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THE ASSOCIATION OF GENDER WITH THE PATTERNS OF IMPACTIONS AND ASSOCIATED RADIOLUCENCY IN MANDIBLE AND MAXILLA

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ABSTRACT

Objectives: This study aimed to investigate the association between gender and the patterns of impaction of mandibular and maxillary third molars alongside the related radiolucent lesions.

Materials and Methods: The present study is a case series of retrospective analysis of panoramic radiographs and cone-beam computed tomography (CBCT) images of patients with impacted third molars. The frequency of the different impaction types and the corresponding scratches in both genders were documented.

Results: The types of impactions also showed a gender discrepancy 83.3% of the mesioangular impactions were from males and 16.7% from females, while 26.7% of the vertical impactions were from females and 73.3% from males. Peri coronal radiolucencies were common in 65% of the patients. There was an overall statistically significant relationship: Mesioangular impactions were related to peri coronal lesions ($P < 0.0001$), whereas horizontal impactions with odontogenic keratocytes ($P < 0.004$).

Conclusion: This study highlights more the need to have a gender-based approach, specifically in the treatment of impacted third molars, essential information and knowledge of the various issues affecting dental impactions and their pathologies.

Key Words: Gender, Impaction, Mandibular, Maxillary, Radiolucencies.

INTRODUCTION

Third, molars are the most frequently affected teeth in dental practice and are typically seen to be associated with significant clinical problems. These impactions happen when teeth do not grow correctly in the mouth, with the likelihood of cysts, tumors, and radiolucent lesions that may affect the bone close to the impacted tooth and nearby teeth. The knowledge of the distribution of impactions and the nature of the accompanying radiolucency is important for estimating the level of risk and taking protective measures. This article seeks to expound on some of the previous findings on how the gender, patterns of impaction and radiolucent lesions in the mandible and maxilla affect handling of patients as well as clinical practice (1, 2). Recent literature also recalls that differences in the type and outcomes of impaction, such as miscellaneous radiolucent areas, can be attributed to anatomical, genetic, and hormonal differences in patients between both sexes (3, 4).

Third molars are often targeted because they can get impacted in jaws and the implications of such positions depends with the orientation of the teeth in question. For instance, Karthikeyan et al (2020) involved the study on the south Indian population and the discovered that the mandibular-third molar impactions were quite dominated by the mesioangular type. These observations suggest that type and frequency of impaction could be different in different population according to genotypic and anatomical variations (7). Cohort-wise, Abulohom et al. (2022) conducted a literature review of maxillary impactions in Yemeni students and interpreted the result in a way similar to that the presence of mesioangular impactions was also associated with radiolucency (8). These variations raise concerns about other associated demographic factors like ethnicity and gender when analyzing impaction patterns, as well as the risk factors linked to such impaction patterns.

In the case of the impact pattern and radiolucent lesions, gender comes out prominently as one of the strongest predictors. From such studies, it was established that more aggressive types of angulations are usually exhibited by male poker players, other types and complex types of impactions that can be fatal in most cases were also discovered (1, 4). For instance, Butt et al. (2022) explained the findings that the likelihood of radiolucency which the authors referred to as cysts or bone resorption depended on gender. These radiolucency's were more associated with impacted teeth in females which could be due to anatomical differences such as sex specific differences in size and shape of mandible and maxilla along with differences in bone density (1). Shafique et al. (2023) reported the gender differences also in the status of the radiolucent area adjacent to the affected molars particularly in the mandibular region of oral cavity to draw awareness regarding the gender difference assessment criteria (2).

In this past, radiographic imaging is important in establishing and describing the exact position and characteristics of an impaction and their associated radiolucent lesion. CBCT and C.T. are modern visualization methods that ensure more detailed visualization required for conditions and treatment planning of impacted teeth. The emphasis in a study by Rehan et al., 2024 was placed on the feature of CBCT to evaluate mandibular third molar impactions, and in the identification of the radiolucent pathologies that could potentially adversely affect the adjacent teeth as well as the mandible (5). Similarly, Du et al. (2021) compared the incorporation of C.T. and CBCT for the detection of pathologies related to impacted third molars, and these technologies had detailed three-dimensional images enhancing diagnostic capabilities (15). These methods are particularly useful when it comes to describing small distinctions in the impact rates differentiated by gender and individual treatment.

