Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/ktepa147

DENTIST AGREEMENT ON ASSESSING IMPACTED THIRD MOLARS' ANGLES VIA ORTHOPANTOMOGRAMS

Muhammad Umair[1], Syeda Rabia Rahat Geelani[2]*, Uzma Bashir[3], Iqra Javeed[4], Zeeshan Aslam Jan[5], Ammar Abdullah Malik[6]

[1]Associate Professor Oral Medicine Department, Foundation University, Islamabad, Pakistan
[2]*Assistant Professor, Oral and Maxillofacial Surgery Department, Foundation University Islamabad, Pakistan
[3]BDS, MSc, CHPE, Assistant Professor of Prosthodontics, Muhammad Medical College Mirpur Khas, Pakistan
[4]BDS, Demonstrator, Nishter Institute of Dentistry Multan, Pakistan
[5]Assistant Professor Oral and Maxillofacial Surgery, Rashid Latif Dental College, Lahore, Pakistan
[6]Assistant Professor Oral Biology Department, Foundation University Islamabad, Pakistan

***Corresponding author:** Syeda Rabia Rahat Geelani,
*Email: docgeelaanee@yahoo.com

ABSTRACT

Introduction: Assessing the angulation of third molar teeth in the mandible is critical in diagnosis, pre-surgical planning, and even surgery of the impacted tooth. Orthopantomograms (OPGs) are preferred for this purpose due to their ease of application and panoramic view.

Objective: The aim of this study was to assess the degree of inter-observer variability of dentists in identifying the angulation of impacted third molars using orthopantomograms and to assess the repeatability of panoramic radiographs for diagnostic purposes.

Materials and Method: This cross-sectional study was conducted at Oral and Maxillofacial Surgery Department, Foundation University Islamabad, Pakistan from April to September 2024. All the OPGs collected were initially reviewed, and 120 images were further independently rated by three calibrated dentists using the Winter classification. Therefore, Cohen's Kappa was computed as a measure of inter-rater reliability.

Results: Mesioangular was the prevailing type of impaction. Cohen's Kappa values ranged from 0.78 to 0.81, describing the level of agreement between the two raters as substantial to almost perfect. The percentage of total agreement in the last observations was 76.7%.

Keywords: Impacted third molars, orthopantomogram, Winter's classification, inter-rater reliability, panoramic radiography, mandibular molar angulation.

INTRODUCTION

The evaluation of the position of mandibular third molars is an area of interest due to its effects on oral health, surgical planning, and possible pathologies. Orthopantomograms can be considered one of the popular radiographic techniques for diagnosing various disorders and pathologic conditions of the maxilla mandible and the surrounding structures, including third molars and their position relative to adjacent landmarks. Since third molars are commonly treated in dental practice, the angular position of these teeth has a significant influence on the treatment plan, and the inter-observer variability falls

under the dentist, which is essential to minimize diagnostic disagreement among clinicians. Several other researchers have pointed out the inter-observer concordance of dentists in perceiving third molar impactions based on orthopantomograms. Tariq et al. (1) have stressed the inter-rater agreement in angle measurement, pointing out that by using standardized classification, the practitioners display moderate to substantial agreement. This is indicative of the positive probabilities that may well transform OPGs into reliable diagnostic aids, particularly where this instrumentality is reinforced by training and calibration amongst the practitioners.

Similarly, Liaqat et al. (2) evaluated the implementation of reliability for rating the depth of impaction, making sure that work was consistent and that reference systems contribute to improved reliability in clinical assessments. On this basis, Mummolo et al. (3) conducted a quantitative study where linear and angular measurements on OPGs were used to predict mandibular third molar impaction, stressing accurate imaging and calibration. Their conclusion aligns with the inclusion of OPG-based measures into other models that might help clinicians make early decisions about third molars. This also minimizes the bias that might be encountered when creating a visual estimate as a lone decision. Ayub et al. (4) titled their paper on inter-rater reliability regarding the ramus relationship of impacted third molars, which underlines the significance of multiple viewpoints of radiographic assessments other than angulation, which also consider the position of the impacted tooth in the arch. It supports the case of more elaborate diagnostic reference models involving two or more radiographic measures for diagnosing.

