Bifid mandibular condyle: a study of the clinical features, patterns and morphological variations using CT scans

Balaji SM ✉

Director and Consultant
Oral and Maxillofacial Surgeon, Chennai

Received: 17 November 2009 / Accepted: 25 February 2010
© Association of Oral and Maxillofacial Surgeons of India 2009

Abstract Bifid Mandibular Condyle (BMC) are usually diagnosed on routine radiographic examination, is described in the literature as a rare entity. It is reported that BMC has no predilection by sex or ethnic background or the age. The etiopathogenesis of BMC still remains controversial and proper description of the condition is not defined owing to fewer reported cases. Dental professionals should have some knowledge of this anatomic abnormality, as well as its implications for function and appropriate treatment modalities, so that they can be alert to this potential diagnosis. This paper reports the largest series of BMC, using CT scans with history of trauma and presents some of the characteristic clinical features.

Keywords Bifid mandibular condyle · Tempromandibular joint trauma

Address for correspondence:

Balaji SM
Director
Balaji Dental & Craniofacial Hospital
30, KB Dasan Road, Teynampet
Chennai-18, India
E-mail: smbalaji@gmail.com

Introduction

The Bifid Mandibular Condyle (BMC) represents a rare developmental anomaly first described in 1941 and only 67 cases have been reported till now [1]. These patients had well formed double or bifid mandibular condyles separated by a shallow or deep groove. Small bony processes projecting from the mandibular ramus or condylar neck without a well formed duplicated condyle are not usually considered as BMC [1]. Several factors have been cited as possible causes of BMC, including condylar fracture, developmental anomalies, perinatal trauma, teratogenic embryopathy and surgical condylectomy [2]. It is reported to affect only one condyle, and the observation of bilateral BMC is exceptionally rare. Often, BMC is usually identified as an incidental finding on routine radiographic examination [3]. This paper reports a series of clinical cases of BMC possibly resulting from trauma, with emphasis on clinical diagnosis, radiographic and tomographic features, and management. To the best of author's knowledge this case series remains the largest ever series of BMC reported in English literature.

Materials and methods

All archived cases treated for Temporomandibular Joint (TMJ) related problems from June 1999 to June 2008 were reviewed for BMC. Established or developing TMJ Ankylosis was identified by the presence of a markedly reduced joint space and irregular, enlarged joint margins with fibrous and or bony bridging in CT coupled with clinical features. These patients had well formed double or bifid mandibular condyle separated by a deep groove as described by Rehman TA et al. [1]. Patients with small bony processes projecting from the mandibular ramus or condylar neck, without a well formed duplicated condyle, were not included. Though these patients had undergone preliminary investigations such as plain radiography and orthopantomograms as they were neither digitalized nor stored and were not available for some of the earlier cases, hence these details were not considered. Clinical details of these patients including demography, etiology, duration of symptoms and clinical findings were analyzed from medical records. CT

records of TMJs in these patients were analyzed by the author. These CTs were taken by an independent private radiologist over the period of time of 10 years. Based on the CT features patients were divided into those with bifid condyles in one TMJ only (unilateral BMC) and those with bifid condyles on both sides (bilateral BMC). Patients were then classified with regard to the relation of one condylar process to the other as Medio-lateral (ML) or anteroposterior (AP). These were further classified, based on the presence of TMJ ankylosis, as present or absent.

Statistics

All the data were entered and analyzed using SPSS software version 16.0. Descriptive statistics were presented for all variables from all papers and overall cases. One way ANOVA was performed for finding the association of age and interincisor opening for gender, etiology, and ankylosis. p value of <0.05 was considered statistically significant.

Results

There were 121 cases treated during the period for various TMJ pathologies. Overall 15 cases were diagnosed with BMC. Of this 12 cases of BMC were with marked evidence of TMJ Ankylosis features on CT. The prevalence of BMC among TMJ pathologies was 12.40%.

