Anatomical and Radiological Investigation of Dry Bone Adult Mandibles Having Impacted Third Molar Teeth

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Objective: To investigate the incidence of the impacted mandibular third molars in dry bones adult mandibles.

Methods: The 198 dry bones adult mandibles gathered from the bone collections in Laboratory of the Anatomy Department of Dokuz Eylul University School of Medicine were macroscopically examined for the presence of impacted mandibular third molars. The genders of the adult bones were unknown. The adult mandibles having impacted third molars were photographed with Canon 400B (55 mm objective). The mandibles having impacted third molars were also radiographically examined with orthopantomography (a dental radiographic technique, kV 60, mA 2.0) in radiology unit of Faculty of Dentistry, Ege University. The impacted teeth were grouped according to their position and degree of impaction.

Results: The each of 2 of 198 adult mandibles (2/198; 1.01%) was having an impacted 3rd molar teeth. These 2 molar teeth were belonged to class 1, B and partially buried, vertically oriented. The first impacted 3rd molar teeth was located on the left side of the one mandible and the second one on the right side of the other mandible.

Conclusion: The present study provides information about impacted mandibular 3rd molar in dry bones.

Key Words: 3rd molar teeth, impaction, mandible

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Notwithstanding the mandible is considered the strongest and most rigid bone in facial skeleton, it is more vulnerable to fractures than other facial bones.[1–5] Killey and Rowe[6] declare that fractures of the mandible comprise 40% to 65% of all facial fractures.

In recent studies, it was established that the presence of the mandibular third molars, particularly whether incompletely erupted (not yet totally perforated the oral mucosa), increased the risk of the mandibular angle fractures.[2,4-10]

Tooth impaction is a pathological condition that a tooth cannot erupt through the overlying mucosa for its normal functioning position.[11] There are several possible factors causing the third molar impaction: lack of space distal to the permanent second molar, delayed third molar mineralization, and early physical maturation.[11]

The any fracture located posterior to the second molar tooth—and extending from any point on the curve formed by junction of the body and the ramus in the retromolar area to any point on the curve formed by the inferior border of the body and posterior border of the ramus of the mandible—is defined as mandibular angle fracture.[12] The actual stress patterns applied to the human mandible determine the site of fracture and are influenced by several factors: the osseous anatomy, the forces exerted by the mastication muscles, the occlusal loading pattern, the exact application point, and direction and severity of the impact force.[13,14]

Clinical signs and symptoms associated with impacted third molars include: caries, pain, swelling, paresthesia, periodontal pocket, pericoronitis, noninflammatory radiological changes, root resorption (internal or external), interdental bone loss, hyperplastic dental follicle, mild inflammatory radiological changes, pericoronal radiolucent areas suggesting pericoronitis, periapical radiolucent areas suggesting abscess, severe inflammatory radiological changes, osteomyelitis, radiological signs of cysts and benign tumors, dentigerous cyst, keratocystic odontogenic tumor, odontomes, ameloblastoma odontogenic fibroma, radiological signs of malignant tumors, squamous cell carcinoma, fibrosarcoma, and mucoepidermoid carcinoma.[15] The frequent association of impacted teeth with pericoronitis, periodontitis, cystic lesions, neoplasm, and root resorption may cause detrimental effects on adjacent tooth.[8]

The functional disorders (such as occlusal interference, cheek biting, mastication disorders, trismus, and temporomandibular joint problems) are observed with impacted third molars.[16,17]

The depth and angulation of impacted teeth affect the development of symptoms and pathologies.[18–20]

The choice of treatment alternatives (includes observation, exposure, transplantation, or removal of the impacted tooth) depends on the presenting complaint, history of the patient, physical evaluation, radiographic assessment.[15]

The objective of this present study is to investigate the incidence of the impacted mandibular third molars in dry bone adult mandibles.

METHODS

The 198 dry adult mandibles gathered from the bone collections in Laboratory of the Anatomy Department, School of Medicine, Dokuz Eylul University were macroscopically examined for the presence of impacted mandibular third molars. The genders of the adult bones were unknown. The official permission for this study was obtained from School of Medicine, Dokuz Eylul University. The adult mandibles having impacted third molars were photographed with Canon 400B (55 mm objective). The mandibles having impacted third molars were also radiographically examined with orthopantomography (a dental radiographic technique, kV 60, mA 2.0) in radiology unit of Faculty of Dentistry of Ege University.