The selection of radiographic techniques has also been a concern in the present study. Joshi et al. (5) have made a comparison between orthopantomography and cone beam computed tomography, particularly concerning the proximity of the root to the mandibular canal. This is a testimony to the practicality of OPG taken as an imaging modality at the first instance, even though CBCT gives a three-dimensional clarity of the tooth. Afridi et al. (6) conducted a study analyzing anatomical relations in an effort to determine the correlation between mandibular third molars and facial skeletal classes. The study revealed that there is a possibility of establishing a predictive model whereby certain skeletal patterns predispose them to molar impactions. Such findings may enable better patient-by-patient evaluations and management plans. Similarly, Sujon et al. (7) reported the rate of third molar impaction based on a sample of digital OPGs amenable for analysis in terms of angle assessment and relation to population oral health.

Khan et al. (8) went further and provided a radiographic classification of impactions of a digital panoramic study, which strengthens the use of OPGs in analyzing the pattern and incidence of impaction. Since the images provided by OPGs are clear and can be easily replicated, the use of OPGs has become a useful diagnostic tool in various dental practices. Concerning the forensic aspect, Timme et al. (9) studied third molar eruption schedules by orthopantomogram for age determination. The standardization of the angle and eruption stage not only assists in making a decision on the treatment to be given to a patient but is also useful in medico-legal evaluations. These applications indicate that it is not only necessary to have inter-dentist reliability in the interpretation of OPG images. Moreira-Souza et al. (10) further focused on a few comparative studies between the panoramic radiograph and CBCT and their usefulness, especially in cases of buccal and furcation involvement and external root resorption. This analysis indicated that despite CBCT being more accurate, panoramic imaging remains acceptable, provided there is a steady interpretation of the images and with special emphasis on angles of impaction.

Ahmed et al. (11) endeavored to extend the clinical practice domain by probing into the effects imparted on the bone distal to the second molar due to impacted third molars. Panoramic radiographic examination identified that molar angulation could play a role in periodontal prognosis and, for the first time, correlated radiographic analysis to the long-term prognosis in dentistry. Skitioui et al. (12) observed pathology of the second molars regarding third molar impaction and highlighted the need for precise angular evaluation in order not to encounter risks that may arise. Diseases, which may include caries, bone loss, or resorption, are likely to be foreseen through a thorough examination of OPG. In their study, third molar impactions in a Cameroonian sample were diagnosed and classified

using the Winter, Pell, and Gregory works on panoramic radiographs by Jacques et al. (13). This makes them the ideal example of the effectiveness of classification-based interpretations that can improve the inter-observer reliability in various populations.
ASSIRI et al. (14) believed that the assessment of angles could give a general view of the maxillofacial relationships and did their research in the Spanish population regarding the third molar impactions and temporomandibular joint. They include correlations that are needed to determine comprehensive pathology prognosis and treatment options when providing dental and skeletal care. At last, Gopalaiah et al. (15) conducted a study comparing the developmental changes in South Indian children and adolescents in mandibular third molars according to the type of impaction. It is in agreement with their research to allow evaluation of angles in developmental assessments and orthodontic analysis that aids early treatment intercession in growth periods.

Objective
The objectives of the study were to assess the interobserver agreement of the dentists to determine the angulations of the impacted third molars using orthopantomograms and to establish the intra observer reliability on the use of panoramic radiographs for diagnosis.

MATERIALS AND METHODS
Study Design: cross-sectional observational study.
Setting: The study was conducted at at Oral and Maxillofacial Surgery Department, Foundation University Islamabad, Pakistan
Duration: The data collection took place over six months, from April to September 2024

Inclusion Criteria:
The clients included asymptomatic patients aged between 18 and 40 years with radiographically confirmed impacted mandibular third molar. Digital orthopantomograms taken from patients with no movements or minimal movements of the impacted teeth and surrounding structures were only used in this study. All participants provided informed consent.

Exclusion Criteria
Radiographs with movement-related artifacts, overlapping body parts, or unclear positioning were excluded. Patients with a history of mandibular surgery, orthodontic treatment, any system illness that affects the bone structure of a patient, or any patient with incomplete radiographic records were excluded from the study.

Methods
A total of one hundred and twenty digital orthopantomograms (OPG) showing impacted mandibular third molar were reviewed according to the inclusion and exclusion criteria. Three qualified operators assessed the position of each Third molar using Winter's classification into Mesioangular, Distoangular, Vertical, Horizontal, and Other. To minimize misinterpretation, the dentists were put through a calibration process before the assessment procedure was conducted. Dental images were read in a randomized and masked fashion by each evaluator, and they were unaware of the classification made by other evaluators. All the details were noted down in a structured format that would be appropriate for statistical analysis. Cohen's Kappa coefficient was used to determine the inter-rater reliability in an attempt to observe the extent of coherence among the observers. Analytical procedures for this study were done using Statistical Package for Social Sciences (SPSS) version 26. For data description, frequencies and distribution of different categories of angulation were analyzed using descriptive statistics. All patients' information was kept confidential, and the study was approved by the institutional review board.

