Clinical and orthopantomographic evaluation of mandibular third molar

SARASWATI F. K., BALAJIRAO B.1, MAMATHA G. P.2

Abstract

Objective: To evaluate sensitivity of orthopentograph (OPG) in assessing the number and morphology of roots of the mandibular third molar. Materials and Methods: The study population consisted of 100 ILTMs (impacted lower third molars) ranging from 18 to 42 years with equal sex distribution. All the teeth were subsequently extracted, collected and compared with OPG features for position, number, morphology, and relation to mandibular canal. Conclusion: In conclusion, a large sample study is suggested with techniques like Clark’s and right angle technique which determines the three-dimensional orientation of the impacted teeth.

Keywords: Clinical anatomy, diagnostic imaging number and morphology of roots, impacted lower third molar, radiographic anatomy

Introduction

Garn stated that the mandibular third molar is an unusual tooth characterized by considerable variability in formation, timing, variation in crown and root morphology, and, not infrequently, by agenesis. Garn et al. stated that the tooth most commonly missing in man is the third molar. Third molar has been the most widely discussed tooth in the dental literature, and the debatable question, to extract or not to extract, serves to run into the next century “watchful waiting” until a problem manifests, to routine prophylactic removal at an early age. Van Gool stated that a discrepancy existed between the findings of the X-ray and what could be observed clinically regarding the number and morphology of roots.

So a study has been planned to evaluate to what extent the radiographic anatomy corresponds to the true anatomy of the tooth.

Harry et al, defined impacted tooth as completely or partially unerupted and positioned against another tooth, bone or soft tissue, so that its further eruption would be unlikely. Many authors have explained the causes of the impacted tooth as follows:

- Size of human maxilla and mandible reduced gradually, in terms of evolution.
- Dietary patterns changed with the advancement of civilization from hard food to soft foods that led to less effort for mastication, less stimulus for the growth of jaws, and irregularity in the position of the tooth.

Imaging techniques for impacted lower third molars (ILTMs) are as follows: intraoral periapical radiography (IOPA); bisecting, paralleling, and distal oblique methods; Clark’s and right angle technique; other intraoral techniques like occlusal techniques; extraoral techniques like lateral oblique and panoramic methods, skull radiography, stereoradiography, xeroradiography, computed tomography (CT), magnetic resonance imaging (MRI), among which orthopantomograph (OPG), an adjunct to IOPA, remains the method of choice. Orthopantomography (means straight broad coverage slice technique) was first proposed by Numata in 1933.

Materials and Methods

The study to evaluate the mandibular impacted third molar by orthopantomographic view was conducted in the Department of Oral Medicine and Radiology and Department of Oral and Maxillofacial Surgery, Bapuji Dental College and Hospital, Davangere, Karnataka. The study population consisted of 100 ILTM ranging from 18 to 42 years with equal sex distribution.

Clinical examination was carried out by adapting methods of KERR, ASH, and MILLARD [Table 1, Figure 1].

Radiographic technique

The subject was positioned properly in the panoramic machine set up by adopting the principles of Goaz and White. Appropriate kVp and mA parameters were selected and exposures were made. All the films were processed manually in a well-equipped lightproof dark room as described by Goaz and White.

Results

The interpretation of radiographs was carried out in a dark room with the help of a radiographic viewer and a magnifying lens. The radiographs were interpreted for the radiographic...
status of the third molar, its eruption, position, number and morphology of roots, and relation to the mandibular canal [Table 2, Figure 2]. Radiographs were interpreted for the number and morphology of roots and were compared with tooth anatomy [Table 3]. Later the teeth were surgically extracted [Figure 3]. Teeth which were sectioned were attached and compared with radiographic anatomy.

Discussion

In the present study, clinical examination was done with reference to symptoms and their status of eruption. Westesson, Carlson, Wenzel, Aagaard, and Pedersen have taken up only radiological parameters, and none of them have categorized clinically impacted third molar with reference to symptoms. So direct comparison could not be made. This was only a correlation observation.

