Classification of impacted mandibular third molars in a sample of the Saudi population as assessed by cone beam CT

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Abstract: Objective: Treatment planning the removal of impacted third molars requires ample knowledge of their position and relation to adjacent vital structures. Traditionally two-dimensional radiographs have been used for this purpose. With the advent of volumetric imaging, the aim of this study was to examine the classification of impacted mandibular third molars using CBCT images. **Materials and methods:** A cross sectional retrospective chart review was conducted using the database of a university based oral and maxillofacial radiology service. An oral and maxillofacial radiologist reviewed the images of patient's referred for CBCT imaging prior to extraction of an impacted mandibular third molar. **Results:** The images of 100 consecutive patients were included. The most common mandibular third molar angulation was mesioangular and the most common depth was Level B while the most common ramus relation was class II. **Discussion:** New classifications for impacted third molars should be developed based on the added information provided by three-dimensional imaging.
[Fatima Jadu; Daniah Alhazmi; Fatma Badrand Ahmed Jan. **Classification of impacted mandibular third molars in a sample of the Saudi population as assessed by cone beam CT.** *J Am Sci* 2016;12(11):24-27]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). http://www.jofamericanscience.org. 2. doi:10.7537/marsjas121116.02.

Keyword: Classification; impacted; mandibular third molars; Saudi population; assessed by cone beam CT

1. Introduction

Tooth impaction is a pathological condition in which a tooth fails to reach its normal functional position in the oral cavity. Third molars are among the more commonly impacted teeth accounting for nearly two thirds of all impacted teeth.(1, 2) Impacted third molars can remain asymptomatic but can also be associated with pathologies that range from external resorption to tumors.(3) Therefore the removal of impacted third molars is highly advocated.

Radiographic examination is an integral part of the treatment planning of impacted third molar extraction procedures. It allows the oral and maxillofacial surgeon (OMFS) to assess the position of the impacted tooth and its relation to the surrounding structure. Accordingly, several classifications have been proposed in the literature for appraisal of the position of the impacted third molar and, not surprisingly, most are based on radiographic findings. Two classifications have stood the test of time; the first by Winter in 1926 classified impacted third molars according to their angulation relative to the second molar (Figure 1).(4) Pell and Gregory developed the second classification in 1933. This classification addressed the position of the impacted third molar in two dimensions, the mesiodistal dimension and cephalocaudal dimension (Figure 2).(5)

Several imaging modalities have been used for the purpose of classifying impacted third molars but each modality has its shortcomings. To date, panoramic radiographs have been considered the gold standard but the two-dimensional (2D) images suffer from overlapping structures and distortion. Cone beam CT (CBCT) is becoming a more appealing alternative imaging technique because of the many advantages that it offers such as 3D images and submillimeter spatial resolution.

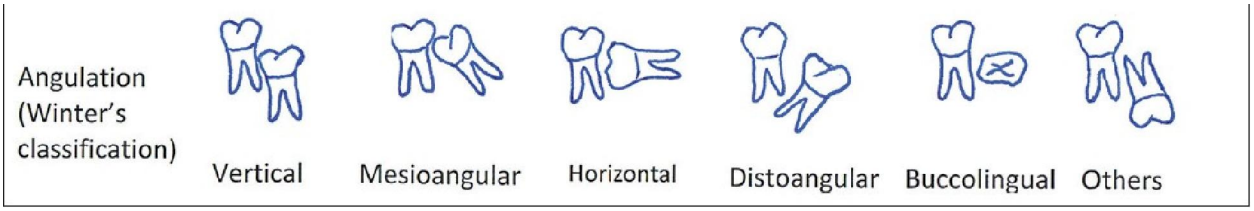

Figure 1: Winter's classification of impacted mandibular third molar angulation.

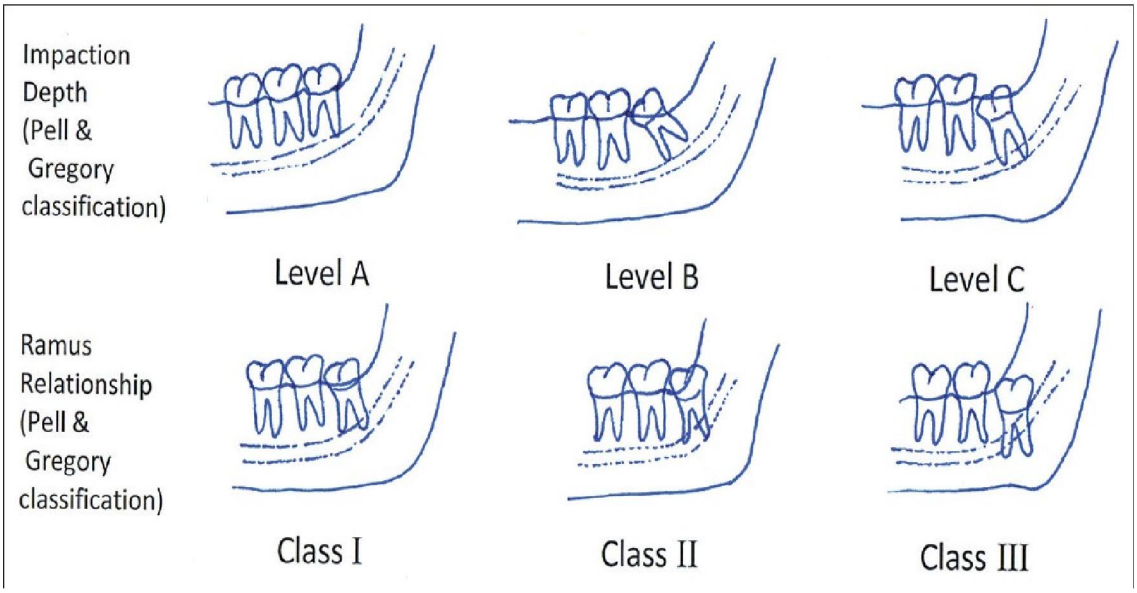

Figure 2: Pell and Gregory classification of impacted mandibular third molar position.