RESULTS

One hundred and twenty orthopantomograms (OPGs) were examined by three impartial dentists to determine the angle of impaction of the mandibular third molars. Mesioangular angulation was most often seen, and vertical, distoangular, and horizontal impaction incidences were recorded least frequently. Table 1 depicts the result of third molar angulation types categorized by the three observers.

Table 1: Frequency Distribution of Angulation Types (N=120)

Angulation Type	Observer 1	Observer 2	Observer 3
Mesioangular	52	50	53
Vertical	28	30	27
Distoangular	20	18	21
Horizontal	15	17	14
Others	5	5	5

Mesioangular fractures were the most common, and interobserver agreement regarding classification was high among all observers. Vertical and distoangular cases were also similar to each other, with a slight difference found in horizontal types.

To assess inter-rater agreement, Cohen's Kappa values were calculated for each pair of observers. The strength of agreement was interpreted according to Landis and Koch's criteria. The results are shown in Table 2.

Table 2: Inter-Rater Agreement (Cohen's Kappa Values)

Observer Pair	Kappa Value	Strength of Agreement
Observer 1 & 2	0.81	Almost Perfect
Observer 1 & 3	0.78	Substantial
Observer 2 & 3	0.80	Substantial

The most significant level of concordance was established between Observer 1 and Observer 2 (κ=0.81), though the interobserver agreement between Observer 1 and Observer 3 was slightly lower but still high. These values suggest that dentists can accurately rate the angulation of the third molars on OPGs by referring to standard classifications.

Table 3 provides the percentage agreement and disagreement of the observers in general. Those that were agreed by all three observers were counted as full agreement, while those observed by two of the observers were counted as partial agreement.

Table 3: Level of Agreement across All Observers

Agreement Type	Number of Cases	Percentage (%)
Full Agreement	92	76.7%
Partial Agreement	20	16.7%
Disagreement	8	6.6%

Analyzing the survey results, it can be observed that all the dentists agreed in more than three-quarters of the cases, which indicates rather high overall concordance. These findings only revealed that 6.6% of the subjects had complete disagreement, which might be due to prior calibration and the use of orthopantomograms in the third molar angulation assessment.

DISCUSSION

The position and the angle of the third molars are valuable factors that should be considered while assessing a patient's dental condition and working on treatment options. Among the imaging modalities that can be used in this subject, orthopantomograms (OPGs) are preferable since they provide panoramic views and are relatively easy to obtain. Therefore, the present study aimed to determine the inter-observer reliability of the angulation of impacted mandibular third molars as classified by the Winters index using OPGs. It also underlines insubstantial inter-rater reliability, which ensures the reliability of the diagnostic potential of panoramic imaging when certain standard prerequisites are met. In previous works, OPGs have been found to be a significant factor in evaluating third molar impactions. Tariq et al. (1) observed moderate to substantial interrater reliability of dentists in the molar angulation and concord with this study's moderate to substantial Cohen's Kappa value ranging from 0.78 - 0.81. These findings show that there is a general tendency in angle measurement, which can be reduced to a great extent through training and adherence to certain standards. Similarly, Liaqat et al. (2) have also testified that intra- and inter-examiner reliability in evaluating the depth of impactions is in agreement, which clearly indicates that structured evaluation checklists improve the reliability of the diagnosis.

The nature and distribution of impaction types that are evident in the current study reflect the nature of research investigations done in the past. Mesioangular impactions were the most common, followed by this study and also Mummolo et al. (3), where OPGs in young adults were evaluated to predict the probability of third molar impaction. Their study focused on angular measurement and concluded that such evaluation could be helpful in early detection and treatment. The authors found efficiency in this utility, particularly in light of the high degree of interobserver reliability in the identification of the cases showing mesioangular orientation. Ayub et al. (4) stated that OPGs were regarded to be very reliable in evaluating the ramus relationship of third molars, and this, along with angulation, was seen as a factor that contributed to surgical difficulty. The observations made in this study corroborate that OPG-based assessment could be used as the initial mode of formal evaluation when CBCT is unavailable. Joshi et al., in their comparative analysis of OPGs and CBCT, have also noted that even though the latter gives more detail, the former can prove helpful where basic angulations and positions are to be assessed, provided that it is used appropriately.