Out of 100 ILTMs, clinically 86 had erupted and 14 were not visible in the oral cavity, but radiographic examination showed that 100 ILTMs had penetrated the bone, and none of them were fully covered by bone. Fourteen teeth which were not visible in the oral cavity had not reached the occlusal plane but they were covered by soft tissue. This disparity between clinical and radiographic findings could be attributed to the fact that the density of the tissue was not radiographically evident due to the low density of the flap and lesser resolution in OPG, and clinically the edematous flap might be displaced resulting in the visibility of the tooth.

The 52% mesioangular impaction of the study is much higher than 34% of Stanley, 38% of Tammisalo, and 30% of Wenzel. The 32% distoangular impaction of this study is near to 24% of Tammisalo but much higher than the 15.5% of Stanley. A total of 11% horizontal impaction was observed which is comparable with 13% of Tammisalo. The 5% of vertical impaction of this study appeared to be far less than 36.9% of Stanley et al. Disparity among the position of impacted third molars could be attributed to the racial variation, sample size, and methodology of their study. In the present study, 5% one, 88% two and 7% had three roots reported by Tammisalo. However, the findings of the present study are very much dissimilar with 22% one 67% two and 11% more than two roots reported by Wenzel. The disparity among the number of roots for third molars could be attributed to the racial variation, sample size, and methodology.

The 52% mesioangular impaction of the study is much higher than 34% of Stanley, 38% of Tammisalo, and 30% of Wenzel. The 32% distoangular impaction of this study is near to 24% of Tammisalo but much higher than the 15.5% of Stanley. A total of 11% horizontal impaction was observed which is comparable with 13% of Tammisalo. The 5% of vertical impaction of this study appeared to be far less than 36.9% of Stanley et al. Disparity among the position of impacted third molars could be attributed to the racial variation, sample size, and methodology of their study. In the present study, 5% one, 88% two and 7% had three roots reported by Tammisalo. However, the findings of the present study are very much dissimilar with 22% one 67% two and 11% more than two roots reported by Wenzel. The disparity among the number of roots for third molars could be attributed to the racial variation, sample size, and methodology.

Table 1: Clinical manifestation of the impacted lower third molar (ILTM)

| Subjects         | Extraoral examination | Intraoral examination | Clinical status of eruption |
|------------------|-----------------------|-----------------------|----------------------------|
|                  | Normal (%)            | Swelling (%)          | Trismus (%)                | Pericoronitis (%)     | Caries (%)          | Keratosis (%)        | Unerupted (%) | Erupted (%) |
| ILTM in male subjects | 48 (96)               | 2 (4)                 | 1 (2)                      | 16 (38.09)            | 8 (19.04)           | 2 (4.76)            | 8 (16)        | 42 (84)     |
| ILTM in female subjects | 43 (86)               | 6 (12)                | 7 (14)                     | 22 (50)               | 8 (18.18)           | 5 (11.36)           | 6 (12)        | 44 (88)     |
| Total            | 91 (91)               | 8 (8)                 | 8 (8)                      | 38 (44.18)            | 16 (18.60)          | 7 (8.13)            | 14 (14)       | 86 (86)     |
Table 2: Diagnostic accuracy of orthopantomographic and tooth *in situ* findings

| Eruption | Crown position | Number of roots | Morphology of roots | In relation to mandibular canal |
|----------|----------------|-----------------|---------------------|-------------------------------|
|          | Radio-graphic findings | Penetrating bone (%) | Fully covered by bone (%) | Mesio-angular (%) | Disto-an-gular (%) | Horizontal (%) | One root (%) | Two roots (%) | Complex roots (%) | Normal roots (%) | Fused roots (%) | Dilacerated roots (%) | Above canal (%) | Below canal (%) | Close contact (%) |
| Iltm in male subjects | 50 (100) | - | 31 (62) | 11 (22) | 5 (10) | 3 (6) | 2 (4) | 43 (86) | 5 (10) | 7 (14) | 3 (6) | 38 (76) | 27 (54) | - | 23 (46) |
| Iltm in female subjects | 50 (100) | - | 21 (42) | 21 (42) | 6 (12) | 2 (4) | 3 (6) | 45 (90) | 2 (4) | 5 (10) | 4 (8) | 43 (86) | 27 (54) | 4 (8) | 19 (38) |
| Total | 100 (100) | - | 52 (52) | 32 (32) | 11 (11) | 5 (5) | 5 (5) | 88 (88) | 7 (7) | 12 (12) | 7 (7) | 81 (81) | 54 (54) | 4 (4) | 42 (42) |

