the transverse dimension of alveolar process, length of mandible, and the vertical direction of condylar growth. The specified factors include differing views about the main factor defining the retromolar space (Shokri et al. 2014, Sapkota 2017), (Yassaei et al. 2014, Broadbend 1943, Björk et al. 1956). However, no study has been carried out on the direct impact of the effective length of mandible on retromolar space, or the correlation between them. We attribute this to the absence of a norm where the effective length of mandible can be categorized. Therefore, in our study, the skeletal class relationships were also assessed while assessing the direct impact of the effective length of mandible on the space of the retromolar region. For this reason, our study is an original study that will bring a different perspective to the eruption pattern of mandibular third molars.

Broadbend 1943 presented lack of space as the main factor of the impaction of lower third molars. He attributed the cause of the existing lack of space to mandible being unable to reach its full growth potential. Björk 1956, on the other hand, proposed that insufficient retromolar space is the most crucial factor in the impaction of third molars. He attributed the main cause of this to the insufficient mandibular length. There are other studies that suggest a direct relation between the retromolar space and the effective length of mandible. Richardson 1987 underlined the fact that the increase in mandibular length leads to a greater retromolar space, which turn will lead to a change in the eruption pattern of third molar. In their respective studies, Breik and Grubor, 2008 and Wu et al. 2010 concluded that the effective length of mandible has a direct impact on the retromolar space, and that it is the main deciding factor in the eruption pattern of mandibular third molars. There are also various studies suggesting that the effective length of mandible does not have an impact on the retromolar space. In their study, Abu Alhaji et al. 2010 found the Class III value in Pell&Gregory classification to be significantly high in individuals who rank in Class III skeletal classification. At the end of this study, the researchers concluded that the effective length of mandible does not play an effective role in determining the retromolar space. Although it is not directly related to our study, the study indirectly indicates that there is no correlation between the retromolar space and mandibular length.

Despite the existence of various studies purporting that the mandibular length plays a defining role for retromolar space, there are also studies arguing that vertical condylar growth has a predominant impact in this regard. In his study, Capelli 1991 asserted that vertical condylar growth is the most fundamental and effective defining factor among all the factors concerning the eruption pattern of mandibular third molar. In the study assessing the impaction pattern of mandibular third molars, Bashir et al. 2016 concluded the vertical condylar growth to be the main factor affecting the retromolar space. A study carried out by Sapkota 2017 ve Yassaei et al. 2014 concluded that Class III value in Pell&Gregory classification has a high statistical significance in individuals with low vertical condylar growth. As a result of the findings from our study, no significant correlation was found between skeletal occlusion Class III, which has the highest

Co-Gn values, and retromolar space. In the light of these values, we can say that the effective length of mandible does not have a significant impact on the retromolar space. In consideration of the findings obtained from various studies, a consensus could not be achieved on the main factor impacting the eruption pattern of mandibular third molars. In conclusion, more studies need to be carried out that assess and compare numerous factors including the findings of our study to establish the factor or factors affecting the retromolar space, which is considered to be the main determining factor of the eruption pattern of mandibular third molars.

Figure 1. X shows retromolar region (Qamruddin et al. 2012)

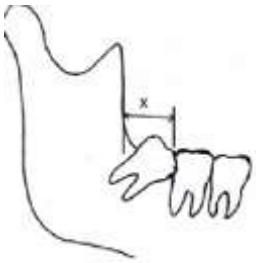
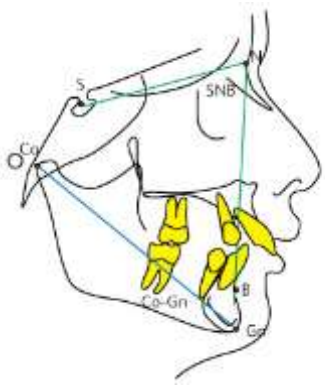


Figure 2. The distance between Co-Gn shows the effective length of the mandible (Raveli et al. 2012)



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