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Research Article

An evaluation of the correlation between the condylar head shape, age, gender, and oral breathing- A radiographic study

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Abstract

Introduction: Growth and development of dental-craniofacial complex occur during various stages of development of dentition with TMJ as one of its centers of growth. Panoramic radiographs are the most common radiographic tool used by dental clinicians to evaluate teeth, mandibles, and other related structures of the jaws. The mandibular condyle is an important anatomical landmark for facial growth and differs widely among different groups of ages and individuals. Mouth breathing is an etiological factor for sleep-disordered breathing during childhood.

Aim: The study aims to evaluate the correlation between the condylar head shape, age, gender, and oral breathing.

Material and method: Children between the ages of 8-14 years (n=60) were considered after obtaining informed consent from the parents. After conducting clinical testing children were allocated into two groups; Group I (n=30) included children with mouth breathing patterns and Group II (n=30) included children with nasal breathing patterns. They were also subdivided into three age groups, [Group A (8-9.99 yrs), Group B (10-11.99 yrs), and Group C (12-13.99 yrs)]. A radiographic assessment was done using a panoramic radiograph.

Result: As per the present study Diamond shape morphology of the mandibular condyle was more common (43.3 %) in mouth-breathing children. Age groups 10 – 11.99 and 12 – 13.99 yrs showed not statistically significant difference, while the age group (8 -9.99 years) showed a highly significant difference between the chronological age and dental age.

Conclusion: The examination of TMJ and specifically the condyle should be included in each and every day of practice.

Keywords: Age, Condyle, Condyle shape, Mouth breathing, Sex, TMJ

1. Introduction

The mandibular condyle is a major growth site for the mandible and plays a vital role in its development. Endochondral ossification, or the sequential formation and degradation of the formed cartilaginous blastema serving as templates for bone formation, is just how the mandibular condyle develops. Appositional growth occurs when the perichondrium's chondrogenic cells emerge, proliferate, synthesize, and lay down new cartilage at the structure's edges. Whether condyles develop by apposition or by appositional combined with interstitial mechanisms is a point of contention. This is vital for bearing the compressive stress that the condyle receives during mandibular movement and development [1, 2].

Panoramic radiographs have been most widely used as an imperative diagnostic tool by dental clinicians to get valuable information about teeth, mandibles, and other related structures of the jaw [3]. As the radiograph provides clinicians valuable knowledge about the anatomical variation of the maxilla and mandible and also osseous changes or flattening happening with time [4]. As per the recommendation by the American Academy of Oral and Maxillofacial Radiology for assessing the structural components of the temporomandibular joint (TMJ), panoramic radiographs are widely used [5].

The mandibular condylar head is an important anatomical landmark for facial growth, expressed in an upward and backward direction [6]. The presentation of mandibular condyle differs widely among different age groups and individuals. Morphological variations depend upon developmental variation along with condylar remodeling to accommodate malocclusion, trauma, and other pathological and developmental abnormalities [7]. Variability in the shapes and sizes of condyles or more precisely of the condylar head helps to diagnose the TMJ disorders associated with malocclusions such as crossbite, deep bite, and open bite [8].

The condylar head shape varies in each individual, both normally and pathologically. Classification of condylar head shape used in the present study, according to Yale, is divided into four main shapes: convex, round, flat, and angle [9]. Theoretically and based on previous research, normal condylar morphology in most adults is convex shaped condyle [10]. The round-shaped condylar head is also considered normal [11].

However, flat and angled shapes are taken into consideration as a pathological form of condylar head shape that took place as a result of a particular condition that brought about pathological wear, such as bad oral habits or growth and developmental disturbance. In infants, condylar cartilage acts as growth cartilage that works similarly with cartilages found at lengthy bone plates at a massive growth potential might be related to this. Round condylar head shape is the maximum common condylar head form determined in infants; as growth and development occur, elongation and condylar ossification toward the d articular surface will happen. In this study, during primary dentition, the morphology of the condylar head was dominated by round shaped condyle. In mixed dentition, the morphology of the condylar head was still dominated by round shape, but the difference in percentage between round and convex-shaped condyles is decreasing compared to the previous phase.

In permanent dentition, the most dominant morphological shape of the condylar head is known to be convex. This result is consistent with several other theories pointing out that the most common condylar head form found in children is round, as growth and development occur, the condyle will elongate, resulting in the change of morphology into convex shaped condyle, the most common condylar-head form found in adults [11]. As age increases, growth and development occur in children, and plenty of changes will happen in TMJ. At the age of 5 to 6, a child mostly enters the mixed dentition stage. In this age, the decreasing condylar cartilage thickness and amount of vascularization in the articular surface of the condyle additionally begin to happen. The reduction of condylar cartilage thickness will affect the form of the condylar head for a certain amount of time [12].