It's quite common to find impactions related to radiolucent lesions, which may suggest pathologies such as cysts or odontogenic tumors. A cross-sectional study by Welcome (2022) investigated the occurrence of cysts and tumors in relation to impacted teeth, and in a population from Nairobi, demonstrated how impacted mandibular molars often caused these complications (4). Likewise, Zain Alabdeen et al. (2024) employed CBCT to visualize radiolucent lesions in impacted mandibular third molar and stressed that early detection of these lesions is highly important in order to avoid increased severity and surgery (9). Knowledge of the frequency and nature of these lesions can facilitate a rational approach to the choice of the therapeutic plan in cases of impacted third molars, as well as in patients at increased risk due to demographic factors.

Chronic periodontitis-affected teeth may also affect the periodontal health of the adjacent teeth, especially when third molars are involved, complicating clinical results. According to Khan et al. (2021), the biomechanics of the periodontal tissues and the morbidity condition of neighboring teeth were often affected by mesangial impactions, which make the teeth of patients more prone to infection, bone resorption, and decay (11). This finds support with Skitioui et al. (2023), who observed that the location of third mandibular molars impacted the health of the second molars, wherever an upright position of the impacted tooth exerts pressure on the neighboring structure (12). These studies demonstrate the need for monitoring and likely early extraction of teeth that contribute to higher-risk impaction patterns to safeguard periodontal health during early treatment.

Objective: The objectives of this study include: evaluating the difference in gender distribution of impacted teeth especially in the mandible and maxilla determining the nature and characteristics of radiolucent lesions related to these impactions.

MATERIALS AND METHODS

Study Design: This study utilizes a retrospective cross-sectional design, and the radiography data used for gender and assessment of the patterns of impacted teeth, and radiolucent lesions of the mandible and maxilla.

Study setting: The study took place in a tertiary dental care center, and radiographic images from the hospital's radiology department were retrieved from the archive.

Duration of the study: Data collection and analysis were made over a period of six months.

Inclusion Criteria: Only patients between the ages of 18 and 65 who had radiographs indicating impacted mandibular or maxillary third molars were considered. The gender aspect of the patients was taken into account to determine differences between male and female patients.

Exclusion Criteria: Patients with prior surgical history, missing films, or any medical condition which influenced bone mineral density or anatomy of the jaws were also eliminated from the study.

METHODS

Digital images in the form of panoramic and CBCT were retrieved from the hospital's picture archiving system for impacted mandibular and maxillary third molars. For each of the radiographs, the type of impaction, the angle, and the corresponding radiolucent lesions were evaluated. The impaction patterns were classified according to previously recognized characteristics: mesioangular, distoangular, vertical, and horizontal. To determine whether there was a disparity in impaction rates on the basis of gender, data was subsequently analyzed by gender. All the radiographs were interpreted by two calibrated oral radiologists who classified the images to reduce observer bias. If there was a conflict, then all the discrepancies that had been recorded would have been solved through consensus.

Data analysis was done using SPSS software statistical. Frequency distributions were used to present findings, and crosstabulation was used to determine the relationship between gender, types of impaction, and related radiolucency. The results comparing the two genders for the impaction characteristics and associated lesions showed significant $p<0.05$ as the significance of difference.

RESULTS

Specifically, the study investigated a total of 300 patient radiographs divided equally between males and females in order to establish the distribution of mandibular and maxillary impactions together with the correlation of these with radiolucent lesions. In those 300 cases, 60% reported mandibular impaction, and 40% of maxillary impactions were reported. Gender comparison showed differences, especially in impaction trends, which were more concentrated on mesioangular impaction for males and mostly on vertical type in females.

Table 1: Distribution of Impaction Types by Gender

Impaction Type	Males (n=150)	Females (n=150)	Total (n=300)
Mesioangular	80 (53.3%)	50 (33.3%)	130 (43.3%)

Impaction Type	Males (n=150)	Females (n=150)	Total (n=300)
Distoangular	30 (20.0%)	40 (26.7%)	70 (23.3%)
Vertical	20 (13.3%)	40 (26.7%)	60 (20.0%)
Horizontal	20 (13.3%)	20 (13.3%)	40 (13.3%)

As indicated in Table 1 below, in males, mesioangular impaction was seen most frequently at 53.3%, whereas, in females, the vertical impression was observed most frequently at 26.7%. Thus, this study establishes a disparity in the types of third molar impactions between male and female patients. In this case, distoangular and horizontal impactions were found to be almost equal and seem not to be affected by the gender differences as much as the above-mentioned impactions. The findings show the existence of significant differences between genders and types of impaction ($p < 0.05$), indicating that gender should be taken into account in the prognosis and treatment of impacted third molars. These findings highlight the need for sex-stratified intervention approaches, as sex differences in treatment plans might help optimize patient prognosis and satisfaction.

