Research Article

Study of Mandibular Condyle Morphology using Orthopantomogram

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ABSTRACT

Introduction: There is a capacity of the human condyle to undergo remodelling with time, as various factors like age, sex, occlusal force, malocclusion, and skeletal class influence this remodelling. This change in the shape can result in the various features of degenerative joint diseases.

Objective: The objective of the study was to evaluate the different shapes of the condyle in different age group population visiting Kathmandu Medical College, Duwakot, using the Orthopantomogram.

Materials and Method: A total of 265 digital panoramic radiographs of 125 (47%) males and 140 (53%) females in age range of 20-80 years were collected. Consequently, 250 (47%) mandibular condyles in males and 280 (53%) in females were evaluated. The outline of the mandible condyle along with the articular eminence and glenoid fossa was traced.

Result: Out of 530 mandibular condyles evaluated, the most common shape was oval shape for both the right 163 (61.5%) and left 174 (65.7%) sides. This was followed by diamond shape, bird beak shape and the least was crooked finger shaped. The younger age group between 20 to 40 years had the oval shape as the most common, whereas the older age group of 61 to 80 years had 3 (60%) diamond shaped condyles.

Conclusion: The shape of the condyles in the different age groups show that with time, there is a capacity of the human condyle to undergo remodelling, as various factors influence this remodeling, thus changing their shapes as depicted in the orthopantomogram.

Keywords: Condyle shape; mandibular condyle; orthopantomogram.

INTRODUCTION

The temporomandibular joint (TMJ), also known as the ginglymo-diarthroidal joint is a complex joint, the components of which are enclosed within a capsule and stabilised by ligaments. The articular disc separates the condyle from the glenoid fossa, providing a smooth translatory as well as rotatory motion of the condyle.[1] The coordination between the various muscles and ligaments helps for the smooth movement of the TMJ, like opening, closing, lateral, and translatory movements.[2]

In normal individuals, the mandibular condyle is characterised by a rounded head, with an upper biconvex and oval surface. With time, there is a capacity of the human condyle to undergo remodelling, as various factors like age, sex, occlusal force, malocclusion, and skeletal class influence this remodelling.[3] This remodelling is

seen to be more pronounced with age as the TMJ is subjected to more and more occlusal loading when the person chews and grinds.[4] The aetiopathogenesis for this remodelling, also known as osteoarthritis, is still not fully understood. It is believed to involve a sustained inflammatory process that initiates a series of biomechanical changes in the hard and soft tissues of the joint, triggering the immune system to release inflammatory mediators like cytokines and chemokines.[5,6] The process is coupled with the activation of the complement system, the release of cartilage degrading factors such as matrix metalloproteinase (MMPs) and prostaglandin E (PGE) which further damage the articular cartilage. This results in the eventual degradation and abrasion of joint cartilage and the remodelling of the bone.[5,7] This remodelling can change the shape of the condyle from being rounded – oval shape to flattening of the condyle head, transforming them into diamond shaped, pointed, bird beak shaped and crooked finger like shape. This transformation is referred to as a degenerative joint disease.

Current study aims to evaluate the different shapes of the condyle in different age group population using the orthopantomogram because of its advantages.[8] The different shapes of the condyle are traced from the orthopantomogram and divided based on the gender and also the right and left condyles are compared.

MATERIALS AND METHOD

The present study comprised of the radiographic evaluation of 530 condylar heads after visualising 265 digitalised orthopantomograms (OPGs) of dentate as well as edentulous mandible. A sample size of 369 was calculated using formula Z^2pq/e^2, where Z=1.96 at 95% confidence interval and p=60%,[9] was taken for the most common condylar shape, e=5% margin of error. A cross-sectional descriptive study was carried out and patients who had come with some complaint in one or both the temporomandibular joints, like pain, clicking were selected for the study. The study was conducted in Kathmandu Medical College, Duwakot, between 1st June 2019 to 29th November 2019 (six months). Among the 265 patients involved, there were 125 males and 140 females between the age group 20 to 80 years. They were further divided into three groups: Group 1 (20-40 years), Group 2 (41-60 years), and Group 3 (61-80 years). A written informed consent was taken from each patient for the study and ethical clearance was obtained from the institutional review board. All the panoramic radiographs were collected in the printed version with the Planmeca Romexis software. With a pencil, the outlines of the mandible along with the condyle were traced. Condylar morphology of four types were identified accordingly: Type I - oval shaped, Type II - bird beak shaped: Type III - diamond shaped and Type IV - crooked finger shaped. The data were collected using the Microsoft Excel and analysed using SPSS software. Only patients without any pathologies or traumatic injuries to the condyle were included in the study. Any radiographs with errors and artifacts, and radiographs showing bifid condyles were discarded from the study.

