

A CORRELATION BETWEEN RADIOGRAPHICAL ASSESSMENT AND POST-OPERATIVE COMPLICATIONS OF IMPACTED TEETH

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ABSTRACT:

Context: Avulsion of impacted 3rd molars may associate with post-operative complications. Certain radiological assessments pre-operatively may reduce these complications. **Aims:** to evaluate the depth, angulation and closeness of impacted third molars to mandibular canal and maxillary sinus and their correlation with post-operative complications. **Settings and Design:** prospective study.

Methods and Material: Eighty six patients with impacted third molars had been recruited between September 2020 to December 2021. Each patient was radiographed using orthopantomographic film. The angle and depth of impactions were classified as reported by Winter's and Pell and Gregory techniques and the proximity of these teeth to mandibular canal was based on Rood and Shehab's technique. The relationship of the upper wisdom impactions to maxillary sinus was estimated as either there is no correlation or the root in close approximation to the floor of the sinus. **Statistical analysis used:** All data were analysed by one way analysis of variance with p level < 0.005 was considered important statistically.

Results: Fifty-one impacted third molars had been observed in the maxilla and hundred-one in the mandible. Vertical angulation demonstrated the greatest part of upper third molar impaction (59%) (p < 0.002) and lower (45%) (p < 0.000) jaws. Greatest impacted upper third molar was in level B and class IIA (37%) (p < 0.20) for the lower impaction. Most impacted maxillary 3rd molars exhibited no relationship to maxillary sinus and 28% of lower 3rd molars showed radiological signs of proximity to mandibular canal. Most complications (64.7%) were associated with horizontally/class IIB impacted lower 3rd molars. **Conclusions:** Vertical class A and B impaction exhibited the highest impactions in the mandible and maxilla. The rates of post-operative complications were low apart from inflammatory responses which mostly associated with horizontally/class IIB impacted lower 3rd molars. Radiological assessment predicted complexity of surgery and to certain extent the post-surgical complications. CBCT study is recommended to correlate with post-surgical complications.

Key words: Impacted teeth, Wisdom teeth, mandibular canal, oral surgery, extraction complications.

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INTRODUCTION:

Impaction is the inability of the tooth to penetrate jaw bone into the oral cavity at the expected period of eruption process. Any area of the jaw may be affected by the status of impaction at various frequencies. Impaction usually involves teeth that are erupting lastly in the jaw, particularly third molars which are more liable for impaction in the lower jaw (1,2).

The causes of impaction comprised insufficient room within jaw, deferred calcification of a tooth and the prime maturation stage (3). Though, genetic causes, lack of eruption force, deficient mesial movement of teeth because of absence of proximal attrition and the development of small jaws after delicate meal ingestion were stated as other reasons of the impaction (4).

Impacted third molars are frequently associated with different pathologies like periodontitis, pericoronitis, root resorption of neighbouring teeth and lesion of benign or malignant feature (5). The pathologies of impacted third molars are more serious particularly those of the lower jaw, as they debilitate the bone at mandibular angle and makes it highly vulnerable to pathological fracture (6). Besides, it may lead to malalignment of dental arch and vague headache (7). Yet, some impacted teeth may remain symptomless and do not need surgical removal (8).

The avulsion of impacted third molars can be performed without unwanted effect. However, affirm relation between the angle and depth of impacted third molars and the development of drawbacks after surgery was reported (9). The complexity and extent of surgical operation might be affected by the level of impacted third molars, because deep-seated impaction requires longer period for tissue exposure and osteotomy (10). The type and level of impaction can be determined according to Winter's (11) and Pell and Gregory techniques (12). Another feature that may enhance the establishment of post-operative complications is closeness of the impacted teeth to maxillary sinus and mandibular canal. The correlation between the roots of lower third molars and mandibular canal can be predicted by Rood and Shehab's technique (13).

This research aimed to assess the correlation between certain radiological factors (angle, depth of impacted wisdom teeth and their proximity to maxillary sinus and mandibular canal) and post-operative complications.