Of the 15 cases, 7(46.7%) were males and rest 8(53.3%) were females. 4(26.7%) cases were below 6 years and 8(53.3%) cases were aged above 12 years 3 (20%) cases 6 to 12 years of age. Of the study group, 11 cases (73.3%) had ipsilateral deviation of chin clinically and the rest of the cases had no deviation. Of the 11 cases with ipsilateral deviation 2 were in right side and 9 in left side. Four cases (26.7%) had bilateral BMC and rest were unilateral cases. Of the unilateral BMC, right side was involved in 13.3% of cases and left side in 60% of cases. In case of bilateral BMC, deviation was noticed clinically to left side in 1 case and no deviation in 3 cases. In the unilateral BMC, deviation to ipsilateral side was observed in 10 cases where as in a single case involving left condylar head had no deviation at all. The difference was statistically significant ($p=0.000$).

The age of the study population ranged from 2 to 29 years with a mean age of 14.07 ± 8.21 years. When age group was compared with clinical deviation, 75% of cases aged below 6 years had no deviation while 87.5% of cases aged above 12 years had clinical deviation of chin. This difference was clinically significant ($p=0.035$). The mean MO of cases with TMJ Ankylosis was 0.83 ± 1.95 mm whereas in cases where TMJ Ankylosis was absent was 20 ± 10 mm. The difference between these was statistically significant ($p=0.000$).

All cases had history of trauma during childhood. All the cases presented with restricted mouth opening. The mean mouth opening was 4.67 ± 8.96 mm that ranged from 0 to 30 mm. All BMC had ML orientation. All the cases had a single glenoid fossa attachment and the condyle with BMC had a characteristic 'Mushrooming effect'.

Discussion

It has been reported that the first description of BMC was published in the American Journal of Physical Anthropology by Hrdlicka, who found 27 cases of this anomaly while analyzing male and female dried human skulls in a Smithsonian

Fig. 1 Unilateral Bifid Mandibular Condyle (BMC) in the present case series. A,B-left bifid condyle with medial head ankylosed, C-bilateral BMC and ankylosis and deviation to left, D-right BMC and left side ankylosis, E-left bifid condyle with lateral head ankylosed, F-left bifid condyle with ankylosis in a 3-year-old female child, G-right BMC, reconstruction of mandible indicating the right mesiolaterally oriented BMC

Fig. 2 Bilateral Bifid Mandibular Condyle (BMC) in the present case series. A,B,C,E,F- Bilateral BMC with ankylosis all involving lateral head of both condyles, D-CT reconstruction done in a case of bilateral BMC showing the mesio-lateral orientation

Table 1 Table depicting the probable etiopathogenesis mechanism for Bifid Mandibular Condyle

Cause	Mechanism	References
Abnormal condylar cartilage	Condylar cartilage, during early stages of its development, is divided by well-vascularized fibrous septa and suggested that persistence of such a septum, in exaggerated form, within the growing cartilage might lead to an error in development that would in turn give rise to the bifid condition.	Blackwood HJ, 1957
Forceps delivery	Trauma during delivery causes rupture of septal blood vessels causing hematoma and subsequently could lead to BMC formation.	Blackwood HJ, 1957
Condylar trauma	Condylar damage causes alteration in position of fiber attachment influencing bone remodelling	Poswillo DE, 1972
Teratogenic substances	N-methyl-N-nitrosourea and formhydroxamic acid induces BMC	Gundlach, 1987
Others	Combination of teratogenicity and muscle attachment endocrine disorders, irradiation and genetic abnormalities	Gundlach, 1987 Quayle AA and Adams JE, 1986

Institution collection [4]. Since then, only a few cases of bilateral BMC have been reported in living human beings. The fact that there are only a few studies conducted on this subject is indicative of the rarity of this disorder. Till date only 67 cases has been reported in literature and the largest number of cases (12) was provided from this same part of the world [1]. To the best of our knowledge, no systematic statistical approach has been performed on BMC to elucidate the clinical findings.

Although panoramic radiograph would serve as a valid diagnostic tool in the diagnosis of BMC, other conventional radiographs were not sufficient to reach a final diagnosis. In the case series presented here, CT scan was favored over other imaging modalities as axial and coronal CT images were of great value in illustrating the relation of the vital structures at the base of the skull to the ML heads of BMC enabling the clinician to identify a suitable treatment plan. Moreover CT allows bilateral visualization without osseous superpositioning, complete recording of the area with a single scan, short examination duration, lower radiation dose and better image quality. Three-dimensional reconstruction can further be used to assess condylar shape including deformity and neoarthrosis or pseudo-arthritis formation, as well as hypoplastic and hyperplastic changes at the condyle. 3D reconstruction allows more accurate evaluation of condylar morphology than 2D images [5].