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TABLE 1. Classification of Impacted Third Molar Teeth According to *Pell and Gregory Classification and †Winter Classification

Either of 2 mandibles having an impacted third molar	Class*	Type of angulation†
First, 3rd molar on the left side	1-B	Vertical
Second, 3rd molar on the right side	1-B	Vertical

The impacted teeth were grouped according to their position and degree of impaction. To determine the class and type of angulation of impacted 3rd molar teeth, Pell and Gregory[21] and Winter[22] classification was used, respectively. The radiographic examinations of the mandibles (orthopantomography) were founded by authors of the present study.

RESULTS

The each of 2 of 198 adult mandibles (2/198; 1.01%) were having a impacted 3rd molar teeth. These 2 molar teeth were determined as belonging to class 1—B, partially buried and vertically oriented (Table 1). The first impacted 3rd molar teeth was located on the left side (Fig. 1A–C) of the 1 mandible and the second one on the right side of the other mandible (Fig. 1D–F).

DISCUSSION

Even if some studies reported a higher frequency in females than males on the contrary, most studies reported no gender predilection in third molar impaction.[23–28] Tevepaugh and Dodson[5] stated that mandibles with third molars were being 3.8 times more susceptible to angle fracture than mandibles without third molars. Reitzik et al[29] determined that 40% less force was required for the mandibles with impacted third molars to be fractured than the mandibles with fully erupted third molars and suggested that the unerupted third molars, which occupied more of the osseous space, might weaken the mandible.

Koerner[30] established the extraction indications for mandibular third molar as follows: pericoronitis causing pathology or pain, periodontitis, periapical abscess, cysts or neoplasms, resorption of adjacent roots, inflammation of the opposing soft tissue, aberrant positions (buccal or lingual orientation), prior surgical treatments including fixed or removable appliances and arch length discrepancy affecting the stability of orthodontic treatment.

For the prevention of mandibular fractures, Peterson[31] suggests the prophylactic extraction of unerupted third molar teeth of patients engaging in contact sports. The third molars have no role in the mouth; therefore, to minimize the risk of disease (cysts and tumors) development and the risk of mandibular angle fracture as well as increased difficulty of surgery with advancing age, prophylactic surgery has been proposed for the third molars.[1,4,9,32–38]

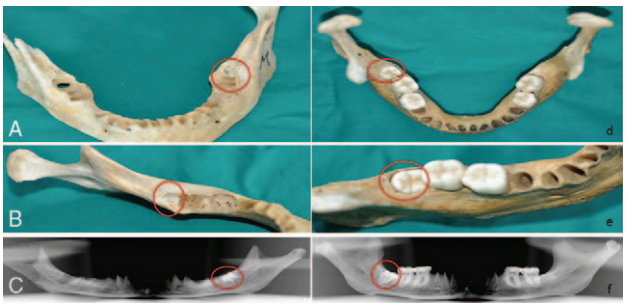


FIGURE 1. Patient 1 (mandible having impacted third molar on the left side): superior view (A and B), anterior view (C, orthopantomography-radiographic examination). Patient 2 (mandible having impacted third molar on the right side): superior view (D and E), anterior view (F, orthopantomography-radiographic examination).

To choose optimal treatment and to avoid the majority of possible complications, clinicians need to determine the difficulties in removal of the impacted third molar according to grade of its impaction. The assessment of wisdom tooth position was performed clinically and radiographically.[16] According to the Winter[22] classification, the impacted third molars were classified as follows: mesioangular, distoangular, vertical, and horizontal. In the present study, we observed that 2 patients with impacted third molar were partially buried and vertically oriented (Table 1).

There are many factors that affect the removal of third molar: grade of tooth impaction, type of tooth angulation, root length, patient age, presence of cyst or tumor around impacted third molar, systemic disease or medications impairing bone strength, preoperative infections in the third molar site, experience of the surgeon, and preoperative inadequate examination.[39] Upward extension of impacted third molars decreases significantly with age, especially after the age of 20 years, and postoperative morbidity, accordingly, significantly increases with age; therefore, prophylactic extractions are offered during the second and third decades of life.[6] The decreased bone elasticity with advancing age causes weakening of the mandible which may lead to the higher incidence of fractures reported among patients over 40 years of age at the time of surgery.[40] Early surgical removal of third molars by germectomy at 9 to 16 years of age does not reduce the complication rate compared with that at 17 to 24 years of age; therefore, the prophylactic removal of third molars can be delayed until 17 to 24 years of age when the patient's compliance increases.[41,42] The surgical procedure involves incision, stripping of periosteum, removal of bone and tooth, and suturing.[4,43]

