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Assessment of Condylar Shape in Different Angle Classification of Malocclusions among Iraqi Subjects through Orthopantomography

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ORIGINAL STUDY

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Assessment of Condylar Shape in Different Angle Classification of Malocclusions among Iraqi Subjects through Orthopantomography

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Abstract

Background: Changes in occlusion are necessary to be taken into consideration for their importance as a causative factor for variability in the structural morphology of mandibular condyles which in turn may cause internal disorders of the Tempromandibular joint.

Objectives: to investigate the relationship of different Angle classification Cl I, Cl II, Cl III, on the trabecular structure of the mandibular condyles shape through Orthopantomo-graphy and demonstrate the most prominent shape in relation to angle classification.

Material and Methods: A retrospective study in which 4000 condyle process were examined using Orthopantomograph (OPG). The patient sample was divided into three groups according to angled classification: class I, class II, class III then The shape of condyle was detected for both sides.

Results: This study concluded that round/oval shape condyle is most commonly seen among Iraqi population followed by flat shape, and the least common is crooked finger shape and bifid condyle.

Conclusion: Six different types of condyle shapes were identified, proposed a classification of condylar shapes with 6 different types as follows: oval, flat, diamond, irregular, crooked finger, and bifid.

Keywords: Condyle shape, Angle classification, Panoramic radiography

1. Introduction

Due to the ease of using Panoramic Imaging technic, their acceptance by patients, favorable cost-benefit relationship, the use of a small amount of radiation in addition to reasonable accurate information and visualization of both arches in a single glance including Tempromandibular joints, this makes type of radiographic technic the best choice for the dentist [1].

Condylar shape and size have an important role in the physiological function of the jaw which thus affects sagittal skeletal malocclusions and because of Tempromandibular complexity, the exact relationship is not well under stood [2]. This gap in knowledge highlights the need to generate various research studies to improve the understanding of these relationships and their clinical implication [3]. Accordingly, the anteroposterior relationship position between the jaws was classified as class I, II, and III malocclusion. Facial esthetic and mastication are then affected relatively, thus affects living in an ideal way [4]. Several authors have discussed various types of condyle shapes in different parts of the world (geographical variations) [5–9].

Most of the previous studies found 4 types of condyles in their study population Type I - Oval shape, Type II - Diamond shape, Type III - Birdbeak shape, Type IV - Crooked finger shape, and only in one study [10], 6 types of condyles were found which

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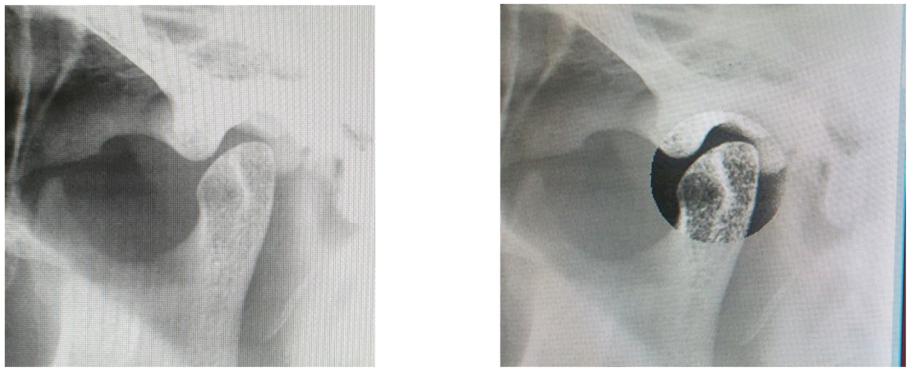

Fig. 1. Left: plan image, right: filter is used to expose the condyle clearly.

were round, flattened, diamond, mixed, crooked finger, and bifid. Apart from the most commonly used classification system which was first given by Sonal et al. [5].

Many researchers have studied the shape and size of the Tempromandibular joint specifically the mandibular condyles and generally, the oval shape was the most common in both genders [1, 10, 11].

There are many factors that make the human condyle to undergo remodeling. Türker & Yaşar (2022) concluded that SN-MP angle increases, the condyle dimensions decrease [11]. Osteophytes were found to be the most predominant feature compared to other condylar morphological changes [12]. Limitations of dental panoramic imaging must be taken in consideration during studying condylar shape. Although the bifid condyle is often found on accidental panoramic radiographs [13], Abhishek et al. [10] revealed that the least common shape observed was bifid and suggest to use three-dimensional imaging, or skull study would be more accurate even dimensionally.

