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RESEARCH ARTICLE

"CLEFT IN TWO PARTS" ASSESSMENT OF BIFID MANDIBULAR CONDYLE USING CBCT

***Dr. Sujatha S Reddy, Dr. Pushpanjali Sharma, Dr. N. Rakesh, Dr Yashoda Devi, B. K., Dr. Shwetha, V., Dr. Pavan kumar, T., Dr. Priyadharshini, R. and Dr. Rizwana Azmi, S.**

Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences Bangalore

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ABSTRACT

Context: Introduction: Bifid condyle is a rare anatomical variation of the mandibular condyle. This condition is considered to be developmentally formed with some exceptions of traumatic origin been reported. In most of the cases it is an incidental finding, and this condition is most often not associated with any clinical signs and symptoms. The present study was conducted to evaluate the various characteristics of bifid mandibular condyle (BMC) pattern.

Materials and Methods: A retrospective study was carried out in the Department of Oral Medicine and Radiology in the year 2016. In the present study 8100 Cone beam computed tomography (CBCT) images were evaluated for the presence of bifid mandibular condyle in the axial, coronal and sagittal sections.

Results: Bifid condyle was detected in 14 images. 11(78.57%) patients had unilateral bifid condyle and 3(21.42%) patients presented with bilateral bifid condyle. The bifid condyles in all the 14 patients were oriented mediolaterally. In cases where there was unilateral presentation, right side (54.54%) of the condyle was more commonly involved than left side (45.45%). The mean depth of the bifurcation groove was found to be 2.69 mm.

Conclusions: In most of the reported cases bifid mandibular condyle is not associated with any clinical signs and symptoms making it an incidental finding. Initial screening for the presence of bifid mandibular condyle can be performed by panoramic radiograph, but CBCT images can reveal morphological changes and the exact orientation of the condylar heads. The diagnosis of a bilobed condyle usually relies on radiological findings rather than clinical findings.

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INTRODUCTION

The bifid mandibular condyle (BMC) is a rare anatomic condition associated with duplicated or lobulated head of the condyle. This condition was first described by Hrdlicka (1941), wherein he reported 27 cases of BMC in a series of skulls in Smithsonian Institute (Fuentes *et al*., 2009). It has been sporadically reported since then, perhaps due to its generally asymptomatic nature. Its incidence has been reported to be from 0.018% to 1.82%. The presence of bifid mandibular condyle is usually reported during routine radiographic examination. In most of the cases it is an incidental finding since this condition is not associated with any clinical symptoms (Jabi Shriki *et al*., 2005). The condylar head is divided into two partially or completely separated lobes by a rift or a deep groove. The separating groove can be oriented anteroposteriorly or mediolaterally determining the spatial relationship of the bifid heads (Khojastepour *et al*., 2016). The exact etiology and pathogenesis of bifid mandibular condyle is not clearly understood. Although the mediolateral type of BMC is considered to be developmentally formed, some exceptions of traumatic origin have been reported (Loh and Yeo, 1990). It may be related to developmental anomalies, trauma, nutritional disorders, infection, irradiation, genetic factors, teratogenic embryopathy, perinatal trauma and surgical condylectomy (Fuentes *et al*., 2009; Neves *et al*., 2013). It has been postulated that the anteroposterior pattern can be as a result of a facial trauma during childhood and mediolateral pattern can be due to the persistence of the fibrous septa of mandibular cartilage which can lead to different patterns of bifid mandibular condyle (Oliveira *et al*., 2004). Radiographic appearance of BMC can mimic vertical condylar fractures, which confuses the physicians in cases of trauma to the face. Three dimensional reconstruction provides excellent visualization and images can be analyzed from any angle (Upadhyaya *et al*., 2007). BMC is believed to play a role in some cases of temporomandibular joint disorder (TMD), and joint symptom (Neves *et al*., 2013). Herein we are reporting fourteen cases of

Corresponding author:* **Dr. Sujatha S Reddy,
Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bangalore

bifid mandibular condyle diagnosed incidentally on CBCT scans.