Subjects and Methods:

Consecutive patients with impacted third molars treated in dental hospital, college of dentistry, university of Babylon were recruited in the period between September 2020 to December 2021. The inclusive criteria of this study included patients above 15 years old and have impacted teeth. The exclusive criteria involved impacted teeth associated with peri-coronitis, medically compromised patients, pregnant ladies, patients taking oral contraceptive pills and heavy smokers (one packet/day). Each patient was radiographed using orthopantomographic view. The angle of the impacted teeth was classified as reported by winter's method (11) and their depth and spatial relationship to the ramus of the mandible were based on Pell and Gregory's technique (12). The relationship of the impacted lower teeth to inferior alveolar nerve was determined as stated in Rood and Shehab's criteria (13). Rood and Shehab's criteria was defined with alphabet A,B,C,D,E F and G (Figure 1). The correlation of the impacted upper wisdom teeth to maxillary sinus was estimated as either there is no relationship or the tooth roots in close association with maxillary sinus.

Consent forms were signed by the patients before surgical operation. Surgical procedure of the impacted teeth were carried out by single surgeon under local anaesthesia. Simple

crestal incision or L- shaped flap were used to expose the underlying bone and bone removal was carried out using surgical burs. The tooth was removed by dental elevator and forceps or sometimes tooth sectioning was performed by high speed dental turbine. Post-operative instructions were handed and antibiotics and pain killers were prescribed for all patients. Patients were followed-up for 5 days to remove the surgical suture and to record any post-operative complications namely (dry socket, paraesthesia or anaesthesia of the lower lip and oro-antra-communication) and inflammatory responses (pain, swelling and trismus). Oro-antral communications was considered as post-operative complication as sometimes the fistula is small in size (< 2 mm) and difficult to detect immediately during surgical operation. This research was approved by the Ethical Committee of College of Dentistry. All data were analysed by one way analysis of variance with p level < 0.005 was considered important statistically.

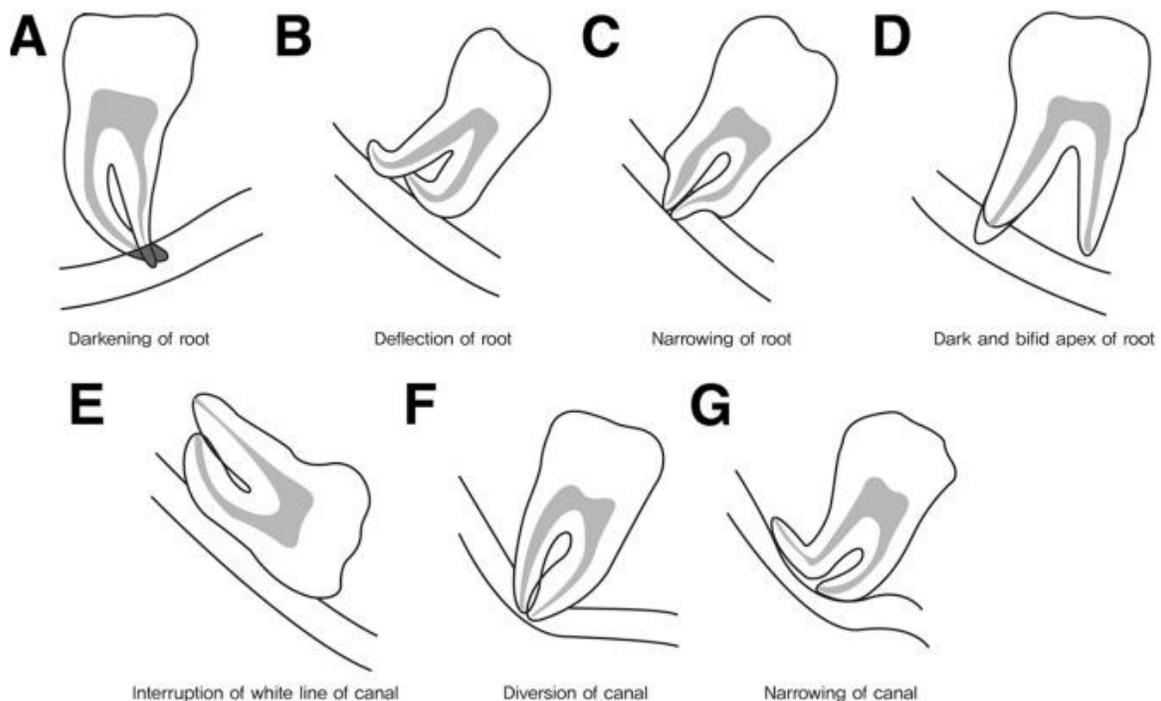


Figure 1: Radiographic correlation of lower wisdom tooth to inferior alveolar canal (Haung et al) ⁽³¹⁾.

