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Research Report

Mandibular condyle shape and symmetry in 4- to 19-year-old children and early adolescents

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ABSTRACT

Background: The prevalence of temporomandibular disorder (TMD) in children and early adolescents varies widely. TMD can cause permanent facial deformities and affect occlusion and speech, which will affect growth, development, and quality of life. For prevention, early detection is needed. However, early detection is often not possible due to a lack of understanding of the normal shape of the condyle. Research on the normal shape of the condyle and symmetry in children and early adolescents has not been much done. **Purpose:** To evaluate the shape of normal condyles in a population of children and early adolescents aged 4–19 years and determine the most dominant shape and symmetry. **Methods:** 220 mandibular condyles of 110 children aged 4–19 years (mean 11.4 years) were analyzed retrospectively using an orthopantomograph. Condyle types in primary, mixed, and permanent dentition were categorized according to Yale (convex, rounded, flat, angled) and Chaudhry classification (oval, diamond, bird beak, crooked). Right and left mandibular condyle symmetry was observed according to a previous study by Ribeiro. **Results:** In primary, mixed, and permanent dentition, the most dominant condyle shapes were (Yale, Chaudhry): 91.6% rounded, 100% oval; 95.8% rounded, 97.9% oval; 98% rounded, 97% oval, respectively. Asymmetry in the right and left mandibular condyles was not found in primary dentition; there were 2 cases in mixed dentition and 3 cases in permanent dentition. **Conclusion:** In children and early adolescents aged 4–19 years, the normal condyles found are: rounded, convex, angled (Yale), and oval, diamond, or bird beak (Chaudhry). The condyles are dominated by rounded and oval shapes. The incidence of asymmetry in the right and left mandibular condyles probably increases with age.

Keywords: children; condyle shape; condyle symmetry; human & health; medicine

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INTRODUCTION

The temporomandibular joint (TMJ) is formed by the condyle that occupies the mandibular fossa in the temporal bone.[1] The temporomandibular joint can experience a disorder known as temporomandibular joint disorder (TMD). TMD is generally caused by two things: the surrounding muscles that have problems or the TMJ that is problematic. If the TMJ is problematic, it usually involves the disc, condyle, or fossa. Problematic condyles can be caused by the occurrence of arthritides: osteoarthritis, osteoarthrosis, and polyarthritides. Problems with the condyle, if not detected early, can lead to facial deformities and impaired occlusion.[1]

Condyles in children and early adolescents can be problematic too. An example is juvenile idiopathic arthritis (JIA). This condition causes the condyle in children to become inflamed, so that the condyle will experience destruction and deformity.[2] In addition, idiopathic condyle resorption (ICR) conditions in children have been reported, which cause occlusion and extraoral problems.[3] In the case of ICR, the condyle will become inflamed, resulting in a very rapid resorption where the body is unable to balance the pace. The manifestation that occurs is an anterior open bite, which will interfere with the child's speech pattern and the child's growth and development, which will affect the child's quality of life.[3,4]

The condyle can have several shapes that count as normal. This variation arises due to factors such as age, sex, facial shape, chewing strength, and type of malocclusion.[4] Several previous studies have tried to classify the shape of the normal condyle. Yale et al., in 1961, were the first researchers to classify the shape of the normal condyle. Yale divides the normal condyle into 4 types according to the superior shape of the condyle (Figure 1), namely convex, flattened, angled, and rounded.[5] Later on, Chaudhry divided the normal condyle shape into 4 types (Figure 1): oval, diamond, bird beak, and crooked finger, and crooked finger.[6] Both classifications look at the condyle from a lateral view. There is not much literature that specifically discusses

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the normal condyle shape in children. Several studies have reported that the right and left condyles can have different shapes.[7] This can also be followed by a different shape of the left and right fossae. However, this has not been widely discussed in the literature for both adults and children.

