

Condylar Morphology- A Review

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Abstract: The temporomandibular joint is a complex joint, the components of which are enclosed within a capsule and stabilized by ligaments. The various movements that occur at the TMJ are possible due to the coordinated action between the various muscles, ligaments and the associated movements that occur in the condyle. Condylar morphology is assessed using radiographic methods and the various factors that influence morphology of the condyle were traced out.. The purpose of this review is to provide an insight about the various factors that influence condylar morphology.

I. Introduction

The temporomandibular joint is a ginglymo-diarthroidal joint which consists of the glenoid fossa, the mandibular condyle and the articular disc which are enclosed within a fibrous capsule and the joint is stabilized by the extracapsular tempromandibular and sphenomandibular ligament^[1,2]. The TMJ is capable of producing a variety of movements like opening, closing, lateral and translatory movements^[2]. This is possible due to the coordination between the various muscles, ligaments and the associated movements of the condyle. The human condyle has a capacity for remodelling^[3] which are influenced by a variety of factors which can result in morphological diversity and variations in shape. Several studies have dealt with the position of the condyle but not much emphasis has been laid on the shape of the condyle^[4]

In this review the various factors which influence the morphology of the condyle are discussed.

The radiographic tools used in the assessment of condylar morphology are Computed Tomogram (CT)^[4,5], Cone Beam Computed Tomography (CBCT)^[6,7], Orthopantomogram (OPG)^[8] and Lateral Cephalogram^[4,9].

II. A Review

Age:

Age is a factor that determines the degree of remodeling, though there is no direct linear relationship^[8]. Because the adaptive or degenerative changes in the temporomandibular joints appear over a long period of time, it is understandable that the condylar changes increase with advancing age^[10,11,12]. The prevalence of changes in the condylar morphology as assessed by orthopantomogram was found to be relatively lower in subjects who were between 20-40years of age as compared to those above 40 years. Whereas flattening, erosion, and sclerosis were observed more commonly in the older age group as compared to the younger age group but the prevalence of osteophyte and ely's cyst decreased as age advances^[8]

Sex:

The condylar surface area as well as volume as assessed using CBCT was significantly higher in males than in females^[7,13]. Morphological index which is indicated as a ratio between surface and volume shows the difference between females and males is about 2.8% of the MI in the whole sample^[7]. Both the volume and the area of a condyle differ between the genders and the subjects with different skeletal class^[14]. The linear measurements showed that the anteroposterior dimension of the condyle had a mean value of 8.25 for females and 8.42 mm for males. The mediolateral dimension of the condyle showed a mean value of 18.92 mm for females and 18.98 mm for males, with no statistically significant differences between sexes for the anteroposterior or mediolateral dimensions of the condyle^[9]. Christiansen and Thompson (1990) also reported that the transverse condylar dimension of normal adult joints was greater for men (19.6 mm) than for women (17.7 mm)^[15]

Shape:

Studies conducted on condylar morphology in dry skulls using x-ray imaging revealed that condyles that had a superior convex surface and oval form were observed frequently^[16]. Radiographic analysis showed that in the anterior view, 58.4% of the specimens exhibited a plane or slightly convex shape, 25% a well-rounded or convex shape, 16.6% were shaped like an inverted "V", and only 3.1% were convex. In the upper view, many of the condyles (60%) had an oblong shape, 20% were pear-shaped and laterally tapered, 18.4% were pear-shaped but medially tapered, and only 1.6% had a rounded or oval shape. Of the skulls examined in

the lateral view, 55% were pointy or shaped like an inverted "V", 31.7% had a convex shape, and 13.3% were plane or slightly convex^[9]

Occlusal force:

Earlier it was thought that the compressive stresses that were generated during clenching was localized at the lateral surface of the condyle by the distribution of sulfated glycosaminoglycans^[17]. Recent finite-element analysis reveals that the largest stress is generated at the middle-to-lateral and superior-to-posterior areas of the condylar cartilage during jaw closure^[18]. Occlusal force is one of the important factors influencing maxillofacial development. Occlusal force, maxillofacial morphology, and mandibular condyle morphology seem to influence each other, but the relationship between occlusal force and mandibular condyle morphology has not been reported. The high-occlusal-force group tended to have condyles with larger, more rounded form at the lateral and posterior side than the low-occlusal-force group^[6]. But a particular study showed no significant correlation between condyle shape and occlusal characteristics^[9]. An increase in the function of the masticatory muscles is associated with anterior growth rotation pattern of the mandible and with well-developed angular, coronoid, and condylar processes^[19].

Malocclusion:

Examination using lateral cephalograms shows no condylar shape difference between class II and class III malocclusion^[20]. The condylar morphology assessed using 3DX imaging revealed that condyles of class II patients were smaller than the condyles of patients with class I malocclusion^[6]. The mean anteroposterior thickness of condylar head as assessed using CT was 8.13 and 8.42 mm for left and right sides, respectively, for class I normal occlusion and 7.25 and 7.39 mm for left and right sides, respectively, for class II division 1 malocclusion^[5]

Skeletal class:

TMJ morphology has a strong correlation with skeletal morphology^[21] and exclusively an inverse relationship between the angle of the articular eminence and the occlusal and the mandibular planes^[22]. Mongini^[23] reported a correlation between condylar shape and its position in the fossa which was confirmed by Akahane et al^[24].

Skeletal class III pattern was more closely associated with the asymmetry of condylar inclination than skeletal I and II groups^[25-27]. In a study in which condylar volume was calculated using 3D CBCT showed that greater condylar volume was associated with skeletal class III^[7].

III. Conclusion:

- As the age increased there is a significant increase in the number of condyles affected.
- Both the volume and the area of a condyle differ between the genders.
- Occlusal force, maxillofacial morphology, and mandibular condyle morphology seem to influence each other.
- An increase in the function of the masticatory muscles is associated with anterior growth rotation pattern of the mandible and with well-developed angular, coronoid, and condylar processes.
- TMJ morphology has a strong correlation with skeletal morphology and exclusively an inverse relationship between the angle of the articular eminence and the occlusal and the mandibular planes.

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