RESULT

A total of 530 condylar heads were studied for a period of six months with age ranging from 20 to 80 years, divided into three groups. The most common shape was found to be oval for both the right (163, 61.5%) and the left condyle (174, 65.7%) heads. This was followed by diamond shape, bird beak shaped, and lastly crooked finger shaped. For the right side condyle, it is observed that (138, 67.3%) between the age group 20 to 40 years had oval shaped condyle whereas patients in the age group 61 – 80 had (3, 60%) falling in the type III diamond shaped) category. For the left side, (157, 76.6%) in the age group 20 – 40 years had oval shaped condyle whereas the older age group had similar percentage as the right side, the diamond shaped, which was (3, 60 %).

Table 1: Distribution of condyle shape according to side in n (%).

	Gender	Oval	Bird beak	Diamond	Crooked finger
Right condyle	Male	87 (69.6)	12 (9.6)	20 (16.0)	6 (4.8)
	Female	76 (54.3)	19 (13.6)	40 (28.6)	5 (3.6)
Left condyle	Male	87 (69.6)	12 (9.6)	20 (16.0)	6 (4.8)
	Female	76 (54.3)	19 (13.6)	40 (28.6)	5 (3.6)

Table 2: Distribution of condyle shape according to age in n (%).

		Condyle shape			
	Age (yrs)	Oval	Bird beak	Diamond	Crooked finger
Right condyle	20-40	138 (67.3)	25 (12.2)	35 (17.1)	7 (3.4)
	41-60	25 (45.5)	4 (7.3)	22 (40)	4 (7.3)
	61-80	-	2 (40)	3 (60)	-
Left condyle	20-40	157 (76.6)	17 (8.3)	31 (15.1)	-
	41-60	17 (30.9)	9 (16.4)	27 (49.1)	2 (3.6)
	61-80	-	2 (40)	3 (60)	-

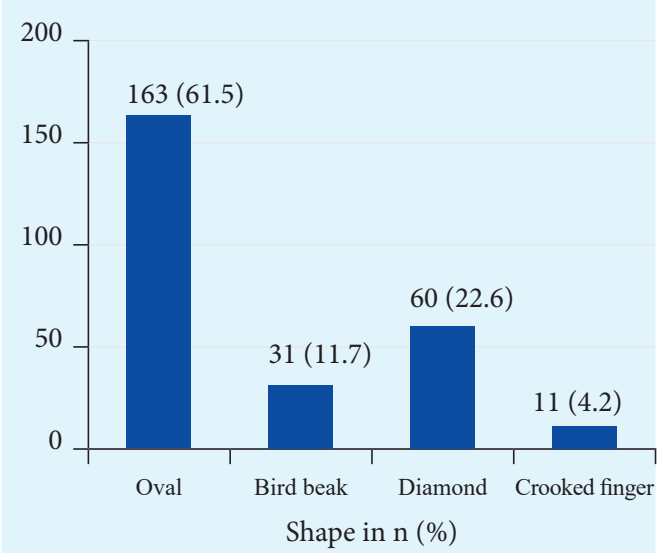

Figure 1: Distribution of shape - right condyle.

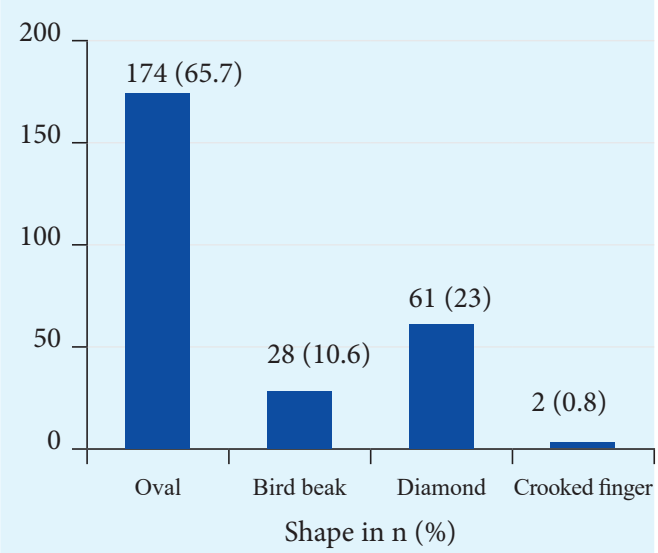

Figure 2: Distribution of shape - left condyle.

