The Radiological Evaluation of Impacted Third Molars in A Group of Turkish Subpopulation

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Abstract

Background: The aim of this study is to determine the incidence of maxillary and mandibular impacted third molar teeth and to determine their status according to position classification.
Materials and Methods: Panoramic radiographs of 2090 patients aged 19 years and older were evaluated. Third molar prevalence, impaction status and position were examined.
Results: 5595 third molar teeth of 2090 patients were evaluated, of which 2681 were in the upper jaw and 2914 in the lower jaw. According to classification types, Vertical, Position A and Class I were observed most frequently. While there was no statistically significant difference between the genders in the classifications made according to the relationship with the occlusal plane and ramus, there was a statistically significant difference according to age groups. In the classification according to the long axis angle of the adjacent tooth, there was a statistically significant difference between both gender and age groups.
Conclusions: Although impacted third molars are more common in women than in men, there is no statistically significant difference according to gender. The positions of impacted third molars change with age.

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Keywords: Panoramic radiography, third molars, impaction, classification.

Introduction

Impacted teeth are teeth that remain completely or partially in bone or soft tissue that have not taken their place in normal occlusion, although the eruption time has been completed (1). Maxillary and mandibular third molars (TMs) are the most frequently impacted teeth because they are the last to erupt (2). In the literature, the frequency of TMs being impacted varies between 16.7% and 68.6%; it has been statistically determined that 98% of all impacted teeth are composed of TMs (3-5). Many factors are effective in the embeddedness of TMs. These factors are such as racial differences, insufficient space in the dental arch, absence of erupted primary teeth, distal eruption of other teeth, retardation in facial growth, early physical maturation, early loss of the second molar tooth, reverse growth direction, late mineralization. (3, 6-8).

TMs can remain as impacted for many years without symptoms. However, they can also cause pathologies such as perichronitis, infection, root resorption of adjacent teeth, distal caries, periodontal bone loss, cystic lesions or neoplasms (9). Extraction of TMs is one of the most common procedures in oral and maxillofacial surgery to prevent pathologies that may occur (10). However, prophylactic extraction of asymptomatic TMs can cause pain, swelling, infection, and nerve injuries (11).

Different classifications have been created to

determine the degree of difficulty of the surgical operation. Winter classification based on the angle of the tooth according to the radiological image, Pell-Gregory classification based on the relationship and depth of the mandibular ramus, age of the patient and duration of the intervention are the most frequently used criteria in classifications. (12-14).

In present study, the level of impacted TMs was made according to the Pell & Gregory classification, and the angulation was according to the Winter classification. In this study, our aim was to determine the impact rate, level of impaction, angulation and mesiodistal distance of TMs using panoramic radiography in a Turkish subpopulation.

Materıals and methods

Ethics committee approval was obtained for the study from the Necmettin Erbakan University, Faculty of Dentistry, Non-Pharmaceutical and Medical Device Research Ethics Committee with the decision numbered 2021/04-49. This retrospective study was evaluated the panoramic radiographs of 2850 patients who applied to the Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, for different reasons between January 2020 and September 2021 were randomly selected. Panoramic radiographs were taken with Morita Veraviewepocs 2D panoramic unit (J Morita MFG Corp., Kyoto, Japan) at 60-70 kVp, 5-7 mA and 6-8 s exposure times according to the manufacturer's recommendations. All data were evaluated by two maxillofacial radiologists (AA and FY) in ambient light on an LCD monitor. After twenty days, two observers reevaluated 100 randomly selected images and the intra-observer agreement value was determined. 250 randomly selected images were evaluated after twenty days for inter-observer agreement. The final classification and radiographic status of each finding was recorded after inter-observer consensus. Radiographs with low image quality and artifacts that did not include the demographic information of the patients were not included in the study. In the present study, diagnostically acceptable images of patients aged 19 years and older were used. 2,850 panoramic images were scanned and 2,090 of them were included in the study. Based on the radiological evaluation, the classifications of the third molars were determined (Table 1).

Table 1. Classification of impacted third molars according to different criteria.