Table 3: Diagnostic accuracy of orthopantomographic and tooth *in situ* findings

| Number and morphology | Subjects | Orthopantomographic | Clinical | TP (%) | FP | FN | K-value (%) | Significant P-value |
|-----------------------|---------|---------------------|----------|--------|----|----|-------------|---------------------|
| One root              | Male    | 2                   | 3        | 2 (66.7) | - | 1 | 0.80 (80) | NS                  |
|                       | Female  | 3                   | 4        | 3 (75)  | - | 1 | 0.82 (82) | NS                  |
|                       | Total   | 5                   | 7        | 5 (83.3)| - | 2 | 0.82 (82) | NS                  |
| Two roots             | Male    | 43                  | 36       | 36 (100)| 7 | - | 0.59 (59) | NS                  |
|                       | Female  | 45                  | 40       | 40 (100)| 5 | - | 0.62 (62) | NS                  |
|                       | Total   | 88                  | 76       | 76 (100)| 12| - | 0.60 (60) | SIG (P<0.05)        |
| Complex roots         | Male    | 5                   | 11       | 5 (45)  | 2 | 6 | 0.36 (36) | NS                  |
|                       | Female  | 2                   | 6        | 2 (33)  | - | 4 | 0.47 (47) | SIG (P<0.5)         |
|                       | Total   | 7                   | 17       | 7 (41)  | 2 | 10| 0.55 (55) | SIG (P<0.5)         |
| Normal roots          | Male    | 7                   | 4        | 3 (75)  | 4 | - | 0.55 (55) | NS                  |
|                       | Female  | 5                   | 4        | 4 (80)  | 1 | - | 0.87 (87) | NS                  |
|                       | Total   | 12                  | 8        | 7 (77)  | 5 | - | 0.37 (37) | NS                  |
| Fused roots           | Male    | 3                   | 3        | 3 (100)| - | - | 1 (100)  | NS                  |
|                       | Female  | 4                   | 6        | 4 (66.7)| - | 2 | 0.78 (78) | NS                  |
|                       | Total   | 7                   | 9        | 7 (77)  | - | 2 | 0.87 (87) | NS                  |
| Dilacerated roots     | Male    | 38                  | 46       | 39 (82)| - | 8 | 0.53 (53) | NS                  |
|                       | Female  | 43                  | 46       | 43 (93)| - | 3 | 0.33 (33) | NS                  |
|                       | Total   | 81                  | 92       | 81 (88)| - | 11| 0.54 (54) | SIG (P<0.5)        |

TP: true positive; K: kappa measure of agreement; FP: false positive; P: probability value; FN: false negative; SIG: significance.

Among 100 ILTMs, 12% had normal, 7% fused, and 81% dilacerated roots. These values could not be directly compared with 19.6% of root curvature reported by Gool as quoted by Westesson and Carlsson’s[6] 30% straight, and 70% deviated roots of Wenzel.[16] They have followed different description of roots. Further, they have adopted different methodologies, namely, multiprojection radiography by the former and single projection by the latter author. A total of 54% of root apices of ILTMs were found to be above the mandibular canal. The presence of the mandibular canal away from root apices of ILTMs has been explained by Huggins and Stockdale.[17] The comparison between OPG and tooth *in situ* findings was done with the criteria to evaluate the sensitivity of OPG for the number and morphology of roots. The comparison was done by following the true positive, false positive, true negative, and false negative. The sensitivity of OPG was statistically significant for two, three, and dilacerated roots with the P-value of <0.05. The false positive or false negative radiographic appearance has been frequently experienced. The disagreement can be explained as follows.

Westesson and Carlsson[6] stated that false negative findings were more frequent. Further, they have not mentioned
individually the number of roots as mentioned in this study.