SUBJECTS AND METHODS

This retrospective study was carried out in the Department of Oral medicine and Radiology in the year 2016. The study consisted analysis of 8100 CBCT images collected over a period of 2 years. The images were obtained using CS 9300S CBCT at an exposure parameter of 90 kVp, 6.3 mA and FOV of 13.5 cm X 17 cm. These images were taken as part of routine examination, diagnosis and treatment planning of patients who visited the outpatient department of the institution. CBCT images were retrospectively reviewed for the presence of bifid condyles. The condylar morphology varying from a shallow groove to two distinct condylar heads in both right and left side of the mandible was considered in this study. CBCT analysis of the mandibular condyle morphology was carried out in all the three planes. The condylar morphology was well appreciated in the sagittal section of the reconstructed three dimensional images. Linear measurements of the depth of the bifurcating groove of the bifid condyle were calculated. The BMC depth was measured by the shortest distance from the line connecting the two highest points of the condyles to the lowest point of the bifurcating groove. Temperomandibular joint (TMJ) pain and noise was assessed by recalling and asking the patients if they felt either joint or muscle pain **and/or** clicking sounds during mandibular movement. None of our patients had any traumatic history or symptomatic joints.

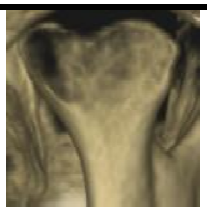
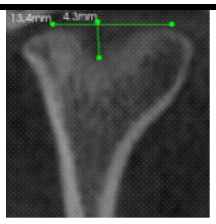
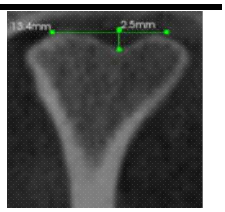
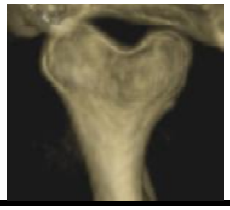
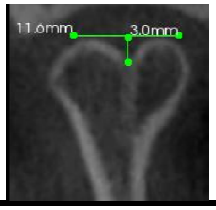
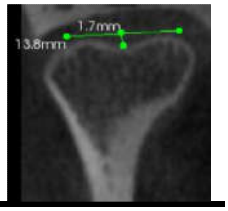
RESULTS

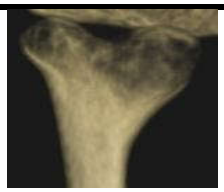
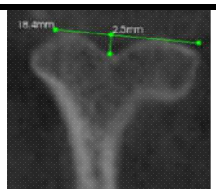
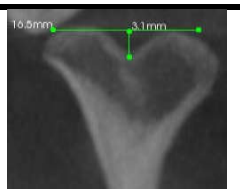
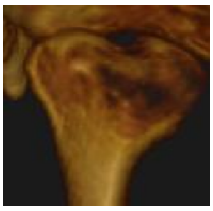
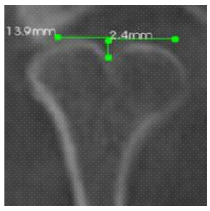
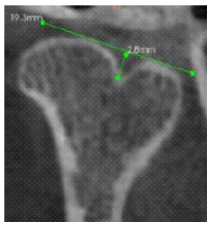
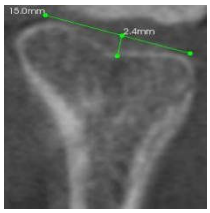
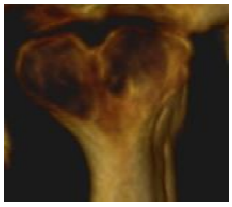
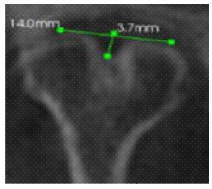
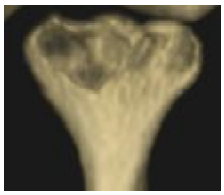
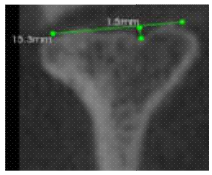
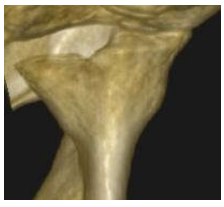
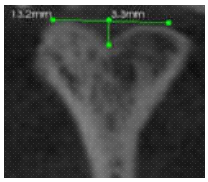
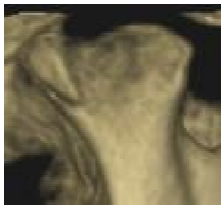
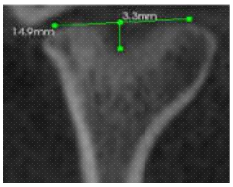
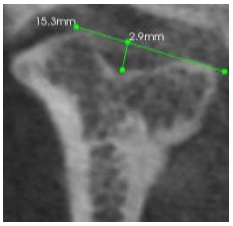
Of the 8100 CBCT images analysed, bifid condyle was detected in 14 images. Of these 14 images, 9 images were of female patients (64.2%) and 5 (35.7%) were from males. The age of the patients ranged from 21 years to 66 years. 11(78.57%) patients had bifid condyle involving only side and 3 patients presented with bifid condyle involving both sides (21.42%). Right side BMC was found in 9 patients and it was present on left side in 8 patients. The bifid condyles in all the 14 patients were oriented mediolaterally. In cases where there was unilateral presentation, right side (54.54%) of the condyle was more commonly involved than the left **side** (45.45%). The mean depth of the bifurcation groove was found to be 2.69 mm (1.5mm- 4.7mm) as tabulated (Table 1).