2. Material and methods

OPG data were obtained from the archives of the Oral and maxillofacial clinic, College of Dentistry in Baghdad, Iraq.

The data were taken from the X-ray scan and case sheets of different patients attended seeking orthodontics treatment, therefore, they were not exposed to unnecessary x-ray exposure according to consent form and ethical approval.

The patients were selected according to selective criteria, which are:

1. good image quality, no distortion, no blurring, and no artifacts. Both sides of the upper and lower jaws are presented clearly.
2. orthodontics patient, aged from 18–25 years old, healthy, without systemic diseases or environmental factors that affect the TMJ or condyle of mandible.
3. No pathological lesion, fractures, missing teeth, dental anomalies, or any causes that interfere with normal TMJ morphology.

According to these selective criteria 2000 panoramic radiographs were selected, that mean 4000 condyle processes were examined. All the OPG scans were obtained using the SORDEX-device, and the measurements were calculated by Scanora software, The evaluation of the images was assessed by two oral and maxillofacial radiologist experts separately for each patient, with inter and intra radiologist examiner.

The patient sample was divided into three groups according to angled classification: class I, class II, and class III.

2.1. OPG measurements

The shape of the condyle was detected for both sides, the observer studied the condyles' shape using the equalized filter of Scanora version 5.2.6 software, with calibration (1:1 magnification), as shown in (Fig. 1).

The collected data were analyzed using SPSS. Chi-square test was performed to check the significance level of associations. The p-value of < 0.05 was considered significant.

Intraobserver agreement of condylar shape, expressed as kappa values, ranged from 0.826 to 0.851 for observer 1 and observer 2. Interobserver agreement for condylar shape, expressed as kappa values, ranged from 0.848 to 0.871. Thus, both intra- and interobserver variability showed very good agreement for all observed condylar shapes.

3. Results

This research was conducted by specialized oral and maxillofacial radiologists; it was a descriptive

Table 1. Percentage of each angle classification in Iraqi sample.

Angle classification	Class I	Class II	Class III
%	44%	40%	15.%

Table 2. The relation of each angle classification and gender.

	Male	Female
Class I	62%	38%
Class II	30%	70%
Class III	65%	35%

Table 3. Distribution of variation in mandibular condyle.

Condyle shape	Frequency	%
Round/oval	1760	44%
Flat	1000	25%
Diamond/angles	850	21.25%
Crooked finger	250	6.25%
Bifid	25	0.6%
irregular	115	2.8%
Total	4000	100%

analytic study. The study showed the shape of the condylar process in individuals with different angle classifications.

Among the selected 2000 panoramic radiographs based on inclusion and exclusion criteria, 800 (40%) were of males, and 1200 (60%) were of females (Table 1).

The result showed that class I is more popular, followed by class II, then class III, as shownn in (Table 1).

As it is shown in (Table 2), the results showed the distribution of angle classification in gender, with class III more prominent in males than in females, in contrast to class II, which is found more in females.

A total of 4000 condyles were evaluated (including both left and right condyles on the OPJ), six different shapes of condyles were detected: oval, flat, diamond, irregular, bifid; and crooked finger, as shown in (Table 3).

The condyle shape type oval is more prominent, while bifid condyle is rare.

There was no significant difference between males and females in the shape of condyle (p value 0.162) (Table 4).

Table 5 showed the percentage of each shape in comparison to angle classification, in class I, class II, the oval shape is more prominent, the cooked figure is less prominent, while in Class III the flat shapes are the most prominent.

Table 6 explains the symmetry between right and left condyles in the same patient in relation to gender and angle classification. The condylar processes in males seem to be more symmetrical than females, and Class I has more symmetrical condyles than Class II and Class III.

4. Discussion

The temporomandibular joint (TMJ) is the joint that connects the mandible (lower jaw) to the skull. Many researchers studied the condyle, coronoid and TMJ; with different results.

This study found six shapes of condyles; others found four shapes [14], in lateral and posterior views, they found the round, angled, flattened, and mixed type. Another study done in Nepal also identified four types of condylar; which was done by (Khanal) [15].