According to the angle formed by the long axis of the impacted wisdom tooth with the long axis of the second molar tooth	Vertical	Parallel to the second molar tooth, perpendicular to the occlusal plane
	Horizontal	Perpendicular to the second molar tooth, parallel to the occlusal plane
	Mesioangular	Inclined to second molar tooth
	Distoangular	Inclined to ramus mandible
	Inverted	Unusual position
According to the position of the occlusal planes of the impacted wisdom teeth with the cervical line of the adjacent tooth	Position A	The highest part of the tooth is at or above the occlusal plane
	Position B	The highest part of the tooth is between the occlusal plane and the cervical line of the second molar tooth
	Position C	The highest part of the tooth is below the cervical line of the second molar tooth
According to the relationship of the mandibular third molar with the ramus	Class I	There is a space between the distal of the second molar tooth and the ramus as much as the mesio-distal dimension of the third molar
	Class II	There is less space between the distal of the second molar tooth and the ramus than the mesio-distal dimension of the third molar
	Class III	There is no space between the distal of the second molar tooth and the ramus

Inclusion criteria:

- Root and crown can be seen clearly,
- Radiographs of individuals older than 19 years of age who do not show extensive osseous pathology,
- No history of trauma to the jaws.

Exclusion criteria:

- Panoramic radiographs with low image quality and artifacts,
- Radiographs of individuals with any bone disease (achondroplasia, Cleidocranial dysplasia, etc.),
- Teeth that have not completed their root formation,
- Radiographs of individuals <19 years of age.

Relationships between gender and age groups of TMs were evaluated with chi-square test and descriptive statistics. IBM SPSS Statistics 21.0 program was used in the analysis. A value of $p<0.05$ was accepted as a criterion for statistical significance.

Results

Kappa values for intra-observer and inter-observer agreement were found to be 0.979(AA), 0.968(FY) and 0.926, respectively.

In the present study, 8,360 TMs of 2,090 patients (mean age 33.81 years, range: 19-74), 907 (%43.4) males and 1,183 (%56.6) females, were evaluated. Some descriptive statistics regarding the age of the patients are summarized in Table 2 by gender.

5,595 TMs were detected in 2,090 patients, 2,681(48%) were in the upper jaw and 2,914(52%) were in the lower jaw.

From the 2,090 patients, a total of 5,595 impacted third molar teeth was examined - males: 2,508 (44.8%) and females: 3087 (55.2%), and the difference was not statistically significant either ($p > 0.05$). The distribution of third molars by occlusal plane is shown in table Table 3 and 4. Position A was the most common in the males and females (4081; 73%), while position C was the second in the males and females (912; 16.3%). In the classification made according to the occlusal plane, there is no statistically significant relationship between the position of the third molar tooth and gender, but there is a statistically significant relationship with age (Table 3 and 4).

In the classification made according to the relationship of the third molar tooth with the ramus, there is no statistically significant relationship between the position of the third molar tooth and gender, but there is a statistically significant relationship with age (Table 5 and 6). In the classification made according to the long axis angle of the third molar tooth, there is a statistically significant relationship between the position of the third molar tooth and both gender and age (Table 7 and 8). The most common angulation of impaction was vertical (4641; 82.9%), and the second common angulation pattern was mesioangular (490; 8.75%).

Table 2. Descriptive statistics for age by gender.

Gender	Mean	Min-Max Age	N (%)
Female	32.93	19-74	1183 (56.6)
Male	34.22	19-71	907 (43.4)
Total	33.81	19-74	2090 (100)

Table 3. Chi-square chart of third molars according to occlusal plane and age.

	Occlusal plane			
Age Groups	**Pos. A**	**Pos. B**	**Pos. C**	**Total**
18-30	1843	437	569	2849
31-50	1971	156	312	2439
51+	267	9	31	307
Total	4081	602	912	5595

$$\chi^2 = 220.985, sd = 4, p = 0.000$$

Table 4. Chi-square chart of third molars according to occlusal plane and gender.

	Occlusal plane			
Gender	**Pos. A**	**Pos. B**	**Pos. C**	**Total**
Female	2223	343	521	3087
Male	1858	259	391	2508
Total	4081	602	912	5595

	$\chi^2 = 3.011, sd = 2, p = 0.222$

Table 5. Chi-square chart of third molars according to ramus and age.