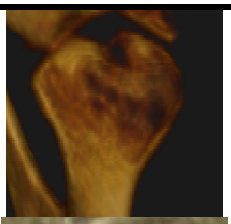
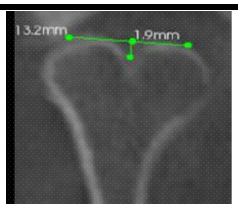
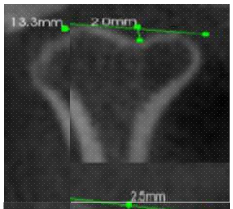
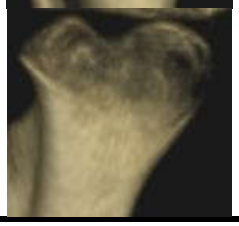
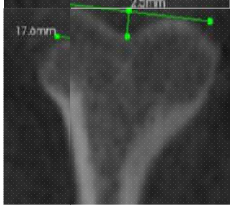
DISCUSSION

Bifid mandibular condyle is an uncommon entity usually discovered as an incidental finding during routine radiographic examinations. The term "bifid" is derived from the Latin word meaning "cleft into two parts". Introduction of advanced imaging techniques have contributed to increased incidence of the condition being reported. In 1948, Schier did the first study in a living subject and reported one case (Schier, 1947). In a study carried out on non-living subjects, Szenpetery *et al*. reported 7 (0.3%) cases of BMC in 1882 skulls with 2077 condyles (Szentpetery *et al*., 1990). In 2008, Menezes *et al*. examined 50,080 panoramic radiographs in a Brazilian population and found only 9 (0.018%) cases of BMC (Menezes *et al*., 1990). Subsequently, in 2010, Miloglu *et al*. examined 10,200 panoramic radiographs in a Turkish population and reported 32 (0.3%) cases of BMC (Miloglu *et al*., 2010). Sahman *et al* in 2011 reported 10 (1.82%) patients with BMC from 550 CT records (Sahman *et al*., 2012). Caglayan & Tozoglu, found that 2.9% of patients had a bifid condyle as an incidental TMJ finding on CBCT scans in Turkish population (Çaglayan and Tozoglu, 2012). In 2013, Cho & Jung, found 37 (0.50%) cases from 7,424 CBCT images and a total of 44 BMCs (0.30%) from 14,848 condyles (Gunduz *et al*., 2015). In the same year, Neves *et al*., performed a retrospective study using CBCT records and panoramic radiographs of 350 patients and found BMCs in 4 cases (1.1%) (Neves *et al*., 2013). In our study, of the 8100 CBCT images evaluated, 14(0.17%) had BMC indicating it to be a rare anomaly often found as an incidental finding on routine examination. According to the literature, the occurrence of BMC does not show a predilection for sex or any particular age group (Gunduz *et al*., 2015). In our study, the occurrence of mandibular bifid condyle was more in females than in males with a female:male ratio of 1.8:1 which is contrast with the findings of Antoniades *et al*. who reported a male:female ratio of 1.5:1 (Antoniades *et al*., 2004). Menezes *et al*. and Miloglu *et al* found a significantly higher female-male ratio in the respective populations (Menezes *et al*., 1990; Miloglu *et al*., 2010). In the literature review, the majority of the BMC cases were unilateral, and a bilateral pattern was rare (Menezes *et al*., 1990; Miloglu *et al*., 2010; Sahman *et al*., 2012). In the present study ratio of unilateral to bilateral condyle was found to be 3.6 : 1 similar to the findings of Faisal *et al* who reported a ratio of 4.6:1 (Faisal *et al*., 2010). Although Dennison *et al*., expressed