Recently, Maglione *et al.,* proposed a new classification for impacted mandibular third molars based on findings from cross sectional images such as those obtained from CBCT.(6) The aim of the new classification is to better determine the topographic relation of the impacted mandibular third molar to the inferior alveolar nerve canal and thus better predict the risk of injury to the inferior alveolar nerve.(6) This classification was developed because nerve injury and the resultant nerve deficit are among the more common complications of surgical removal of impacted mandibular third molars.(6)

There are no studies in the literature that address the classification of impacted mandibular third molars in the Saudi population as identified on CBCT images. Therefore, the aim of this study is to identify the pattern of impacted mandibular third molars as identified on CBCT.

2. Materials and methods

After ethical approval, a cross sectional retrospective chart review was conducted using the database of a university based oral and maxillofacial radiology practice. The review included the CBCT images of 100 consecutive patients referred for imaging the mandibular third molars prior to extraction. Exclusion criteria included impacted mandibular third molars associated with pathology, with incomplete root formation or with a missing adjacent second molar. In addition, patients with craniofacial anomalies were excluded from the study.

All the patients were imaged using the iCAT scanner (Imaging Sciences International, Hatfield, PA, USA) using the exposure settings recommended by the manufacturer and a voxel size (VOX) of 0.4 mm. Age and gender demographics were collected and two calibrated oral and maxillofacial radiology residents reviewed the CBCT images using the Vision software (Imaging Sciences International, Hatfield, PA, USA) and classified the impacted mandibular third molars according to depth, angulation, ramus relationship.(4-6)

Statistical analysis was done using the SPSS software version 22.0 (SPSS inc, Chicago IL, USA). Simple descriptive statistics were calculated using counts, percentages, mean, range and variations. Then, the differences between the groups were assessed using the Chi-square test and the level of significance was set at 5% ($p< 0.05$).

3. Results

The patients included in this study ranged in age from 17 years to 57 years with a mean of 27 years. The gender distribution was slightly skewed towards females (60%). The study included equal numbers of right and let side impacted mandibular third molars (47 tooth #38 and 43 tooth #48).

The results of the classification findings are summarized in Table 1. The most common angulation was mesioangular, whilst the most common depth was position B and class II was the most prevalent ramus relation. The most common angulation and ramus relation were statistically significantly different that the other categories but the same did not apply to the most common depth.

Table 1: frequency of impacted mandibular third molars according to classifications.

Variable	Frequency	Chi-square	Degree of freedom (df)	*p* value
Angulation Mesioangular Horizontal Vertical Distoangular Buccolingual Others	 57 15 24 4 0 0	62.6	3	<0.001★
Depth Position A Position B Position C	 37 42 21	7.2	2	0.027
Ramus relationship Class I Class II Class II	 30 70 0	16.0	1	<0.001★

★ significant at $p<0.005$

4. Discussion

Eruption of third molars varies greatly in timing and may occur as early as 14 years and as late as 26 years but the average eruption time is between 17 years and 21 years.(3, 7, 8) Causes of impaction also vary widely with several suggestions in the literature including the lack of jaw space that has accompanied the human evolution. Some authors suggested diet as a possible cause for impaction and yet other authors blame cross breading and changes in childhood habits. In any case, assessment of the third molars at an early age and surgical removal of impacted third molars is strongly recommended especially in younger adults when the surrounding bone is more resilient and malleable as this will decrease the likelihood of jaw fractures during the procedure.

Several previous studies have demonstrated that impacted teeth are more common in females than males, which is consistent with the finding in this study as well.(9-11) This may be attributed to the smaller jaw size.(12) However, this gender inclination may be a reflection of the propensity of females to seek medical assistance more than males. In this regard, more research is needed to confirm this predilection.

The most common impacted mandibular third molar angulation among the sample of the Saudi population was mesioangular. This finding is an agreement with several publications that took place among different races including American, Singaporean and Iranian populations.(9, 10, 13) The most common depth was level B while the most common ramus relation was class II. Once again these findings were consistent with other publications including another similar study that was conducted on a sample of the Saudi population.(14) However, the Hassan study used 2D panoramic radiographs unlike the 3D CBCT images that were used in the current study.

The two classifications proposed for impacted third molars were based on findings from 2D images such as panoramic radiographs but with the widespread use of volumetric imaging namely CBCT, a new classification may be needed to take into account the information available from the third dimension and the information available about the topographic relation of the impacted tooth to vital surrounding structures such as the mandibular canal. Proposed classifications based on 3D imaging are already being published. Maglione *et al.,* proposed a classification of the relationship of the impacted mandibular third molar to the mandibular canal.(6) The aim of the classification was to aid the oral and maxillofacial surgeon in choosing the most appropriate surgical technique and to provide the surgeon with a risk estimate for IAN injury.(6) Unfortunately, the classification is a complicated and difficult to remember.

The future directions for the current study are to quantify the relation of impacted mandibular third molars to the inferior alveolar never canal and then develop a simple classification for impacted mandibular third molars based on 3D imaging taking into account the relation to the mandibular canal to which will aid OMFS in estimating the risk of nerve injury during mandibular third molar removal surgery.

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10/23/2016