	Ramus			
Age Groups	**Class I**	**Class II**	**Class III**	**Total**
18-30	891	453	82	1426
31-50	1064	199	42	1305
51+	166	13	4	183
Total	2121	665	128	2914
	$\chi^2 = 157.309, sd = 4, p = 0.000$			

Table 6. Chi-square chart of third molars according to ramus and gender.

	Ramus			
Gender	**Class I**	**Class II**	**Class III**	**Total**
Female	1185	348	76	1609
Male	936	317	52	1305
Total	2121	665	128	2914
	$\chi^2 = 3.501, sd = 2, p = 0.174$			

Table 7. Chi-square chart of third molars according to long axle angle and age.

	Long Axle Angle					
Age Groups	**Vertical**	**Horizontal**	**Mesiongular**	**Distoangular**	**Inverted**	**Total**
18-30	2247	97	309	188	8	2849
31-50	2115	60	168	80	16	2439
51+	279	8	13	5	2	307
Total	4641	165	490	273	26	5595
	$\chi^2 = 88.335, sd = 8, p = 0.000$					

Table 8. Chi-square chart of third molars according to long axle angle and gender.

	Long Axle Angle					
Gender	**Vertical**	**Horizontal**	**Mesiongular**	**Distoangular**	**Inverted**	**Total**
Female	2546	69	285	174	13	3087
Male	2095	96	205	99	13	2508
Total	4641	165	490	273	26	5595
	$\chi^2 = 22.231, sd = 4, p = 0.000$					

Discussion

TMs are found in approximately 90% of the population, and impacted tooth rates vary between 22% and 66% (15). However, Sağlam et al.(16) reported that the most common fully impacted teeth in Turkish population were mandibular third molars in men and upper third molars in women, and the incidence of impacted teeth was 11% in Turkish population. The residence time of TMs in the mouth is shorter compared to other teeth. Extraction of TMs is preferred due to the prevention of pathologies that may occur in the future, the preservation of the health of the second molar teeth, or the difficulty of applying treatment due to the position of the tooth. Therefore, surgical extraction of impacted third molars is one of the most frequently performed oral surgical procedures. It is known that operations performed at an early age are more advantageous than late interventions in terms of healthy periodontal space or follicle presence and bone density, and reduce the risk of postoperative complications (17).

Therefore, it is necessary to precisely determine the eruption, impaction and position of these teeth and to make a continuous treatment plan to protect them from pathologies that may occur in the future. In the past, the conditions of the third molar teeth in the lower and upper jaws differed due to the lifestyles, diets and jaw structures of the people. Mead (18) reported in 1930 that the rate of impaction of TMs in the maxilla and mandible was equal. In 1956, Björk et al. (19) found that the upper TMs had a higher impact rate than the lower TMs. Shah et al. (20) 1978 and Linden et al. (21) in 1995, they reported that the lower TMs were more impacted than the upper TMs. As a result of our study, we also determined that the impacted teeth rate of the lower TMs was higher than the upper TMs.

Ventä et al. (17) reported in their study on 293 panoramic radiographs that 23% of TMs remained impacted, and the rate of impacted teeth was similar in the maxilla and mandible. In present study, the positions of impacted teeth were evaluated. It was determined that 52.1% of impacted TMs were mandibular and 47.9% were maxillary TMs. This result is compatible with Ventä et al.'s study. In our study, impacted TMs were mostly seen in the vertical position. Goyal et al.(22) reported that TMs were mostly seen in the mesioangular position. Differences in the results found in the studies may be due to society or racial reasons, as well as the age difference of the individuals evaluated.

In a study evaluating TMs in individuals aged 17-36 years in Turkish subpopulation(23), the rate of complete impaction of mandibular TMs was found to be 13%, and maxillary TMs was 17%. In the same study, the most impacted third molar positions mesioangular (31%), vertical (27%) and distoangular (26%) were found, respectively. In our study, the impacted TMs position was found to be mostly vertical (82.9%), mesioangular (8.75%) and distoangular (4.87%), respectively. The difference in the results found in the studies may be due to the different number of patients evaluated and the age range of the patients.