The primary dentition period begins when a child is about 6 months to 2 years of age, marked by the eruption of the mandibular primary incisors.[8] The mixed dentition period begins when a child is about 6 years old, starting when the permanent first molars erupt.[8] The permanent dentition period begins when the child is about 12 years old, when the child's primary teeth have completely fallen out and are replaced by permanent teeth. [8] Each period is dynamic and can undergo many changes. Changes that occur in the form of altered occlusion patterns, altered masticatory patterns, altered jaw relations, and bad habit patterns (thumb sucking, nail biting, tongue sticking out, etc.) can appear or be eliminated during this period.

One of the commonly used extraoral dental radiography techniques is the orthopantomograph, also known as a panoramic photo. The orthopantomograph presents a single tomographic image of the facial structures, including the maxilla and mandible, and other anatomical structures such as the temporomandibular joint and cervical spine.[9] The orthopantomograph photograph captures the shape of the condyle from a lateral view. This technique is generally used as a supporting examination for routine cases in dentistry, especially pediatric dentistry, because children tend to be more comfortable with extraoral radiographs and can obtain a general condition of the child's teeth. The purpose of this study was to evaluate the shape of the normal condyle in a population of children aged 4–19 years and determine the most dominant shape and its symmetry. By knowing the shape of the condyle, it can be used as an initial step in determining a treatment plan or early prevention in the event of a growth disorder.

MATERIALS AND METHODS

Samples were taken using the total sampling method in patients 4–19 years old who came to a private dental clinic (only one dental clinic) from January 2019 until January 2020 without TMJ complaints. Patients take X-rays for routine dental care or for caries and pulp tissue problems. 220 mandibular condyles of 110 children aged 4–19 years (mean 11.4 years) were analyzed retrospectively using an orthopantomograph. Orthopantomograph x-rays taken with the Villa™orthopantomograph machine (rotograph evo type, Italy) Condyle types in the primary, mixed, and permanent dentition are categorized according to two classifications: the Yale classification (convex, rounded, flat, angled) and the Chaudhry classification (oval, diamond, birdbeak, crooked). A symmetrical pattern of the right and left mandibular condyles was observed. The observed the shape of the right and left condyles in the same skull. If the shape of the right and left condyles is the same, then it is categorized as symmetrical, but if the shape is different, it is categorized as asymmetrical. The entire image of the condyle is observed from a lateral view. An observation of the shape of the condyle is done by the dentist.

RESULTS

From the results of a retrospective analysis using 110 orthopantomograph radiographs, the type of condyle in the primary, mixed, and permanent dentition periods was categorized according to two classifications: the Yale classification (convex, rounded, flat, angled) and the Chaudhry classification (oval, diamond, birdbeak, crooked). According to the results obtained in the primary dentition period (Table 1), the most dominant condyle shapes were rounded (91.6%, Yale classification) and oval (100%, Chaundhry classification). In the mixed dentition period (Table 2), the most dominant condyle shapes were rounded (95.8%, Yale classification) and oval (97.9%, Chaundhry classification). In the permanent dentition period (Table 3), the most dominant condyle shapes were rounded (98%, Yale classification) and oval (97%, Chaundhry classification).

From the results of a retrospective analysis using 110 orthopantomograph radiographs, a symmetrical pattern of the right and left mandibular condyles was observed.