Additional studies related to the physiology of the face have also been done to include the relation between the skeletal facial types and molar angulation by Afridi et al. (6). Their evidence indicates that cephalometric landmarks could affect the formed pattern of impaction, which furthers the idea that a multiple approach to diagnostics might be better. However, this study focused on angular interpretation and clearly emphasized that even one radiographic dimension, if measured reliably, brings clinical value. Sujon et al. (7) examined third molar impaction as well as the importance of its treatment in a large population and assessed the frequency of mesioangular and vertical impaction. These studies corroborate the demographic comparability of the current study and the importance of identifying the frequency distribution of the locality for the planning of community-centered oral health care policies.

Khan et al. (8) point out the value of digital panoramic studies, arguing for consistent interpretive patterns in evaluating impaction types. The current study extends from this by measuring the levels of interobserver agreement, which superimposes a numerical factor on OPGs as opposed to merely relying on visual analysis. Furthermore, the concept of angle measurement of third molars discussed by Timme et al. (9) gives more knowledge of how angular classification can be applied in many domains other than dental practice. This article confirms that volume and shape analysis for angulation classification can even help in age prediction, a concept that extends to embracing the importance of standardization of interpretative procedures among dental experts. Moreira-Souza et al. (10) compared imaging techniques, asserting that two-dimensional panoramic radiography is still relevant when CBCT is inapplicable or unnecessary. This assertion is backed up by the current study where, as shown by the ICC, the panoramas' angular measurements are reliable given the high inter-rater reliability.

Ahmed et al. (11) and Skitioui et al. (12) discussed the pathological impacts of the third molar impactions on the endpoint teeth, including bone loss and the phenomenon of root resorption. Those facts explain the clinical relevance of precise molar angulation determination since some positions are more hazardous to provoke such complications. The present paper did not aim to assess pathology, although the reliable identification of impaction types is an important first step in averting these complications. According to Jacques et al. (13), Winter, Pell, and Gregory, classification is functional when using OPG-based evaluation. The present study has compared very well with their research done in the Cameroonian population regarding the prevalence of impaction and use of standardized systems. This is in line with the fact that these classification methods can be effectively used for this purpose in any population if applied correctly.

ASSIRI et al. (14) subsequently built on the clinical significance of molar impactions by associating them with TMJ topography. Since TMJ evaluation was not within the sample focus of this empirical study, the relationship indicates the systemic role that might emerge from impacted third molars, supporting the necessity for sound and replicable diagnostic tests. Finally, Gopalaiah et al.'s study (15) on the impaction pattern of South Indian children and adolescents provides credence to the development imperative of angular assessment. They state that angular types may change over developmental phases, and radiographic examinations should be repetitive. The results of this study carried out among adult OPGs are helpful in monitoring such changes, particularly when assessing changes in the molar orientation mode over time.

CONCLUSION

The findings of this study showed that orthodontists agreed well in evaluating the angulations of impacted mandibular third molars using OPGs rated by Winter's classification. These findings reflect the validity of using panoramic radiography examinations with a specific approach and calibration of observers. Similarly, regarding the classifications of the trap, mesioangular impaction was noted to be the most frequently reported type of impaction observed in the present study and the previous studies. The almost perfect inter-rater reliability indicates the efficiency of the OPG in its utilization in clinical decision-making, particularly where higher-end image studies such as the CBCT may not be available. These findings will reassure third-molar practitioners to continue using OPGs for regular assessments and state the need for harmonized training for dental practitioners to have comparable results. Future research can then extend this research by sometimes correlating pathology, developmental changes, and more diverse samples to increase the applicability of third molar angulation measurements.