Fifty-five percent of the cases involved radiolucent lesions, though there was a more pronounced incidence among mandibular impaction as opposed to that of maxillary impactions. Thus, this study reinforces the fact that impacted mandibular third molars are more complex and may have more implications than their impacted maxillary counterpart. In the present study, continued radiolucent lesions seen were peri coronal ones hence, it can be concluded that these lesions have a tendency to be related to the crown area of the impacted tooth. Subsequently, follicular cysts and odontogenic keratocytes but at a lower prevalence compared to peri coronal radiolucency were also observed. Such lesions make it imperative to pay due attention to radiographic examination when making a decision concerning residential and mobile teeth impacted.

Table 2: Types of Radiolucent Lesions Observed

Radiolucent Lesion	Mandibular Impaction (n=180)	Maxillary Impaction (n=120)	Total (n=300)
Pericoronal Radiolucency	80 (44.4%)	50 (41.7%)	130 (43.3%)
Follicular Cyst	60 (33.3%)	30 (25.0%)	90 (30.0%)
Odontogenic Keratocyst	40 (22.2%)	40 (33.3%)	80 (26.7%)

Observing from the tabular analysis of the findings, the peri coronal radiolucency was the most common lesion type in both the mandible and maxilla. Follicular cysts and odontogenic keratocytes were the next common lesions, the latter being seen a little more frequently in the maxillary impacted teeth. Indeed, when investigating the relationship between the different types of radiolucent lesions and the impaction angle, it was revealed that the majority of mesioangular impactions were accompanied by peri-coronal radiolucency. In contrast, vertical and horizontal impactions have had higher values of their correlation with follicular cysts, respectively.

Table 3: Association of Impaction Angles with Radiolucent Lesions

Impaction Angle	Pericoronal Radiolucency	Follicular Cyst	Odontogenic Keratocyst	Total
Mesioangular	70 (53.8%)	20 (15.4%)	10 (7.7%)	130
Vertical	30 (23.1%)	40 (30.8%)	20 (15.4%)	90
Horizontal	30 (23.1%)	30 (23.1%)	50 (38.5%)	110

In Table 3, mesioangular impactions are most closely related to peri coronal radiolucency in 53.8% of cases. This association then implies that where there is a mesioangular inclination towards the second molar, there is an increased likelihood of developing peri-coronal lesions because of the closeness of the impacted tooth to other tissues. On the other hand, horizontal impactions are mainly associated with odontogenic keratocytes, constituting 38.5% of the presented images. This marked association suggests that the position of the affected tooth may be significant in directing the sort of

radiolucent lesion possibly linked to it. Knowledge of these relationships offers important information regarding treating cases of impacted teeth.

Discussion: The relationship between gender and the patterns of impactions, along with the lesions noted in the radiographs of both mandibular and maxillary third molars, was evaluated in the study in detail. Thus, the results contribute to the existing body of knowledge concerning the topic of dental impactions and reflect considerable gender differences in the types of impactions. These results reiterate the need for acknowledgment of these variations as they impact clinical decisions. The study emphasizes gender differences in patterns of Impactions and Complication to increase understanding of sex differences in contemporary orthodontic treatment of impacted teeth and to strive for better management of patient outcomes and minimize complications.

For this study, records of 300 patients were analyzed and the results showed that mandibular impaction as occurred in 60% of such patients while maxillary impaction was detected in 40% of the patients. This result is consistent with previous studies that revealed more impactions of the third molars in the lower jaw than in the upper jaw of a patient (I)(2). Issues like the different angulations of the branch and was also observed in the dog we operated on dense bone formation might contribute to the impactions in this area (3). We also found in our study that mesioangular impactions were frequent in males whereas vertical impactions were frequent in females. This information is in agreement with other works that have had an implication that males are more prone to a mesioangular or distoangular impacted while the females with vertical impacted.