Sectioning of the tooth is essential to reduce the amount of bone removal. As males usually apply more biting force than females, they are more prone to mandibular fractures, following surgical extraction.[40,44]

Pain, swelling, and trismus are common symptoms and signs following this surgical procedure.[45] Furthermore, the incidence of both inferior and lingual nerve damage which may be permanent increases.[4,43] Mandibular fracture associated with the removal of teeth is a rarely observed complication that may occur either as an immediate complication during surgery, or as a late complication, usually within the first 4 weeks following surgery.[46]

In contrast, in the case of deeply impacted third molars, Meechan[47] suggested that if the surgical removal of it has the risk of disruption of the superior border it may be better to avoid surgery. The complete occlusion of a tooth causes the widest portion of the tooth to locate in mouth and the external oblique ridge to remain intact, and so this ridge provides strength for the mandible in that region of the jaw. When the tooth is completely impacted, the widest portion of the tooth is generally located below the external oblique ridge. Whether the tooth is partially impacted, the tension line may be disrupted, weakening the mandibular angle and making it more susceptible to fracture.[6]

The surgical extraction is not the first treatment option for the third molar teeth located in mandible. The surgical treatment option must be meticulously considered according to the position of impacted 3rd molar teeth. In the literature, the prevalence of impacted third molar ranges from 16.7% to 68.6% among the populations that apply to the dental clinics (Table 2), whereas, in the present study, the rate of buried 3rd molar is determined as 1.01% in dry bone mandibles (Fig. 1).[6,23,27,28,48–53] This significant discrepancy may depend on the differences in the study populations (patients visiting dental clinics versus dry bone adult cadaveric mandibles). This is the first study that investigates the rate of

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TABLE 2. Number of Patients and Prevalence of Impacted Mandibular Third Molars in Published Studies

				Number of Patients Prevalence (%)		
Study (Year)	**Country**	**Study Design**	**Group**	**Right**	**Left**	**Total**
Ardakani et al[48]	Iran	Panoramic radiographs	59 patients who were referred to maxillofacial surgeons surgical extraction of the lower third molars	31 (52.5%)	28 (47.5%)	
Breik and Grubor[49]	Australia	Lateral cephalometric radiographs and orthopantomograms	98 dental records were sourced from the records of orthodontic patients			58.76%
Hashemipour et al[50]	Iran	Petrospective study orthopantomograms (OPG)	1020 orthopantomograms (OPG) of the patients who were referred to the radiology clinics			640 (54.9%)
Kaur and Sheikh[51]	India	Panoramic radiographs	1840 students which were totally asymptomatic, of age group ranging from 18 to 25	32	48	80
Mehdizadeh et al[52]	Iran	Cross-sectional study, panoramic radiographs	2000 panoramic radiography of patients who were over 20 years old.			339 (62%)
Meisami et al[6]	Canada	Petrospective cohort study, the patients' hospital charts and panoramic radiographs	214 patients presenting for treatment of mandibular fractures	157 (69%)	169 (70%)	
Tsabedze et al[53]	South Africa	Retrospective study patients' records with orthopantomographic radiographs	206 patients with impacted mandibular third molar teeth	50.4%	49.6%	
Present study	Turkey	Dry bones macroscopic evaluation and orthopantomographic radiographs	198 dry mandibular bones were belonged to the Anatomy Laboratory of School of Medicine	1	1	2 (1.01%)

impacted third molars in dry bone adult cadaveric mandibles of humans in the literature.

Therefore, to determine the actual rate of impacted third molar teeth in mandibular bones among general populations, the more detailed studies need to be designed in larger study populations.