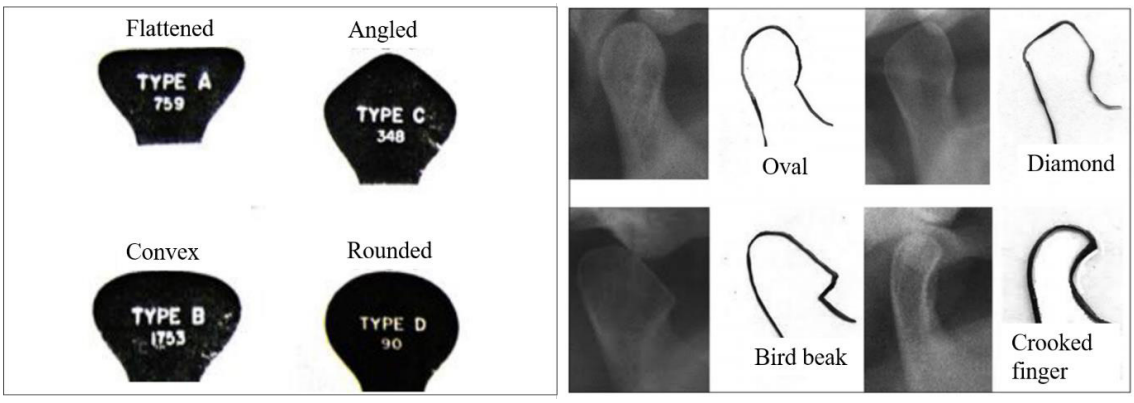

Figure 1. Left Yale classification [(5)], right Chaudhry classification [(6)]

Table 1. Condyle shape and symmetry pattern in the primary dentition

Yale Classification	n	%
Rounded	22	91.6
convex	2	8.3
Flattened	0	0
Angled	0	0
Total	24	100
Chaudhry Classification	n	%
Oval	24	100
Diamond	0	0
Birdbeak	0	0
Crooked	0	0
Total	24	100
Right and Left Condyle	n	%
symmetry	12	100
asymmetry	0	0
Total	12	100

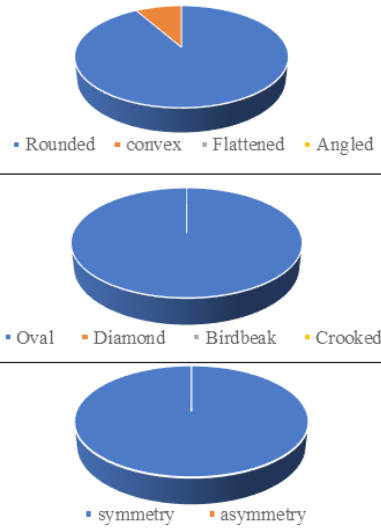

Table 2. Condyle shape and symmetry pattern in mixed dentition

Yale Classification	n	%
Rounded	92	95.8
convex	2	2.1
Flattened	0	0
Angled	2	2.1
Total	96	100
Chaudhry Classification	n	%
Oval	94	97.9
Diamond	2	2.1
Birdbeak	0	0
Crooked	0	0
Total	96	100
Right and Left Condyle	n	%
symmetry	46	95.8
asymmetry	2	4.2
Total	48	100

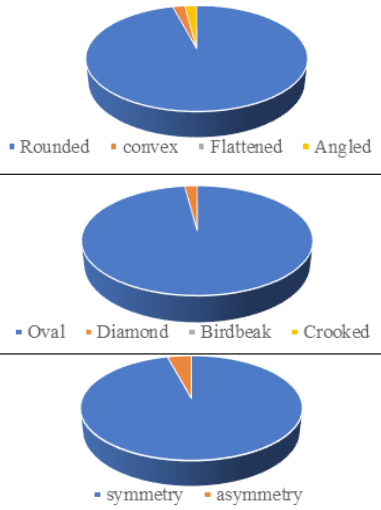

Table 3. Condyle shape and symmetry pattern in the permanent dentition

Yale Classification	N	%
Rounded	98	98
convex	1	1
Flattened	0	0
Angled	1	1
Total	96	100
Chaudhry Classification	n	%
Oval	97	97
Diamond	1	1
Birdbeak	2	2
Crooked	0	0
Total	100	100
Right and Left Condyle	N	%
symmetry	47	94
asymmetry	3	6
Total	50	100

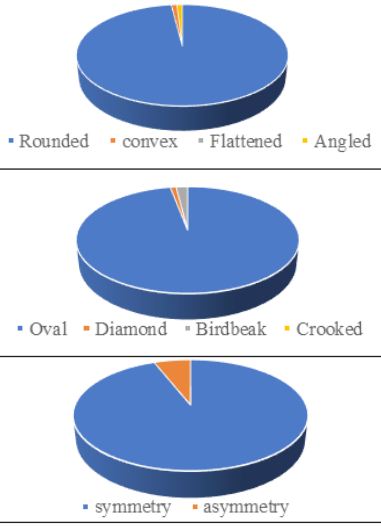

Figure 2. 16 years old patient with bird beak right condyle shape, oval left.