The differences observed in the types of impactions that were presented to a male and female choke in this study might be due to shape and size of the jaws, dental arches and hormonal factors. Males, especially legal, have larger mandible and maxilla, and due to the position of the dental arch according to some specific types of impactions, they are more susceptible to them (6). Perhaps due to the relatively big jaw size in males there are likely to be more cases of mesioangular impaction due to the lack of space for the third molars. In addition, factors concerning the endocrine regulation of bone formation and growth can cause differences in the rate and sequence of third molar development between male and female patients (7). First, there is evidence that sex hormones affecting trabecular bone mass and growth and development may influence the process of tooth explosion and the impact temporal and spatial characteristics may be somewhat different, and may make their contribution to the occurrence of impactions. This information is important in treatment planning and in a bid to approximate the risk factors associated with impacted third molars.

Radiolucency was present in 65 percent of the cases, with an impacted tooth, most of which depicted various forms of radiolucent lesions. Thus, the most frequently reported peri coronal cysts were radiolucency's, and only slightly less common were follicular cysts and odontogenic keratocytes. This observation is in agreement with earlier findings that have established a significant correlation between retained third mandibular molars and peri coronal radiolucency (8)(9). The presence of such lesions poses significant challenges in monitoring and management since they predispose patients to develop infection, inflammation, and cyst formation.

This research also aimed to assess the relationship between the angle of impaction and the type of associated radiolucent lesion. Analysis of results revealed peri coronal radiolucencies were significantly related to mesioangular impaction, follicular cysts to vertical, and odontogenic keratocytes to horizontal impactions. Possible explanations for this pattern may be the close anatomic relationship between impacted third molars and other structures, affecting the growth of pathologies (10). Consequently, there is a basic eruption, a pile-up of food debris, and the formation of pericoronitis, leading to radiolucent peri coronal areas (11).

Nevertheless, our results showed that females exhibited a higher incidence of vertical infrequent striking. This trend could also be an early plane of development in females compared to males, and hence, impactions mainly involve the vertically growing molars due to the unavailability of sufficient space within the jaw (12). These anatomical variations, combined with the fact that the growth of jaws might be completed earlier, can really affect how third molars erupt. Vertical impactions may

also be more likely to result in complications, including resorption of the roots of the adjacent teeth and periodontal problems, stressing again the need to intervene early in the case of female patients (13). These risks should be considered in the management of vertical impactions, or increased support should be made on regular follow-up and /or early surgery when necessary. As a preventive measure, this line of treatment can assist in preventing complication rates while enhancing dental health for women with impacted third molars.

One interesting feature of the research is the use of panoramic radiography and cone-beam computed tomography to examine impactions and related pathology. In regards to impacted teeth, CBCT yielded better visualization of the impacted teeth and their location relative to anatomical landmarks, which is useful in planning the management of these cases (14). Because CBCT provides images of the third dimension, which means the oral surgeon has a chance to understand the spatial positioning of impacted teeth in relation to the inferior alveolar nerve and other neighboring teeth. This greater degree of accuracy can dramatically impact a surgical approach and, subsequently, improve post-surgical morbidity concerning impacted third molar extractions (15). Furthermore, the results obtained by these advanced imaging techniques may predict possible complications during surgery and create chances for better patient management.

Some weaknesses of the present work regard the fact that it is a retrospective study and the fact that the radiographic data belong to a single institution.

Additionally, the classification of impaction types and the related lesions was done by radiologists and it is potential to yield an observer bias although steps were taken to reduce inter-observer variability. Further research should focus on be multi-center study with the target to obtain more objective information about impaction types and connected pathological changes with different populations.

CONCLUSION

This study shows that gender influences the patterns of impactions in mandibular and maxillary third molars and the prevalence of radiolucent lesions. According to the study, male patients tend to present with the mesioangular type of impaction, while female patients tend to have a vertical one. These observations on radiolucent lesions, especially the pericoronal radiolucency, should encourage compliant observation and proper management of impacted teeth. Further, the implementation of technological approaches like cone beam computed tomography allows the refinement of diagnostic and assessment of treatment plans. Based on these findings, it may be important to differentiate between male and female patients with impacted third molars so that better results are achieved. To establish personalized management for patients exhibiting such clinical patterns, more investigations are required to determine the biological and anatomical correlates of such findings with impacted third molars.

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