RESULTS:

Totally, 151 impacted third molars were recognised in 86 patients. Fifty one impacted third molars have been diagnosed in the upper jaw, 19 (39%) of the 51 were bilateral impaction. Vertical impaction was the dominant (59%) and the distoangular was the second (35%), mesioangular type was the lowest (6%) with significant statistical differences ($p < 0.002$), as shown in table 1. Most impacted upper third molars were in class B (75%) and the lowest class C (10%) with insignificant statistical differences ($p < 0.518$), as illustrated in table 2.

Table 1 shows impaction of upper 3rd molars based on Winter’s method

| Impaction type | Total |
|----------------|-------|
| vertical | 30 |

| | |
|----------------|-------|
| distoangular | 18 |
| mesioangular | 3 |
| Total | 51 |
| <i>P</i> value | 0.002 |

Table 2 shows impaction of upper 3rd molars as reported by Pell&Gregory classification

| Class | Total |
|----------------|--------------|
| A | 15 |
| B | 23 |
| C | 13 |
| Total | 51 |
| <i>P</i> value | 0.518 |

Hundred impacted wisdom teeth have been diagnosed in the lower jaw, bilateral impaction compassed (21%). The order of prevalence of impacted third molars was vertical (45%), mesioangular (38%) and horizontal type (17%) with significant statistical differences ($p < 0.000$). Table 3 depicts distribution of types of impacted lower third molar. In accordance with the occlusal table of the neighbouring tooth and proximity to the mandibular ramus, class IIA was the largest (39%), class IA (21%) was the second and class IIIA was the least (3%) with insignificant statistical differences. Table 4 depicts distribution of depth of impacted lower molar based on Pell and Gregory techniques.

Most cases of upper 3rd molars exhibited no relationship to maxillary sinus (80.4%) and only 28% of impacted lower 3rd molars showed radiological signs of proximity of the tooth root to mandibular canal, as demonstrated in table 5. Darkening of the root and interruption of the white line of mandibular canal represented 27% of the impacted lower 3rd molars and 1% revealed root deflection in the panoramic views.

Table 3 shows impaction of lower 3rd molars based on Winter's method

| Impaction type | Total |
|-----------------------|--------------|
| vertical | 45 |
| mesioangular | 38 |
| horizontal | 17 |
| distoangular | 0 |
| Total | 100 |
| <i>P</i> value | 0.000 |

About 87% of patients were followed-up for 5 days after surgical operation. There were no serious complications (dry socket, paraesthesia of lower lip and oro-antra communication) associated with the avulsion of the impactions apart from pain, trismus and swelling and the majority (64.7%) were related to lower jaw particularly, horizontally/ class IIB impaction (Results not shown for brevity).

Table 4 shows impaction of lower 3rd molars as stated in Pell&Gregory classification

| Class | Total |
|----------------|-------|
| IA | 21 |
| IB | 20 |
| IC | 8 |
| IIA | 39 |
| IIB | 6 |
| IIC | 3 |
| IIIA | 3 |
| IIIB | 0 |
| IIIC | 0 |
| Total | 100 |
| <i>P</i> value | 0.021 |

Table 5 relationship of the upper and lower 3rd molars to maxillary sinus and mandibular canal.

| | | |
|--|--------------------------------|------------|
| upper 3 rd molar relationship to maxillary sinus | No relationship | 41 (80.4%) |
| | Sign of proximity | 10 (19.6%) |
| Lower 3 rd molar relationship to mandibular canal | No relationship | 72 (72%) |
| | Presence of radiological signs | 28 (28%) |

DISCUSSION:

Surgical avulsion of impacted third molars is the commonest minor oral surgical procedure carried out by oral surgeon. Complications of such procedure after surgery can be minimized by certain radiological assessment of angle and level of impaction and their proximity to maxillary sinus and mandibular canal.