Normal respiratory activity influences the development of craniofacial structures, favoring their harmonious growth and development by adequately interacting with mastication and swallowing [13-15]. The presence of any obstacle in the nasal and pharyngeal regions causes respiratory obstruction and forces the patient to breathe through the mouth [16]. Mouth breathing is also predominant as an anatomical predisposition or by several pathologies, such as palatine and pharyngeal tonsils hypertrophy, septal deviation, allergic rhinitis, and nasal turbinate hypertrophy, among others [17]. As per several studies, mouth breathing habit leads to a new posture in order to compensate for the decrease in nasal airflow and to allow respiration [18].

The changes in mouth breathers include a lower position of the mandible, and an anterior or a lower position of the tongue, usually associated with lower orofacial muscle tonicity [19]. As a result, there is obvious disharmony in the growth and development of orofacial structures, including narrowing of the maxilla, lower development of the mandible, alterations in the position of the head in relation to the neck, protrusion of the upper incisors and distal position of the mandible in relation to the maxilla, for example [20].

1.1. Aim: The study aims to evaluate the correlation between the condylar head shape, age, gender, and oral breathing.

2. Materials and Method

Children between the ages of 8-14 years (n=60) were considered after obtaining informed consent from the parents. The study was approved by the institutional ethical committee (CDSRC/IEC/20200803/30). After conducting clinical testing (Fig 1, 2) children were allocated into two groups; Group I (n=30) included children with mouth breathing patterns and Group II (n=30) included children with nasal breathing patterns (Table 1). They were also subdivided into three age groups, [Group A (8-9.99 yrs), Group B (10-11.99 yrs), and Group C (12-13.99 yrs)] (table 2). A radiographic assessment was done using a panoramic radiograph. The shape and height of the condylar head were determined by tracing the panoramic image on adobe photoshop software (Fig 3). Condylar-ramus height: the distance from the highest point of the condyle to the point of intersection at the gonion (CG) was also measured (Fig 4,5).

Figure 1: Mirror test

Figure 2: Massler's water holding test

Table 1: Demographic distribution of Male and Female participants.

Group	Male	Female	Total participants
Group 1- Mouth Breather	17 (56.6 %)	13 (43.3 %)	30 (100 %)
Group 2- Nasal Breather	14 (46.6 %)	16 (53.3 %)	30 (100 %)

Table 2: Age group-wise distribution of participants

Age Group	Total participants
8 - 9.99	18 (30 %)
10 – 11.99	20 (33.3 %)
12 – 13.99	22 (36.6 %)

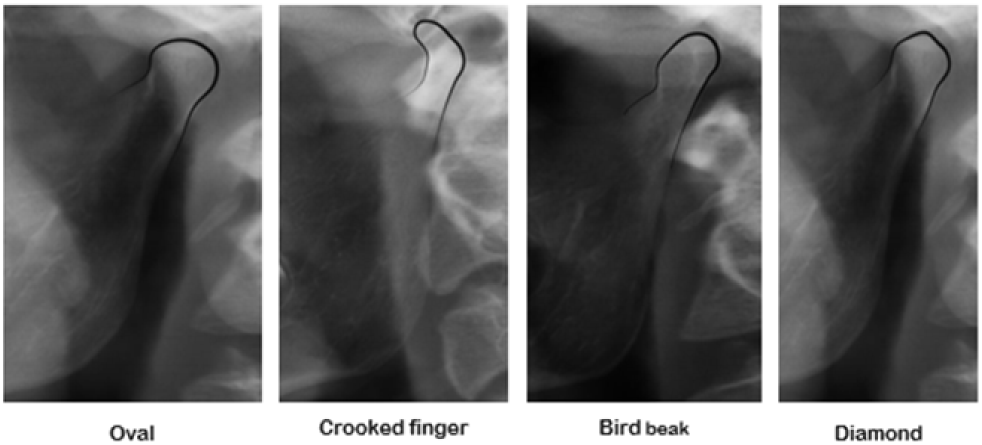

Figure 3: The shape and height of the condylar head were determined by tracing the panoramic image on adobe photoshop software

Figure 4: Measurement of condylar-ramus height on adobe photoshop software

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Figure 5: Cropped images of measurement of condylar-ramus height

The measurements were made using condylar-ramus height. After image calibration, the following mandibular ramusconverted to centimetres. For standardization, a reference line was drawn along the posterior border and along the inferior border of the mandible with the point of intersection at the gonion was taken. Condylar-ramus height: the distance from the highest point of the condyle to the point of intersection at the gonion (CG). The measurements were then added to the formula given by Gupta et al [21].