In the case of complex roots, the path of beam passing through the roots could give different projections as stated by Goaz and White.[11] The position and number of roots, their placement buccally or lingually, could result in a difference in the radiographic and in vitro appearance as stated by Neville.[18] The false positive and false negative radiographic appearance is more frequent with the morphology of roots. The disagreement can be explained as follows. Westesson and Carlsson[6] stated that dilacerations were not accurately radiographed due to the path of the X-ray beam. Wenzel [16] stated that the root bent inward rather than outward, and resulted in a difference in the radiographic and tooth in vitro appearance for dilacerations.

Conclusion

In conclusion, a large sample study to assess the number and morphology of roots using more than one radiographic projection and techniques like Clark’s and right angle technique which determines the three-dimensional orientation of impacted teeth is needed. Further studies are suggested in the direction of application of CT keeping in view of the ALARA concept to forecast the complications of third molar removal.

References

1. Garn SM, Lewis AB, Bonne B. Third molar formation and its development course. Angle Ortho 1962;32:271-9.
2. Goaz PW, White SC. Oral Radiology – Principles and Interpretation. 2nd ed. St. Louis: C.V Mosby Company; 1992. p. 97-112, 174-7, 314-25, 421.
3. Goaz PW, White SC. Oral Radiology – Principles and Interpretation. 3rd ed. St. Louis: C.V Mosby Company; 1994. p. 83-5, 126-30, 242-5, 249-53.
4. Graber LW. Congenital absence of teeth-A review with emphasis on inheritance patterns. J Am Dent Assoc 1978;6:266-75.
5. Gravely JF. A radiographic survey of third molar development. Br Dent J 1965;119:397-401.
6. Archer HW. Oral and maxillofacial surgery. 5th ed. Philadelphia: W.B. Saunders Company; 1975. p. 250-6, 258-67.
7. Kapoor V. Text Book of Oral and Maxillofacial Surgery. 1st ed. New Delhi: Arya (Medi) Publishing House; 1996. p. 45-71.
8. Krennmair G, Lenglinger FX, Traxler M. Imaging of unerupted and displaced teeth by cross-sectional CT scans. Int J Oral Maxillofac Surg 1995;24:413-6.
9. Langland OE, Langlais RP, Morris CR. Principles and practice of panoramic radiology. Philadelphia: W.B. Saunders Company; 1982. p. 2-21, 37-45, 64-76.
10. Ledyar BC. A study of the mandibular third molar area. Am J Orthod 1953;39:366-72.
11. Littner MM, Kaffe I, Tamse A, Dicapua P. Relationship between the apices of lower molars and mandibular canal - a Radiographic study. Oral Surg Oral Med Oral Pathol 1986;62:595-602.
12. Neville BW, Damm DD, Allen CM, Bouquot JE. Oral and maxillofacial pathology. 1st ed. Philadelphia: W.B. Saunders Company; 1996. p. 60-79.
13. Lewis AB, Garn SM. The relationship between tooth formation and other maturational factors. Angle Ortho 1960;60:70-7.
14. Tammisalo T, Happonen RP, Tammisalo EH. Stereographic assessment of mandibular canal in relation to the roots of impacted lower third molar using multiprojection narrow beam radiography. Int J Oral Maxillofac Surg 1992;21:85-9.
15. Rood JP, Shehab BA. Radiological prediction of inferior alveolar nerve injury during third molar surgery. Br J Oral Maxillofac Surg 1990;28:20-5.
16. Stanley HR, Alattar M, Collett WK, Stringfellow HR Jr, Spiegel EH. Pathological sequel of neglected impacted third molars. J Oral Pathol 1988;17:113-7.
17. Wenzel A, Aagaard E, Sindet-Pedersen S. Evaluation of a new radiographic technique: Diagnostic accuracy for mandibular third molar. Dentomaxillofac Radiol 1998;27:255-63.
18. Westesson PL, Carlsson LE. Anatomy of mandibular third molars. Oral Surg Oral Med Oral Pathol 1980;49:91-4.