Patients were followed-up after 5 days of surgical extraction during suture removal. The follow-up stage included the diagnosis of dry socket, paraesthesia or anaesthesia of lower lip and oro-antral communication. In addition, A questioner was done on the development of inflammatory responses (pain, swelling and trismus) after surgical manoeuvres.

It has been stated that the angle⁽¹⁴⁾ and depth⁽¹⁵⁾ of impactions are considered the most important position-related factors that determine surgical difficulty. Blum⁽¹⁶⁾ stated that there is a proportional correlation between surgical difficulty and the rate of dry socket. In this study, the majority of impacted upper and lower wisdom teeth were vertically impactions. Besides, the depth of most of these impactions classified at level B and A in the upper and lower jaws, respectively. Avulsion of these teeth necessitate dental elevator only and slight osteotomy. Hence, such teeth were classified as low difficult according to Pell and Gregory⁽¹⁴⁾. Mesioangular and distoangular impactions were less common in the upper jaw and horizontal impactions in the lower jaw / level C were the least in this study. These impacted teeth are highly difficult according to Pell and Gregory⁽¹⁴⁾. However, these teeth were avulsed with moderate difficulty, as avulsion of these teeth required bone removal and rarely teeth sectioning. It is worth to mention that the impacted teeth in this

study was performed under atraumatic surgical technique and the use of antibiotics and analgesics. Therefore, dry socket was not reported in this study. It has been stated that infection and dry socket can be reduced by prescription of antibiotics⁽¹⁷⁾ and atraumatic surgical technique⁽¹⁶⁾. The results of this study are in line with other studies^(18,19) where the rate of dry socket ranged from 0% to 35%. The variation in the rate of dry socket among studies may be attributed to the lack of definitive diagnostic criteria used by the researchers⁽¹⁷⁾. It is worth to mention that the spatial relationship of the ramus was not considered as a factor of difficulty in this study, as there is no association between this anatomical structure and surgical difficulty⁽¹⁴⁾.

It has been claimed that the depth of impactions is a risky factor in the development of paraesthesia after surgical avulsion⁽²⁰⁾. Although the panoramic results of this study indicated that some of the lower impactions are classified as IIC (according to Pell and Gregory method) and in close approximation to inferior alveolar nerve based on Rood and Shehab's technique, cases of paraesthesia or aesthesia of lower lip were not reported. Surgical extraction of these teeth were moderately difficult, as avulsion was performed by bone removal and teeth sectioning. It is claimed that the issue of proximity encountered only when root fracture occurs in the area close to mandibular canal⁽¹⁴⁾. The result of this study is close to that of the study of Sayed et al⁽²¹⁾ where the rate of alveolar nerve injury was 0.2%.

The rate of oro-antra fistula after surgical extraction of upper 3rd molars ranged from 3.1% to 13%^(22,23). The result of this study denotes that there were no cases of oro-antral communication after avulsion of impacted wisdom teeth. This is despite the fact that some of these teeth (19.6%) revealed radiological signs of proximity of their roots to the maxillary sinus. The possible explanation is that oro-antral communication might occur after avulsion of such teeth, but it was small in size (≤ 2 mm), which further explains their difficulty being detected during surgical operation, and healed spontaneously after blood clot formation. It is found that small size (< 2 mm) oro-antra communication can heal spontaneously after blood clot formation providing that there is no epithelization and sinus infection^(24,25).

The panoramic views are widely used in surgery of impacted wisdom teeth. In the present study, the expectation of surgical difficulty was relatively coincide with pre-surgical radiological assessment. However, complications such as dry socket cannot be predicted from radiological assessment, as this complication might be associated with other factors rather than surgery of impacted teeth. Besides, determination of the exact position of impacted wisdom teeth to mandibular canal and maxillary sinus using this techniques is controversial. This is due to the drawbacks of this technique such as magnification and distortion effects. Therefore, cone beam computed tomography (CBCT) is more advisable to determine the accurate position of impacted wisdom teeth^(26,27).