The round/oval shape had the highest prevalence in this study of Iraqi population which was similarly high in studies done by Khanal [15], Sonal et al. [5], Anisuzzaman et al. [16], Maqbool et al. [17], Jawahar and Maragathavalli [18] Shaikh et al. [19], Kanjani et al. [20], Nagaraj et al. 2017 [21], Singh and Chakrabarty [22], Singh et al. [23], with differences in percentage due to the sample size which was not taken with any of the studies.

The second most common shape seen in this study was flattened, which was similar to the study by Nagaraj et al. [21] quite higher among the studies by Singh and Chakrabarty [22] and Singh et al. [23], Maqbool et al. [17], Kanjani et al. [20] but reported it to be the most common after diamond/angle shape, whereas studies done by Sonal et al. [5], Khanal [15], Shaikh et al. [19], Anisuzzaman et al. [16], and

Table 4. Distribution of variations in the mandibular condyle between males and females.

	condyle shape						
Gender	Round/oval	Flat	Diamond/angles	Crooked finger	Bifid	Mixed	Total
Male							
No.	435	160	75	44	11	75	800
%	54.3%	20%	9.4%	5.5%	1.4%	9.4%	100%
Female							
No.	560	360	115	65	15	85	1200
%	46.6%	30%	9.5%	5.5%	1.25%	7%	100.0%

Table 5. Shape percentage in angle classification.

Angle classification	Class I	Class II	Class III
Condyle shape	Oval 46% Flat 33% Diamond 13% Cooked fing. 4% Irregular 4%	Oval 45% Flat 16% Diamond 25% Crooked fing. 4% Irregular 10%	Oval 22% Flat 35% Diamond 20% Crooked fing 8% Irregular 15%

Table 6. Side symmetry in condyle shape.

	Side Symmetry	Gender	Angle classification
%	66%	Male 68% Female 34%	Class I 62% Class II 27% Class III 11%

Jawahar and Maragathavalli [18] did not mention about flattened shapes.

The third most common shape seen in this study was diamond, which was similarly observed in other studies by Sonal et al. [5], Singh et al. [23], Shaikh et al. [19], Anisuzzaman et al. [16], and Jawahar and Maragathavalli [18], other studies such as Maqbool et al. [17], Kanjani et al. [20] attributed a bird beak shaped as one of the classification which was not included in this study, as well as studies [22, 15] similar to this study. Nagaraj et al. [21] not discussed about diamond shape in their study.

The fourth less common shape found was the irregular shape (mixed shape) of the condyle which was much less than the study done by Singh and Chakrabarty [22] and Singh et al. [23] whereas other studies [5, 18–21] did not mention about irregular shape of condyle.

The least common shape noted in this study was a crooked finger shape, almost half more prevalent than the bifid shape, which is rare, and was similar studies, Anisuzzaman et al. [16], and Singh and Chakrabarty [22] and high in other study by Khanal [15], Shaikh et al. [19], and Jawahar and Maragathavalli [18], whereas most of the other studies did not mention about crooked shaped condyle, and none of the studies mentioned about bifid condyle except one study by Singh et al. [23].

This is the first study discussing the relationship between the shape of condyle and angle classification. It improved the class I is more prominent, class III is less prominent, and Class II is more prominent in females, while class III is more prominent in males. It also improves the ovale shape of condyle head is prominent in each angle classification, and the crooked figure condylar shape is less prominent in each angle classification. The side asymmetry is more symmetrical in males related to Class I.

These variation due to race. This first study was conducted in the Iraqi population and related the shape of condyle to the angle classification. This classification will help dentists identify normal condyle shapes and prevent them from any inadvertent treatment plans. This classification will provide a baseline for future studies as well. This classification can further be used for the evaluation of gender and age estimation in forensic dentistry.

5. Conclusion

This study concluded that round/oval shape condyle is most commonly seen among Iraqi population followed by flat shape, and the least common is crooked finger shape and bifid condyle. This study identified 6 different types of condyle shapes, proposed a classification of condylar shapes with 6 different types as follows: oval, flat, diamond,irregular, crooked finger, and bifid. This study was done using panoramic radiograph (two-dimensional imaging), and discussed the angle classification, along with side asymmetry.

Disclosures

Competing interests: None.

Research funding: The research is self-funded.

Publication: The research is not under publication elsewhere.

Ethical issue

This is an observational study. The Ethics Committee at the College of Dentistry in Baghdad has confirmed that no ethical approval is required.

Conflict of interest

The authors declare no conflict of interest.

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