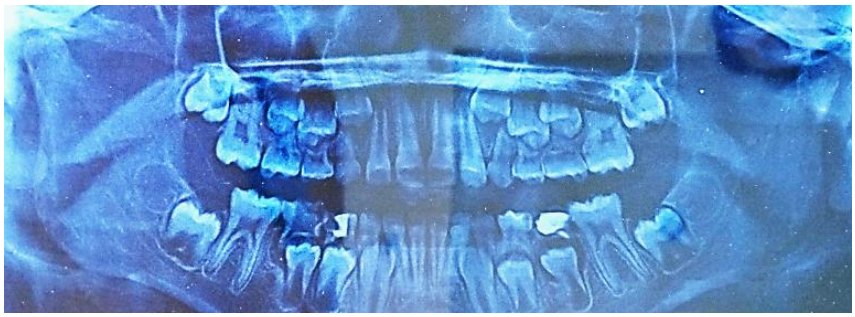

Figure 3. 9 years old patient with oval right condyle shape, diamond left.

The results obtained showed that asymmetrical right and left mandibular condyles were not found in the primary dentition period, 2 cases in the mixed dentition period, and 3 cases in the permanent dentition period (Tables 1-3). The shape of the right and left condyles is categorized as symmetrical if, in the same individual, the shape of the right and left condyles is the same. However, if the right and left condyles in the same individual differ in shape, it is categorized as asymmetry. In this study found only 5 cases asymmetry condyles with subjects aged 4-19 years (4.54%) (Figure 2 and 3).

DISCUSSION

According to various studies, the prevalence of temporomandibular disorder (TMD) in infants, children, and adolescents varies widely. A previous study found that 11.9% of adolescents experienced TMD. In addition, TMD symptoms increased with age.[8,9] TMD was rare in children aged 3-5 years, but in children aged 10-15 years, it is reported that 5–9% show more severe symptoms. 16% of children and adolescents had clinical symptoms of TMD, and 14% had TMJ disorders.[8,9] There is a case where a 12-year-old girl had idiopathic condylar resorption (ICD), so the child had an open bite clinical condition.[3] The American Academy of Pediatric Dentistry states that TMD may be associated with clinical findings including: skeletal anterior open bite, overjet greater than 6mm, skeletal class II profile, class III malocclusion, unilateral posterior crossbite, and posterior crossbite.[10]

The mandibular condyle has been reported by various studies to have a variety of shapes. This variation can occur due to variations in growth and development, trauma, disease, malocclusion, and various other factors.[5] It is important to understand these variations in order to be able to distinguish between physiological and pathological conditions. If the pathological condition can be detected early, preventive measures can be taken immediately. Several previous studies tried to classify the shape of the condyle from a lateral, posterior, or superior view. However, in general, these classifications have similarities. Around the 1960s, research on the condyle began to be carried out through observations on the dry skulls of humans. Yale, in 1961, was the first to classify the shape of the human condyle. At first, Yale was divided into three types, namely concave, convex, and flat, based on the superior surface of the condyle. Then, in its development, it was changed to four, namely convex, flattened, angled, and rounded.[5] Then another study conducted by Chaudhry classified the shape of the condyle into four categories based on the lateral view and the superior and anteroposterior shapes of the condyle. The four shapes of the condyles are oval shape, diamond shape, bird beak shape, and crooked finger shape.[6] The above classification is carried out on adult human subjects, and not many studies have been done on the condition of children.