Complications relevant to post-operative inflammatory process such as pain, trismus and swelling were observed frequently after surgery of lower wisdom teeth in the present study. Many studies indicated that post-operative inflammatory complications occur in lower jaw more than that of the upper jaw^(28,21) This might be related to the type of bone and blood supply of the jaws, as the upper jaw has thin cortical bone and profuse collateral circulation that render it less susceptible to infection and inflammation⁽²⁹⁾. Notably, most of these complications are associated with horizontally/class IIB impactions. These findings were expected as such an impaction needs extensive flap reflection, more bone removal, tooth sectioning and longer operation time⁽³⁰⁾.

CONCLUSION:

Vertical impaction with class B and A exhibited the commonest impaction in the upper and lower jaws, respectively. The rates of post-operative complications (dry socket, paraesthesia or aesthesia and oro-antra communication) associated with such impactions were low. The commonest complications were related to inflammatory process and associated with lower wisdom teeth, particularly horizontally /class IIB impaction. Pre-operative radiological assessments are essential to predict complexity of surgery and to certain extent the post-surgical complications. Another study must be carried out to correlate between assessment of impaction based on cone beam computerized tomography and post-surgical complications.

Ethical compliance:

- This study was not funded by any person or organisation.
- The authors declare there is no conflict of interest.
- Informed consent was obtained from each individual participant involved in this study.
- This study was conducted in accordance with the 1964 Declaration of Helsinki and its subsequent amendments.
- No animals involved in this study.

REFERENCES:

1. Secic S, Prohic S, Komsic S, Vukovic A. Incidence of impacted mandibular third molars in population of Bosnia and Herzegovina: a retrospective radiographic study. *J Health Sci* 2013;**3**:151.
2. Shetty DC, Ahuja P, Urs AB, Bablani D, Paul M. Epidemiological status of 3rd molars—their clinical implications. *J Oral Health Comm Dent* 2010;**4**:12–5.
3. Qamruddin I, Qayyum W, Haider SM, Siddiqui SW, Rehan F. Differences in various measurements on panoramic radiograph among erupted and impacted lower third molar groups. *J Pak Med Assoc* 2012;**62**:883–7.
4. Kaur B, Sheikh S, Pallagatti S. Radiographic assessment of agenesis of third molars and para-radicular third molar radiolucencies in population of age group 18-25 years old—a radiographic survey. *Archives Oral Rese* 2012;**8**:13–8.
5. Ma'aita J, Alwrikat A. Is the mandibular third molar a risk factor for mandibular angle fracture? *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000;**89**:143–6.
6. Meisami T, Sojat A, Sándor GK, Lawrence HP, Clokie CM. Impacted third molars and risk of angle fracture. *Int J Oral Maxillofac Surg* 2002;**31**:140–4.
7. Almendros-Marqués N, Berini-Aytés L, Gay-Escoda C. Influence of lower third molar position on the incidence of preoperative complications. *Oral Surg Oral Pathol Oral Radiol Endod* 2006;**102**:725-32.
8. Polat HB, Özan F, Kara I, Özdemir H, Ay S. Prevalence of commonly found pathoses associated with mandibular impacted third molars ased on panoramic radiographs in Turkish population. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;**105**: 41-7.
9. Deliverska E, Petkova M. Complications after extraction of impacted third molars. Literature review. *Journal of IMAB* 2008; **22**.