In the study of Meral et al.(1) on 300 panoramic images, the impacted positions of the third molars were determined as vertical (46.2%), mesioangular (28.4%), horizontal (14.4), distoangular (11%) and inverted (0%), respectively. In the same study, classification according to ramus was reported as Class II (51.2%), Class I (33.1%) and Class III (15.7%), respectively. According to the occlusal plane, they found Pos B (41.8%), Pos A (30.4%) and Pos C (27.8%), respectively. In our study, the impacted TMs classification according to ramus was Class I (72.94%), Class II (22.82%) and Class III (4.39%); according to the occlusal plane, it was found as Pos. A (72.74%), Pos. C (16.3%) and Pos. B (10.75%), respectively.

Kruger et al. (24) followed 821 patients between the ages of 18-26 and reported eruptions and current status of impacted wisdom teeth. According to the results of the study, they reported that significant eruption was achieved especially in the vertically positioned teeth, and that, in the presence of sufficient space, the vertically positioned wisdom teeth should be followed instead of prophylactic extraction at an early age. According to the data obtained from our study, the number of vertically impacted TMs decreases with age. This is in agreement with the results of Kruger et al.

Karslıoğlu et al. (25) evaluated the presence of impacted TM's in patients aged 50 and over and found that 13.2% of TM's were impacted. While there was no statistically difference between the sexes, they observed that statistically significantly more impacted TM's in the lower jaw than in the upper jaw. Impacted TM's were seen mostly in vertical, mesioangular, horizontal and distoangular

positions, respectively. These findings are consistent with the results of the present study.

Haddad et al. (26) evaluated the presence of a impacted mandibular TM's (IMMTMs) in 1600 patients aged 20 to 55 years. IMMTMs were observed mostly in mesioangular (36%), vertical (33.4%), horizontal (14.4%) and distoangular (6.9%) positions, respectively. IMMTMs, in Pell&Gregory classification to the occlusal plane were seen Position B (46.8%), Position A (42.8%) and Position C (10.4%) respectively. According to the ramus, it was observed as Class II (51.3%), Class I (47.3%) and Class III (1.5%), respectively. Their findings differ from the results of the present study. This difference may be due to the fact that it was studied in different populations and age ranges.

This study was planned retrospectively and therefore clinical findings could not be evaluated. However, due to the large number of patients, a homogeneous sample size was obtained.

Conclusion

Many studies on TMs have been conducted in young individuals. In this study, panoramic radiographs of individuals with a wide age range were evaluated. In the present study, it was observed that impacted teeth were most frequently in the vertical position. It is known that extraction difficulties and complications increase during impacted tooth extraction in older ages. For this reason, it is necessary to carefully evaluate the position of these teeth in the mouth, taking into account the pathologies caused and may be caused by impacted TMs.