Research on the shape of the condyle of children conducted in a previous study with a sample of 210 children with an average age of 7 years using sagittal computed tomography showed three forms of the condyle: round shape, anterior beak, and flattening. The round shape is

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the most common shape found in children aged 0–5 years.[2] With age, the size and shape of the condyle will change. The size of the condyle will increase with age, and the anterior angle will decrease, so that the shape of the condyle will change from round to oval.[2] Previous studies with subjects of mixed dentition showed that the round shape was the most dominant shape in the first transitional period. (46.1%) and in the inter-transitional period (44.23%). In the second transitional period, the most dominant form is convex (58.7%). [9]

The next step in research is research that uses adult subjects as samples. Through this research, we can at least see the trend in the shape of the condyle as the child grows. A previous study conducted in 200 subjects aged 18–65 years showed the oval shape was the dominant shape found, namely 60%, followed by the bird's beak at 29%, the diamond at 9%, and the crooked finger at 2%.[6] In the other hand, there was a study with 450 subjects aged 18-66 years showed that the oval shape was the dominant shape found, which was 56% followed by diamond, bird beak and crooked finger.[11] There was an influence on the status of the teeth, chewing habits, parafunctional habits, forms of occlusion, and the shape of the condyle.[4] The dominant shapes found are the oval Chaudhry classification and the rounded Yale classification.

There is a limited study on the symmetry pattern of the condyles in children. So far, the studies reported have included adults as research subjects. A previous study with a sample age range of 23–82 years found 50 cases of asymmetry between the right and left sides.[7] In addition, a previous study conducted in 350 samples aged 18–58 years showed 81.1% had the same condyle shape, and 18.6% of the right and left condyles did not have the same shape. 450 samples aged 18–66 years showed 74.2% of the samples had symmetrical left and right condyles, and 25.8% did not have left and right symmetrical condyles.[11] The above study was a study with adult subjects. Asymmetrical left ancondyles may occur in patients with crossbite.[7] This occurs because the condyle on the side that does not have a crossbite moves more anteriorly, causing imbalance and a different condylar shape. Asymmetrical left and right condyles may also occur because, in general, the right side is used more for chewing and the chewing power exerted on the right side is greater, causing asymmetrical left and right sides. [12]

From the various studies above, it can also be seen that, generally, condyles have four normal shapes. If in practice you find shapes outside of these 4, it is advisable to carry out further examination. TMD and malocclusion affect each other. In some cases, it was found that the child had a systemic disease, resulting in inflammation and condyle resorption.[13] However, there are also cases where malocclusion can cause TMD. Before starting the orthodontic treatment for the malocclusion, it would be better to assess the masticatory system and TMD-related complaints. Although the severity of malocclusion was not related to the presence of TMDs, OHRQoL was significantly lowered.[14] The mandibular condyle, although not a conventional development center, has a substantial impact on the final size, shape, and function of the mandible, as well as indirectly on the entire facial appearance. Face deformities and functional deficiencies are frequently the results of acquired temporomandibular joint (TMJ) and condylar abnormalities, such as juvenile idiopathic arthritis, idiopathic condylar resorption, TMJ ankylosis, and condylar hyperplasia. For the doctor to estimate possible deformity progression, forecast prognosis, and plan treatment, an accurate diagnosis is essential. [15]

From the research above, it was also found that the asymmetric shape of the condyle causes no complaints or problems. From this study, it can be concluded that in children aged 4–19 years, the shapes of normal condyles found are: rounded, convex, angled (Yale classification), and oval, diamond, or birdbeak (Chaundhry classification). The condyles are dominated by rounded and oval shapes. Asymmetry of the condyle wasn't discovered in younger groups (primary dentition), and there were only a few cases in older groups (permanent dentition). Limitations of sample age make this study unable to show the pattern of mandibular condyle shape and symmetry change over time, and we suggest further research on this topic.

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