10. Chuang SK, Perrott DH, Susarla SM, Dodson TB. Risk Factors for Inflammatory Complications Following Third Molar Surgery in Adults. *J Oral Maxillofac Surg* 2008; 66:2213-2218.
11. Winter, G.B., 1926. Impacted mandibular third molar. St. Louis: American Medical Book, 41.
12. Pell GJ, Gregory GT. Report on a ten year study of a tooth division technique for removal of impacted teeth. *Am J Orthod Oral Surg* 1942; 28: 660-9.
13. Rood JP and Shehab NB. "The radiological prediction of inferior alveolar nerve injury during third molar surgery". *Br J Oral and Maxillofac Surg* 1990; 28.1: 20-25.
14. Park KL. Which factors are associated with difficult surgical extraction of impacted lower third molars?. *J Korean Assoc Oral Maxillofac Surg*. 2016;42(5):251-258. doi:10.5125/jkaoms.2016.42.5.251.
15. Akadiri OA, Obiechina AE, Arotiba JT, Fasola AO. Relative impact of patient characteristics and radiographic variables on the difficulty of removing impacted mandibular third molars. *J Contemp Dent Pract* 2008;9:51-8.
16. Blum IR. Contemporary views on dry socket (alveolar osteitis): a clinical appraisal of standardization, aetiopathogenesis and management: a critical review. *Int J Oral Maxillofac Surg* 2002; 31:309-17.
17. Kumar V, Chaudhary M, Singh S, Gokkulakrishnan. Post-surgical evaluation of dry socket formation after surgical removal of impacted mandibular third molar— A prospective study. *Open Journal of Stomatology*, 2012, 2, 292-298.
18. Osunde O, Saheeb B, Bassey G. Indications and risk factors for complications of lower third molar surgery in a Nigerian teaching hospital. *Ann Med Health Sci Res*. 2014;4(6):938-942.
19. Obiechina AE, Arotiba JT, Fasola AO. Third molar impaction: evaluation of the symptoms and pattern of impaction of mandibular third molar teeth in Nigerians. *Odontostomatol Trop*. 2001 Mar;24(93):22-5.
20. Blondeau F. Extraction of Impacted Mandibular Third Molars: Postoperative Complications and Their Risk Factors. *Journal of Canadian dental association*. 2007; 73(4).
21. Sayed N, Bakathir A, Pasha M, Al-Sudairy S. Complications of Third Molar Extraction: A retrospective study from a tertiary healthcare center in Oman. *Sultan Qaboos Univ Med J*. 2019;19(3):e230-e235.
22. Hasegawa T, Tachibana A, Takeda D, Iwata E, Arimoto S, Sakakibara A, Akashi M, Komori T. Risk factors associated with oroantral perforation during surgical removal of maxillary third molar teeth. *Oral Maxillofac Surg*. 2016 Dec;20(4):369-375.
23. Rothamel D, Wahl G, d'Hoedt B, Nentwig GH, Schwarz F, Becker J (2007) Incidence and predictive factors for perforation of the maxillary antrum in operations to remove upper wisdom teeth: prospective multicentre study. *Br J Oral Maxillofac Surg* 45(5):387–391.
24. Liversedge RL, Wong K. Use of the buccal fat pad in maxillary and sinus grafting of the severely atrophic maxilla preparatory to implant reconstruction of the partially or completely edentulous patient: technical note. *Int J Oral Maxillofac Implants*. 2002;17(3):424–428.

25. Parvini P, Obreja K, Begic A, et al. Decision-making in closure of oroantral communication and fistula. *Int J Implant Dent*. 2019;5(1):13. Published 2019 Apr 1. doi:10.1186/s40729-019-0165-7.
26. Bouquet A, Coudert J L, Bourgeois D, Mazoyer J F, Bossard D: Contributions of reformatted computed tomography and panoramic radiography in the localization of third molars relative to the maxillary sinus. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 98: 342–347 (2004).
27. Pierre P, Pourmand Guido R, Sigron Beatrice, Mache Bernd, Stadlinger Michael C, Locher. The most common complications after wisdom-tooth removal, Part 2: A retrospective study of 1,562 cases in the maxilla. *Swiss dental journal*. 2014;124.
28. Haug RH, Perrott DH, Gonzalez ML, Talwar RM. The American Association of Oral and Maxillofacial Surgeons age-related third molar study. *J Oral Maxillofac Surg*. 2005;63:1106–14
29. Manimaran K., Suresh Kannan P., Kannan R. Osteomyelitis of maxilla bilateral involvement: a case report. *JIADS*. 2011;2(2):57– 58.
30. Albert DGM, Gomes ACA, Vasconcelos BCE, Silva EDO, Hollanda GZ: Comparison of orthopantomographs and conventional tomography images for assessing the relationship between impacted lower third molars and the mandibular canal. *J Oral Maxillofac Surg* 2006, 64:1030-1037.
31. Huang C., Lui Man, Cheng D. Use of panoramic radiography to predict postsurgical sensory impairment following extraction of impacted mandibular third molars *J Chin Med Assoc*, 78 (2015), pp. 617-622

