The relation between the distance from mandibular retromolar foramen to mandibular angle and lower third molar using panoramic radiographs

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Abstract

**Background:** Third molars are the last to erupt in the permanent teeth series. These teeth are the most likely to be impacted this research aims to evaluate whether the distance between mandibular retromolar foramen and mandibular angle renders different results in case of absence or presence of lower third molar in both genders.

**Methods:** A respective study conducted on 186 the distance between mandibular retromolar foramen and mandibular angle were examined on Digital panoramic radiograph (DPR). The radiographs were grouped according to Absence or presence of left lower third molar and subject gender. A logistic regression model was created using the statistically significant data.

**Results:** The lower third molar impaction on the distance between mandibular retromolar foramen and mandibular angle was not significantly different between mean groups (absence and presence) when gender is disregard. The distance between the two was significantly increased in the male subgroup.

**Conclusion:** The relation between the distance between mandibular retromolar foramen and mandibular angle and third molar using panoramic radiographs showed no fundamental difference in the distance between mandibular retromolar foramen and mandibular angle in case of absence or presence of lower third molar when gender is disregard.

Introduction

The last three decades have shown a marked increase in the use of dental panoramic radiography rising from 0.7 million radiographs taken in 1989 to an estimated 2.3 million for the years 2004 (1). The panoramic radiograph has been shown to be inferior to periapical and bitewing radiographs in the detection of approximal caries. However, the design of each of the relevant studies can be criticized in some way; for example, the small sample size, the absence of a ‘gold standard’ for caries diagnosis, differing diagnostic thresholds and the consequent failure to derive figures for sensitivity and specificity.

Third molars are the last to erupt in the permanent teeth series. These teeth are the most likely to be impacted (2). Impaction of the lower third molar was associated with reduced retromolar space width, increased B angle, and reduced third molar angulation in all A-P skeletal patterns (3). All images should be of good quality. In particular, conventional plain images should accurately depict the geometrical relationship of the lower third molar to its surrounding structures. Assessment of the Surrounding Bone the main features to examine include: 1) The anteroposterior position of the ascending ramus, to determine access to the tooth and the amount of overlying bone. 2) The texture and density of the bone. 3) Evidence of previous pericoronal infection. (4)

A normal panoramic radiograph contains a substantial amount of information and this technique is optimized to ensure high-quality diagnostic images (5).
The structure of the mandibular ramus tends to be discrete in several aspects in the erupted other than impacted lower third molars topics, according to Farman et al, suggesting that this may be a potential cause of impaction. The mandibular cortical index (MCI), a qualitative index used to measure the inferior cortical bone of the mandible posterior to the mental foramen on both the left and right sides, is another simple qualitative index used to evaluate the bone of the mandible. There are three outcomes that may occur: C1 ¼ normal cortex: the endosteal margin of the cortex is matched and tapered on both sides; C2 ¼ moderately eroded cortex: the endosteal margin shows semilunar defects resulting from lacunar resorption, or forms endosteal cortical residues; C3 ¼ severely eroded or porous cortex: the cortex forms dense layers of endosteal and clearly porous cortical residues (6).

Since several studies have pointed out that mandibular inferior cortical width below the mental foramen, which is manually measured on dental panoramic radiographs, may be useful for identifying postmenopausal women with low skeletal BMD or osteoporosis.

**Materials And Methods**

Out of 800 panoramic radiographs, only 93 Digital panoramic radiographs (93 right side and 93 left side, in total of 186 were examined) of male and female patients and their related data were selected from these records. The inclusion criteria were: all patients between 20 years old and 50 years old, good quality of DPR, treated at the same dental center and non-syndromic patients.

Participant were divided into four groups, two main groups based on gender and two subset based on absence or presence of left lower third molar despite absence or presence of right lower third molar and despite its statue (erupted or impacted).

**Impacted Group**: males and females without left lower third molar.

**Control Group**: males and females with left lower third molar.

The mean age of the total sample was 35 ± 15 years (range: 20–50 years). The radiographs were then imported to analysis software for tracing and measurements. Six landmarks were defined on the radiographs (Table 1). Two linear measurements were done (Table 2) using EasyDent V4 Simple Viewer v4.1.5.9 software. All measurements were done to the nearest two decimal points obtained from the software program and to avoid magnification errors DPRs from one source of radiographic center were used. In each subject of each groups two linear measurements were obtained: the distance between right mandibular retromolar foramen and right mandibular angle and the distance between left mandibular retromolar foramen and left mandibular angle. In this study, the DPR showing pathological or traumatic changes to the retromolar area were excluded. Those two points were chosen as an indicator because they’re composed from critical bone not alveolar bone. Thus, they’re stable regardless of denture statue. One investigator did all tracings and measurements.

**Statistical Analysis:**
The data was analyzed using SPSS V.22 using both descriptive statistics (mean, standard deviation) and inferential statistics (Independent sample T-test).

**Results**

Control group comprised DPR of 18 male and 28 female patients (figure N.1), whereas Absence group comprised DPR of 18 male and 28 female patients. The mean patient age amounted to $35 \pm 15$ years in absence and presence group.

Each group have five columns includes: subject number, Left Lower Third Molar (LLTM) presence, Left Mandibular width, and Right Lower Third Molar (RLTM) and Right Mandibular width.

The relationship between the distance between mandibular retromolar foramen and mandibular angle and the presence or absence of lower third molar on both sides right and left when gender is disregard: Statistical significance in $p=0.263, 0.475 > 0.05$ level is pointed out with asterisk.

The relationship between the distance between mandibular retromolar foramen and mandibular angle and the absence of lower third molar based on gender. Statistical significance in $p= 0,001 – 0,012 < 0.05$ level is pointed with asterisk.