REFERENCES

1. Hanson BP, Cummings P, Rivara FP, et al. The association of third molars with mandibular angle fractures: a meta-analysis. *J Can Dent Assoc* 2004;70:39–43
2. Lee JT, Dodson TB. The effect of mandibular third molar presence and position on the risk of an angle fracture. *J Oral Maxillofac Surg* 2000;58:394–398
3. Peterson LJ. Principles of management of impacted teeth. In: Peterson LJ, Ellis III E, Hupp JR, Tucker MR, eds. *Contemporary Oral and Maxillofacial Surgery.* 3rd ed. St. Louis: Mosby; 1993:215–248
4. Safdar N, Meechan JG. Relationship between fractures of the mandibular angle and the presence and state of eruption of the lower third molar. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995;79:680–684
5. Tevepaugh DB, Dodson TB. Are mandibular third molars a risk factor for angle fractures? A retrospective cohort study. *J Oral Maxillofac Surg* 1995;53:646–650
6. Meisami T, Sojat A, Sandor GK, et al. Impacted third molars and risk of angle fracture. *Int J Oral Maxillofac Surg* 2002;31:140–144
7. Fuselier JC, Ellis EE, Dodson TB. Do mandibular third molars alter the risk of angle fracture? *J Oral Maxillofac Surg* 2002;60:514–518
8. Ma'aita J, Alwrikat A. Is the mandibular third molar a risk factor for mandibular angle fracture? *Oral Surg Oral Med Oral Patho Oral Radiol Endod* 2000;89:143–146
9. Ugboko VI, Oginni FO, Owotade FJ. An investigation into the relationship between mandibular third molars and angle fracture in Nigerians. *Br J Oral Maxillofac Surg* 2000;38:427–429
10. Wolujewicz MA. Fractures of the mandible involvingthe impacted third molar tooth: an analysis of 47 cases. *Br J Oral Surg* 1980;18:125–131
11. Bishara SE. Impacted maxillary canines: a review. *Am J Orthod Dentofacial Orthop* 1992;101:159–171
12. Kelly DE, Harrigan WF. A survey of facial fractures related to teeth and edentulous regions. *J Oral Surg* 1975;33:146–149
13. Halazonetis JA. The weak regions of the mandible. *Br J Oral Surg* 1968;6:37–48
14. Sicher H, DuBrul EL. *Oral Anatomy.* 6th ed. St Louis: CV Mosby; 1975 :82–84
15. Santosh P. Impacted mandibular third molars: review of literature and a proposal of a combined clinical and radiological classification. *Ann Med Health Sci Res* 2015;5:229–234
16. Juodzbalys G, Daugela P. Mandibular third molar impaction: review of literature and a proposal of a classification. *J Oral Maxillofac Res* 2013;4:e1
17. Song F, Landes DP, Glenny AM, et al. Prophylactic removal of impacted third molars: an assessment of published reviews. *Br Dent J* 1997;182:339–346
18. Akarslan ZZ, Kocabay C. Assessment of the associated symptoms, pathologies, positions and angulations of bilateral occurring mandibular third molars: is there any similarity? *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;108:e26–e32
19. Polat HB, Özan F, Kara I, et al. 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–e47
20. Yamalik K, Bozkaya S. The predictivity of mandibular third molar position as a risk indicator for pericoronitis. *Clin Oral Investig* 2008;12:9–14
21. Pell GJ, Gregory BT. Impacted mandibular third molars: classification and modified techniques for removal. *Dent Digest* 1933;39:330–338
22. Winter GB. *Impacted Third Molars.* St. Louis: American Medical Book Co; 1926:241–279
23. Quek SL, Tay CK, Tay KH, et al. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. *Int J Oral Maxillafac Surg* 2003;32:548–552
24. Hugoson A, Kugelberg CF. The prevalence of third molars in a Swedish population. An epidemiological study. *Community Dent Health* 1988;5:121–138
25. Brown LH, Berkman S, Cohen D, et al. A radiological study of the frequency and distribution of impacted teeth. *J Dent Assoc S Afr* 1982;37:627–630
26. Haidar Z, Shalhoub SY. The incidence of impacted wisdom teeth in a Saudi community. *Int J Oral Maxillofac Surg* 1986;15:569–571