DISCUSSION

The mandibular condyle is characterised by a rounded head, with an upper biconvex and oval surface. It is housed in the glenoid fossa and articulates with the articular disc, which provides a translator as well as rotator movement of the condyle.[1,2] With age, the condyle undergoes a lot of changes depending upon the amount of functional loading to which it is subjected to. A continuous, aggressive loading can lead to degenerative diseases of the condyle as well as the other components of the temporomandibular joint. An internal derangement of the articular disc leading to a perforation in the disc, presence of osteophytes in the head of the condyle and flattening of the condyle surface are examples of degenerative joint diseases.[8]

Thus, in cases of both normal as well as condyles showing remodelling, the joints are loaded with masticatory forces. This forces, along with factors like occlusal discrepencies, causes its cartilaginous structures to deform. The magnitude of deformation and the resulting stress is primarily determined by the biomechanical properties of the cartilage, which in turn indirectly causes remodelling of the condyle head. This property of the cartilage determines it as a stress-distributing and load-absorbing structure.[10,11] These mechanical properties of the cartilaginous structures and their alterations by joint loading thus influence the stresses and strains that occur in the subchondral layers, leading to bone remodelling in the long run.

The common symptoms which the patients present when there is remodelling of the joint, in cases of degenerative joint diseases, are pain, restriction in joint function, and joint sounds. The pain usually can present as dull aching in nature and may have occasional sharp component on movement. The pain may or may not be associated with joint stiffness, joint crepitus and limitation in mouth opening. Patients in advanced stages of a degenerative joint disease may exhibit facial skeletal remodelling, with deviation of the chin towards the affected side and unstable or fluctuating malocclusion along with some occlusal

discrepancies. This can lead to detrimental effects on the lifestyle of the individual as the patient presents with difficulty in chewing and can also lead to certain psychological problems.

There are various radiological techniques used to study the shape of the condyle which can be useful to know the progress of the disorder. Some common conventional techniques are transpharyngeal, transcranial, and transorbital views. In our study, the orthopantomograms are used because of its advantages.[8,12] The panoramic radiographic images do not only give us the image of the temporomandibular joint, but also give us a picture of both maxillary and mandibular dental arches along with other surrounding structures such as the maxillary antrum, nasal fossa, styloid processes, and hyoid bone. It is also a favourable cost-benefit relationship and exposes patients to relatively low doses of radiation.

In the study, the most common shape was found to be oval for both the gender group and for the right as well as the left side. This was for the population with age between 20 to 40 years. In this group, the next common shape was the diamond shape with the least being the crooked finger shape. This result for the diamond shaped to be the second common shape in this age group is different from other studies. Anisuzzaman et al. in his study in Bangladeshi population found that although the oval shape was the most common (68%), the second most common was the bird beak shape (20%).[8] In another study done by Vahanwala et al., 200 pairs of condylar heads were evaluated and they concluded that 60% were oval in shape, followed by bird beak (29%), diamond (9%) and least being crooked finger (2%).[13] This was consistent with present study. This raised a curiosity whether the TMJ followed any typical feature of symmetry. Oval-oval was commonly occurring combination (67%), whereas crooked/ crooked finger was a rarity.

As we have divided the age population into three groups, it is seen that as the age increases, the number of patients falling to the oval shaped category is seen to decrease; age 41 to 60 years shows 45.5% had oval shape for the right condyle and 30.9% for left side. As the number of patients showing the oval shaped condyle decreased with increase in the age, the other shapes are seen to increase as age advances. Patients between the age group 41 to 60 years showed an increase in the diamond shape and patients above age 61 years showed 40% bird beak and 60% diamond shape for both right and left condyles. This change in shape from oval to other forms as age advances can be a clear indication that the degenerative joint diseases are more prevalent in the older age patients. The change in the shape of the condyle in older age groups can be due to the continuous functional loading the condyle is subjected to which results in the wearing of the condylar head leading to osteophyte formation.[1,4,8,14,15]

Again radiographs are two-dimensional depictions of the three-dimensional temporomandibular joints. Thus, these radiographs have their limitations too especially knowing the tilt of the condyle anatomically. Hence, they might have to be viewed at different angulations and positions to get a clearer picture. Other modalities like computed tomographic scans, cone beam volumetric imaging, and magnetic resonance imaging (MRI) can be other options to give a detailed information of the condyle.[15,16]

CONCLUSION

A low exposure dose, ease of prescription and cost effectiveness makes orthopantomogram a common choice of imaging prescription to study the mandibular condyle. Fine observations can be made easily, where the oval shape was the most common in both genders. More sample size and evaluation of other parameters along with more sophiscated radiographs like cone beam computed tomography (CBCT), may aid in giving more information about the population falling in the different catagories, and thereby also generating interest in forensic studies.

Conflict of Interest: None.

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