The relationship between the distance between mandibular retromolar foramen and mandibular angle and the presence of lower third molar based on gender:

Statistical significance in $p= 0,52 – 0,09 < 0.05$ level is pointed out with asterisk.

The logistic regression analysis revealed three main point, a statistically significant impact of gender on distance between mandibular angle and retromolar foramen on the level of lower third molar absence ($P= 0,001 – 0,012 <0.05$). **Table N.3**

The distance between mandibular retromolar foramen and mandibular angle was significantly increased in the male subgroup in case of absence of lower third molar in compare with female subgroup. **Figure N.2**

No impact of gender on distance between mandibular angle and retromolar foramen on the level of lower third molar Presence ($P= 0,52 – 0,09 >0.05$). The distance between mandibular retromolar foramen and mandibular angle did not show much difference between male subgroup in case of presence of lower third molar in compare with female subgroup. **Table N.4**

**Discussion**

Because of an insufficient dental arch and room through which to erupt, third molars are the teeth that most frequently adopt an abortive eruption route and become impacted. Third molar impaction appears
to be becoming more common. Rajasuo et al 1993 found that 19-to-20-year-old Finnish men had slightly more partially erupted and less completely erupted lower third molars than 40 years earlier (7).

Gaddipati et al 2014 found that it might not be appropriate to strengthen the mandibular angle region and make the mandible vulnerable to condylar fractures by removing the unerupted third molars (8). Which raise the question what are the affection of lower third molar on the distance between mandibular retromolar foramen and mandibular angle and whether it's possible or not to determine it using digital panoramic radiograph. As there is a significant correlation was observed between the length of the mandible and eruption of the lower third molar according to Begtrup et al 2012 (9).

We used digital panoramic radiographs instead of traditional film-based panoramic radiographs in this research since Mahesh et al. (2011) found that conventional film-based panoramic radiographs and digital PSP-based panoramic radiographs were comparable in accuracy in the preoperative study of impacted mandibular third molars in terms of impaction status, tooth location, and number of teeth (10).

The Gonial angle is used for the definition of facial growth pattern with some other measures such as mandibular plane angle which needs further research to determine the relationship between third molar impaction and gonial angle according to Demirel & Akbulut 2020 (11). Thus, we measured the distance between retromolar foramen and mandibular angle in both sides and it was identified as the predictor of sex, in the present study this parameter was 29.205125 ± 1.0913 in men and 26.3858 ± 0.84815 in women. As for other studies different measurement were taken: lengths and widths of the mandibular ramus and body, the ramus inclination, the mandibular plane angle, and the mandibular gonial angle (12).

Several studies used DPR to examine predictors of mandibular third molar eruption (13). For this study no fundamental difference were found in the distance between mandibular retromolar foramen and mandibular angle in case of absence or presence of lower third molar which correspond with the study of chen et al 2017 that concluded Congenital missing number of the third molar has no significant association with Gonial angle, upper Gonial angle and lower Gonial angle (14).

In the same time there is a difference in the distance between mandibular retromolar foramen and mandibular angle based on gender as the male subjects demonstrated greater values for most of the variables compared to the female subjects in case of absence of lower third molar and no fundamental difference in case of presence. The configuration of the the distance between mandibular retromolar foramen and mandibular angle is sex-related, which might enhance the probability of third molar eruption or impaction this correspond with the study of Al-Gunaied 2020 (15). But Demirel & Akbulut 2020 concluded No relationship was observed among age, gender and gonial angle measurements (11).

Despite the limitations of this analysis, which should have been conducted in young adults with samples from various ethnic backgrounds and malocclusion forms, some apparent differences discovered between the groups may be useful in terms of prediction and treatment planning.
Conclusion

The relation between mandibular bone width and third molar using panoramic radiographs showed no fundamental difference in the distance between mandibular retromolar foramen and mandibular angle in case of absence or presence of lower third molar when gender is disregard. But there is a difference in the distance between mandibular retromolar foramen and mandibular angle based on gender as the male subjects demonstrated greater values for most of the variables only in case of absence of lower third molar compared to the female subjects which can be used as Landmarks and reference planes in Forensic age estimation.

Declarations

Ethical approval

Ethical approvals were obtained from the Damascus university – Syria. All methods were carried out in accordance with relevant guidelines and regulations. And informed consents were collected in order to use the panoramic radiograph for the analysis.

Consent for publication:

Not applicable.

Availability of data and materials:

The datasets generated during and analyzed during the current study are not publicly available due to copyright regulations of Damascus university for medical research, but are available from the corresponding author on reasonable request.

Competing interest:

There is no conflict of interest.

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Authors' contributions:

HA: collected the data, wrote the manuscript.

AA: helped writing the manuscript, finalized the article.

MBA: analyzed the data, helped writing the manuscript.
CK: supervised the research, finalized the article.

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Abbreviations

| Abbreviation | Description                  |
|--------------|------------------------------|
| DPR          | Digital Panoramic Radiograph |
| BMD          | Bone Mineral Density         |
| MCI          | Mandibular Cortical Index    |
| RMA          | Right Mandibular Angle       |
| RRMF         | Right Retromolar Foramen     |
| LMA          | Left Mandibular Angle        |
| LRMF         | Left Retromolar Foramen      |
| LLTM         | Left Lower Third Molar       |
| RLTM         | Right Lower Third Molar      |

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**Tables**

Tables 1-4 are available as downloads in the Supplementary Files section.

**Figures**
Figure N.1 - gender distribution

39.10% female
60.90% male

Figure 1

gender distribution
Figure 2 - the relation between the Gender and third molar status

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- TableN.2.docx
- tableN.1.docx
- tableN.3.docx
- tableN.4.docx