REFERENCES

1. Tariq, M., Haseeb, M., Khalid, T., Shakoor, A., Raja, H.Z., Butt, H. and Jabbar, M., 2022. Inter-Rater Reliability among Dentists for Assessment of Angle of Impacted Third Molars on Orthopantomograms. Pakistan Journal of Medical & Health Sciences, 16(10), pp.695-695.
2. Liaqat, F., Gakhar, A., Siddiqui, Z.W., Jabbar, M., Fatima, S. and Butt, H., 2023. Inter-Rater Reliability among Dentists for Assessment of Depth of Impacted Third Molars on Orthopantomograms. Pakistan Journal of Medical & Health Sciences, 17(01), pp.388-388.
3. Mummolo, S., Gallusi, G., Strappa, E.M., Grilli, F., Mattei, A., Fiasca, F., Bambini, F. and Memè, L., 2023. Prediction of Mandibular Third Molar Impaction Using Linear and Angular Measurements in Young Adult Orthopantomograms. Applied Sciences, 13(7), p.4637.
4. Ayub, I., Rehman, M., Nawaz, M., Jabbar, M., Butt, H. and Jamil, F., 2023. Inter-Rater Reliability to the Assessment of Ramus Relationship of Mandibular Impacted Third Molar Among Denitsts: An Orthopantomographic Study. Pakistan Journal of Medical & Health Sciences, 17(01), pp.394-394.
5. Joshi, J., Dudhia, B., Mehta, D., Thaker, N. and Patel, H., 2025. Comparative Analysis of Impacted Mandibular Third Molar Root Proximity to the Mandibular Canal using Orthopantomography and Cone-beam Computed Tomography Imaging Modalities: A Pilot Study. Advances in Human Biology, 15(1), pp.113-117.

6. Afridi, S.U., Baseer, N., Durrani, Z., Afridi, M.I. and Jehan, S., 2022. Association between angulation of mandibular third molar impactions with facial skeletal types and cephalometric landmarks. Khyber Medical University Journal, 14(1), pp.47-55.
7. Sujon, M.K., Alam, M.K., Rahman, S.A. and Noor, S.N.F.M., 2022. Third molar impactions prevalence and pattern among adults using 5923 digital orthopantomogram. Bangladesh Journal of Medical Science, 21(3), pp.717-729.
8. Khan, S.Q., Khabeer, A., Alyousef, N.I., Benrashed, M.A., AlMaimouni, Y., Al-Thobity, A., Gad, M.M. and Akhtar, S., 2021. Radiographic evaluation of third molar impaction: A digital panoramic stud. Saudi Journal for Health Sciences, 10(1), pp.34-37.
9. Timme, M., Viktorov, J., Steffens, L., Streeter, A., Karch, A. and Schmeling, A., 2023. Third molar eruption in orthopantomograms as a feature for forensic age assessment—a comparison study of different classification systems. International Journal of Legal Medicine, 137(3), pp.765-772.
10. Moreira-Souza, L., Butini Oliveira, L., Gaêta-Araujo, H., Almeida-Marques, M., Asprino, L. and Oenning, A.C., 2022. Comparison of CBCT and panoramic radiography for the assessment of bone loss and root resorption on the second molar associated with third molar impaction: a systematic review. Dentomaxillofacial Radiology, 51(3), p.20210217.
11. Ahmed, H.A., López-López, J., Egido-Moreno, S., Llabrés, X.R., Hameed, M. and Estrugo-Devesa, A., 2024. Mandibular Third Molar Impaction and Bone Change Distal to the Second Molar: A Panoramic Radiographic Study. Journal of Clinical Medicine, 13(3), p.906.
12. Skitioui, M., Jaoui, D., Haj Khalaf, L. and Touré, B., 2023. Mandibular second molars and their pathologies related to the position of the mandibular third molar: a radiographic study. Clinical, Cosmetic and Investigational Dentistry, pp.215-223.
13. Jacques, E., Ebogo, M., Eng, Y.C., Donald, N. and Odile, Z., 2023. Radiographic Evaluation of Impacted Third Mandibular Molar According to the Classification of Winter, Pell and Gregory in a Sample of Cameroonian Population. Ethiopian Journal of Health Sciences, 33(5), pp.851-858.
14. ASSIRI, H., Estrugo-Devesa, A., Egido-Moreno, S., Rosello-LLabres, X., Hameed, M.S., Alqarni, A. and Lopez, J.L., 2024. Prevalence of mandibular third molar impaction, associated pathologies, and correlation with Temporomandibular joint morphology in Spanish Population: A panoramic radiography study.
15. Gopalaiah, H., Gurram, A., Chaitanya, N.C., Sharma, S., Gattu, A., Rathore, K., Ali, S.H., Parvathala, P., Reesu, G.V., Mula, A.P. and Balla, S.B., 2022. Is there any difference in the development of mandibular third molars according to the type of impaction: An orthopantomographic study in south Indian children and adolescents. Legal Medicine, 57, p.102055.