References

1. Meral G, Saysel M, Ökten DS. Surgical Extraction of Impacted Wisdom Teeth: Patient Profile and Preoperative Parameters. Hacettepe Diş Hek Fak Derg. 2005;29(4):56-61.
2. Hassan AH. Pattern of third molar impaction in a Saudi population. Clin Cosmet Investig Dent. 2010;2:109.
3. Tuğsel Z, Kandemir S, Küçüker F. Evaluation of impaction status of third molars in university students. Cumhuriyet Ünv Diş Hek Fak Derg. 2001;4:102-105.
4. Kaya GŞ, Aslan M, Omezli MM, Dayi E. Some morphological features related to mandibular third molar impaction. J Clin Exp Dent. 2010;2:e12–e17.
5. Hashemipour MA, Tahmasbi-Arashlow M, Fahimi-Hanzaei F. Incidence of impacted mandibular and maxillary third molars: a radiographic study in a Southeast Iran population. Med Oral Patol Oral Cir Bucal. 2013;18(1):e140-45.
6. Zafersoy Z, Çelik İ, Güngör K, Erten C. Clinical and Radiographical Evaluation of Mandıbulary and Maxillary Third Molars. T Klin Diş Hek Bil. 2002;8:75-9.
7. Quek S, Tay C, Tay K, Toh S, Lim K. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. Int J Oral Maxillofac Surg. 2003;32(5):548-52.
8. Brown L, Berkman S, Cohen D, Kaplan A, Rosenberg M. A radiological study of the frequency and distribution of impacted teeth. J Dent Assoc s Afr. 1982;37(9):627-30.
9. Polat HB, Ozan F, Kara I, Ozdemir H, Ay S. Prevalence of commonly found pathoses associated with mandibular impacted third molars based on panoramic radiographs in Turkish population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105:e41-7.
10. Fuster Torres MA, Gargallo Albiol J, Berini Aytés L, Gay Escoda C. Evaluation of the indication for surgical extraction of third molars according to the oral surgeon and the primary care dentist. Experience in the Master of Oral Surgery and Implantology at Barcelona University Dental School. Med Oral Patol Oral Cir Bucal. 2008, vol 13, num 8, p 499-504. 2008.
11. Altan A, Akbulut N. Does the Angulation of an impacted mandibular third molar affect the prevalence of preoperative pathoses? J Dent(Shiraz). 2019;20(1):48-52.
12. Miloro M, Ghali G, Larsen P, Waite PD. Peterson's Principle of Oral and maxillofacial Surgery. BC Decker, Ontario; 2004.
13. Renton T, Smeeton N, McGurk M. Factors predictive of difficulty of mandibular third molar surgery. Br DentJ. 2001;190(11):607-10.
14. García AGa, Sampedro FG, Rey JG, Vila PG, Martin MS. Pell-Gregory classification is unreliable as a predictor of difficulty in extracting impacted lower third molars. Br J Oral Maxillofac Surg. 2000;38(6):585-87.
15. Venta I, Murtomaa H, Turtola L, Meurman J, Ylipaavalniemi P. Clinical follow-up study of third molar eruption from ages 20 to 26 years. Oral Surg Oral Med Oral Path. 1991;72(2):150-53.
16. Sağlam AA, Tüzüm MŞ. Clinical and radiologic investigation of the incidence, complications, and suitable removal times for fully impacted teeth in the Turkish population. Quintessence Int. 2003;34(1):53-9.
17. Ventä I, Ylipaavalniemi P, Turtola L. Clinical outcome of third molars in adults followed during 18 years. J Oral Maxillofac Surg. 2004;62(2):182-5.
18. Mead SV. Incidence of impacted teeth. Int J Orthod Oral Surg. 1930;16(8):885-90.
19. Björk A, Jensen E, Palling M. Mandibular growth and third molar impaction. Acta Odontol Scand. 1956;14(3):231-72.
20. Shah RM, Boyd MA, Vakil TF. Studies of permanent tooth anomalies in 7,886 Canadian individuals. I: impacted teeth. J Can Dent assoc. 1978;44(6):262-4.
21. van der Linden W, Cleaton-Jones P, Lownie M. Diseases and lesions associated with third molars: Review of 1001 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Oral Endod. 1995;79(2):142-5.
22. Goyal S, Verma P, Raj SS. Radiographic evaluation of the status of third molars in Sriganganagar population–A digital panoramic study. Malays J Med Sci. 2016;23(6):103-12.
23. Etöz M, Şekerci AE, Şişman Y. Retrospective radiographic evaluation of third molar teeth in a Turkish population. J Dent Fac Atatürk Uni. 2011;2011(3):170-4.
24. Kruger E, Thomson WM, Konthasinghe P. Third molar outcomes from age 18 to 26: findings from a population-based New Zealand longitudinal study. Oral Surg Oral Med Oral Pathol Oral Radiol Oral Endod. 2001;92(2):150-5.
25. Karslıoğlu H, Sumer PA. Evaluation of the Third Molars in Middle Aged and Older İndividuals. EÜ Dişhek Fak Derg. 2019;40(2), 97-102.
26. Haddad Z, Khorasani M, Bakhshi M, Tofangchilla M, Shalli Z. Radiographic position of impacted mandibular third molars and their association with pathological conditions. Int J Dent. 2021;2021:8841297