Table 1. Characteristics of Bifid Mandibular Condyle

S.No.	Age	Sex	Unilateral/ Bilateral	Side	Orientation of the Bifid Condyle	Depth of Bifurcating groove	3 d reconstructed image of BMC	BMC in coronal section	
1	22 years	Female	Bilateral	Right and left	Mediolateral	Right : 2.5mm Left : 4.3 mm			
2	20 years	Female	Bilateral	Right and left	Mediolateral	Right : 1.7mm Left : 3mm			

3	25 years	Male	Bilateral	Right and left	Mediolateral	Right :3.1mm Left : 2.5mm			
4	66 years	Female	Unilateral	Left	Mediolateral	2.4mm			
5	36 years	Female	Unilateral	Right	Mediolateral	2.8mm			
6	48 years	Female	Unilateral	Left	Mediolateral	2.4mm			
7	57 years	Female	Unilateral	Right	Mediolateral	3.7mm			
8	36 years	Female	Unilateral	Right	Mediolateral	1.5mm			
9	25 years	Male	Unilateral	Right	Mediolateral	3.3mm			
10	21 years	Female	Unilateral	Right	Mediolateral	3.3mm			
11	35 years	Female	Unilateral	Right	Mediolateral	2.9mm			

12	26 years	Male	Unilateral	Left	Mediolateral	1.9mm		
13	29 years	Male	Unilateral	Left	Mediolateral	2.0mm		
14	33 years	Male	Unilateral	Left	Mediolateral	2.5mm		

that only the anteroposterior division of a condyle is a "true" bifid condyle (Dennison *et al*., 2008), BMC has been generally considered in cases in which a condyle arises to be duplicated anteroposteriorly or mediolaterally (Cho and Jung, 2013). In our study all the BMCs had mediolateral orientation. In this study, right side was more commonly involved than left side which is similar in presentation to that reported by Miloglu *et al*. (2010). The exact etiology of BMC is unknown, however trauma is considered as the most common cause. Thomason and Yusuf reported two cases of traumatic condyle fracture with subsequent unilateral BMC (Thomason and Yusuf, 1986). Also, Antoniades *et al*. presented a case of unilateral BMC which resulted following a sagittal condylar fracture (Antoniades *et al*., 2004). On the other hand, minor trauma to the growth center or deficient remodeling of the mandibular condyle may subsequently result in a variation such as **BMC.** In a retrospective study, Rehman *et al*. reported 10 cases of BMC in 37 patients with TMJ ankylosis suggesting it could be one of the etiologic factors for development of BMC. Of those ten cases, nine were post-traumatic and one was post-infectious (Rehman *et al*., 2009). Shriki *et al*. proposed that a bifid condyle with mediolateral division is a developmental phenomenon with the intervening fibrous or vascular structures dividing the condylar heads (Shriki *et al*., 2005). This observation can be extended to our study as all the subjects in our study had a mediolateral orientation of the bifid condyle and none of them had a history of trauma. Furthermore, Gulati *et al*. reported two cases of BMC with joint ankylosis (Gulati *et al*., 2009).

Conclusion

In the present study unilateral bifid condyle was found to be more common than the bilateral bifid condyle, with the overall incidence of BMC being 0.17%. The bifid condyles in all the patients were oriented mediolaterally. In cases where there was unilateral presentation, right side (54.54%) of the condyle was more commonly involved than left side (45.45%). The mean depth of the bifurcation groove was found to be 2.69 mm. A good understanding of morphological variation of this condition is important so that it shouldn't be misdiagnosed as any other TMJ pathology.

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