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27. Hattab FN, Rawashdeh MA, Fahmy MS. Impaction status of third molars in Jordanian students. *Oral Surg Oral Med Oral Pathol Radiol Endod* 1995;79:24–29
28. Kaya GS, Aslan M, Ömezli MM, et al. Some morphological features related to mandibular third molar impaction. *J Clin Exp Dent* 2010;2:e12–e17
29. Reitzik M, Lownie JF, Cleaton-jones P, et al. Experimental fractures of monkey mandibles. *Int J Oral Surg* 1978;7:100–103
30. Koerner KR. The removal of impacted third molars. Principles and procedures. *Dent Clin North Am* 1994;38:255–278
31. Peterson LJ. *Principles of dentoalveolar surgery. In: Peterson LJ, Indresanio AT, Marciani RD, Roser SM, eds. Principles of Oral& Maxillofacial Surgery. Vol 1.* Philadelphia, PA: JB Lippincott; 1991:107
32. Baykul T, Saglam AA, Aydin U, et al. Incidence of cystic changes in radiologically normal impacted lower third molar follicles. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005;99:542–545
33. Glosser JW, Campbell JH. Pathologic change in soft tissues associated with radiologically normal third molar impactions. *Br J Oral Maxillofac Surg* 1999;37:259–260
34. Güven O, Keskin A, Akal UK. The incidence of cysts and tumors around impacted third molars. *Int J Oral Maxillofac Surg* 2000;29:131–135
35. Iida S, Nomura K, Okura M, et al. Influence of the incompletely erupted lower third molar on mandibular angle and condylar fractures. *J Trauma* 2004;57:613–617
36. Iida S, Hassefeld S, Reuther T, et al. Relationship between the risk of mandibular angle fractures and the status of incompletely erupted mandibular third molars. *J Craniomaxillofac Surg* 2005;33:158–163
37. Schwimmer A, Stern R, Kritchman D. Impacted third molars: a contributing factor in mandibular fractures in contact sports. *Am J Sports Med* 1983;11:262–266
38. Seward GR. Surgical removal of third molars. Each case needs careful thought. *BMJ* 1994;309:1302
39. Chrcanovic BR, Custódio AL. Considerations of mandibular angle fractures during and after surgery for removal of third molars: a review of the literature. *Oral Maxillofac Surg* 2010;14:71–80
40. Woldenberg Y, Gatot I, Bodner L. Iatrogenic mandibular fracture associated with third molar removal: can it be prevented? *Med Oral Patol Oral Cir Bucal* 2007;12:E70–E72
41. Chiapasco M, Crescentini M, Romanoni G. Germectomy or delayed removal of mandibular impacted third molars: the relationship between age and incidence of complications. *J Oral Maxillofac Surg* 1995;53:418–422
42. Kim SJ, Hwang CJ, Park JH, et al. Surgical removal of asymptomatic impacted third molars: considerations for orthodontists and oral surgeons. *Semin Orthod* 2016;22:75–83
43. Werkmeister R, Fillies T, Joos U, et al. Relationship between lower wisdom tooth position and cyst development, deep abscess formation and mandibular fracture. *J Craniomaxillofac Surg* 2005;33:164–168
44. Miyaura K, Matsuka Y, Morita M, et al. Comparison of biting forces in different age and sex groups: a study of biting efficiency with mobile and non-mobile teeth. *J Oral Rehabil* 1999;26:223–227
45. Bouloux GF, Steed MB, Perciaccante VJ. Complications of third molar surgery. *Oral Maxillofac Surg Clin North Am* 2007;19:117–128
46. Bodner L, Brennan PA, McLeod NM. Characteristics of iatrogenic mandibular fractures associated with tooth removal: review and analysis of 189 cases. *Br J Oral Maxillofac Surg* 2011;49:567–572
47. Meechan JG. The effect of mandibular third molar presence and position on the risk of an angle fracture (discussion). *J Oral Maxillofac Surg* 2000;58:399
48. Ardakani FE, Booshehri MZ, Azam AN, et al. Diagnostic accuracy of panoramic radiography in determining the position of impacted third molars in relation to the inferior dental canal compared with surgery. *Iranian J Radiol* 2010;7:2
49. Breik O, Grubor D. The incidence of mandibular third molar impactions in different skeletal face types. *Aust Dent J* 2008;53:320–324
50. Hashemipour MA, Tahmasbi-Arashlow M, Fahimi-Hanzaei HF. Incidence of impacted mandibular and maxillary third molars: a radiographic study in a Southeast Iran population. *Med Oral Patol Oral Cir Bucal* 2013;18:e140–e145
51. Kaur B, Sheikh S. Status of third molars in North Indian population: a radiographic survey. *J Dental Peers* 2013;1:10–19
52. Mehdizadeh M, Haghanifar S, Seyedmajidi M, et al. Radiographic evaluation of impacted third molars and their complications in a group of Iranian population. *J Res Pract Dent* 2014;2014:11
53. Tsabedze VN. Prevalence of impacted mandibular third molar teeth at Medunsa Oral Health Centre (Doctoral dissertation, University of Limpopo (Medunsa Campus) 2012.

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