Age = -33.86 + 11.65 x Condylar ramus height.

3. Results

The data collected was recorded in Microsoft excel 2016 and statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software (version 23.0). Overall statistical comparison between the chronological age and the estimated age was done using paired t-test, where p ≤0.05.

Table 3: Distribution of the condyle morphology

Group	Diamond	Bird beak	Crooked finger	Oval
Group 1- Mouth Breather	13 (43.3 %)	5 (16.6 %)	4 (13.3 %)	8 (26.6 %)
Group 2- Nasal Breather	4 (13.3 %)	8 (26.6 %)	3(10 %)	15 (50 %)

Table 4: Condylar height in relation to age groups.

Age Group	Condylar height In CMS		't' value	P-value
	Mean	SD		
8 - 9.99	3.89	0.40	4.73	0.06
10 – 11.99	4.12	0.47	7.11	0.001**
12 – 13.99	4.93	0.54	7.82	0.001**

Table 5: Age-group-wise difference between chronological age & estimated age.

Age Group	Mean difference	SD	't' value	P-value
8 - 9.99	0.522	0.993	5.259	< 0.001**
10 – 11.99	0.082	0.478	2.628	0.009
12 – 13.99	0.0013	0.851	0.002	0.943

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As we can see in table no.3 the Diamond shape morphology of the mandibular condyle was more common (43.3 %) followed by Oval (26.6 %), Bird beak (16.6 %), and Crooked finger (13.3 %) in mouth breathing children.

Table no. 5 shows the age group-wise difference between chronological age and dental age. Age groups 10 – 11.99 and 12 – 13.99 yrs showed not statistically significant difference, while the age group (8 -9.99 years) showed a highly significant difference between the chronological age and dental age.

4. Discussion

The mandibular condyle –Stages of mandibular development; growth rate and the duration of the growth are different in both the sexes and hence mandibular ramus can be used in differentiation of the sexes. The form and dimensions of mandibular ramus is affected by masticatory forces which are different in males and females. Inspite of the variability in anatomical landmarks of the mandible, numerous studies have been carried out using ramus as a standard of measurement for age and sex determination [22].

Of all the facial bones, mandible is the strongest and is used for identification of age and sex by forensic odontologist. Mandible is made up of dense cortical bone and shows sexual dimorphism which occurs mostly due to the genetic predisposition of males and females during the development period. In the present study, we have used a linear measurement of Condylar-ramus height: the distance from the highest point of the condyle to the point of intersection at the gonion (CG) to estimate the age as well as sex of an individual [23].

The study showed age group-wise difference between chronological age and dental age. Age groups 10 – 11.99 and 12 – 13.99 years showed not statistically significant difference, while the age group (8 -9.99 years) showed a highly significant difference between the chronological age and dental age (Table 5).

Condylar head shape varies in each individual, both normally or pathologically. Classification of condylar head shape was given by Yale [9]. It was classified into four main shapes: convex, round, flat, and angle. Theoretically and based on previous research, normal condylar morphology in most adults is convex shaped condyle. Round shaped condylar head is also considered normal, but round shaped condyle found to be less prevalent than convex in adults. However, flat and angled are taken into consideration as pathological form of condylar head shape that took place as a result of particular condition that brought about pathological wear, such as bad oral habits or growth and developmental disturbance [24].

In infants, condylar cartilage acts as growth cartilage that works similarly with cartilages found at lengthy bone plates so that a massive growth potential might be related to this. Round condylar head form is the maximum common condylar head form determined in infants; as growth and development occur, elongation and condylar ossification toward articular surface will happen. As in this present study, in both groups, clinical as well as radiographic evaluation was done. The mandibular condyle showed diamond shape head in mouth-breathing children and there were not significant gender-related changes observed.

5. Conclusion

The examination of TMJ and specifically the condyle should be included in each and every day of practice. This present study should be further evaluated in depth the get more rectified and fine results. Condylar head can be used as an adjuvant radiographic age estimation method. For further futuristic approach, the study can be evaluated using 3D CBCT and other modifications.

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