Literature provides an age range of 3 to 67 years with a mean age of 35 years [6]. The age of present study population ranged from 2 to 29 years with a mean age of 14.07 ± 8.21 years. The difference could be due to hospital referral bias as this center is recognized as a craniofacial

deformity center in this part of the world. This case series has documented the youngest patient with BMC aged 2 years.

BMC has been reported in patients of various ethnic backgrounds and both sexes. The present study concurs with this finding. Literature sites about 67% of patients with BMC had no complaints related to the affected condyles and the condition was often detected as an incidental finding during dental radiographic examination [5]. Whereas in our case series, 80% of cases had TMJ ankylosis and 20% cases non-specific symptoms including general jaw pain, swelling, articular clicking and limited oral opening. Such a presentation is often observed in cases reported in English literature [4].

The orientation of bifid condyle has been classified as AP and ML [1]. Szentpetery et al. have concluded that when 2 condylar parts lie in the sagittal plane trauma is indicated as the cause and when the parts lie in the coronal plane the persistence of the fibrous septa at the condylar cartilage is likely to be the cause [7]. While this may be true for the majority of cases, some mediolateral BMC have been reported following sagittal fracture through the condylar head and has been disproved by several reports [1]. In our present case series, all our 15 cases were oriented ML and all cases with history of trauma sustained during early childhood.

The etiology of bifid mandibular condyle is not fully understood and the literature considers a number of postulations and is tabulated as Table 1. The findings from the present study stresses that the mandibular condyle region is a crucial centre of facial growth. Injuries sustained during childhood and puberty can lead to condylar

malformations including BMC and severe facial asymmetry as evident by 73.3% of cases with clinical deviation of chin.

Though 16 cases of BMC with temporomandibular joint ankylosis is found in literature [1,8] which has been published separately earlier [9]. We present 12 cases of BMC with temporomandibular joint ankylosis in this series. It is evident from this report of case series that trauma is an important etiological phenomenon and BMC often accompanies in TMJ ankylosis cases. Employment of recent imaging techniques has enabled us to identify this previously under reported phenomenon [1]. TMJ ankylosis cases with BMC had a definite reduced mouth opening as compared to cases with BMC and the difference was statistically significant. In such cases of TMJ ankylosis, ankylosis treatment has to consider the presence of BMC and arthroplasty may be advised in warranted cases.

According to Garcia-Gonzales et al. appropriate treatment for BMC depends on the symptoms. Asymptomatic BMC cases needs to be followed up and does not require any intervention till any abnormalities are noted. Patients with internal articular derangement should be treated with occlusal splints and arthroscopic surgery [10]. TMJ ankylosis is generally treated with gap arthroplasty with a costochondral graft in children and gap arthroplasty and temporalis flap in adults [11].

The prevalence of BMC among general population is estimated to be 0.018% among Brazilian population [12]. The present case series reports of 12.40% of BMC among South Indian patients with TMJ pathologies from a single institution owing to admission bias.

Conclusion

BMC is a rare phenomenon and increasingly reported owing to advancing imaging modalities. This case series is the single largest presented so far and has 15 South Indian cases of BMC, of which 80% presented with TMJ ankylosis. There was slight female predilection and 53.3% cases were aged above 12 years. The age of the study population ranged from 2 to 29 years with a mean age of 14.07 ± 8.21 years. 73.3% had ipsilateral deviation of chin clinically. 26.7% had bilateral BMC. All cases had history of trauma and oriented ML. Further long term follow-up will reveal more about this rare phenomenon.

References

1. Rehman TA, Gibikote S, Ilango N, Thaj J, Sarawagi R, Gupta A (2009) Bifid mandibular condyle with associated temporomandibular joint ankylosis: a computed tomography study of the patterns and morphological variations. *Dentomaxillofac Radiol* 38(4): 239–244
2. Stefanou EP, Fanourakis IG, Vlastos K, Katerelou J (1998) Bilateral bifid mandibular condyles. Report of four cases. *Dentomaxillofac Radiol* 27(3): 186–188
3. Cowan DF, Ferguson MM (1997) Bifid mandibular condyle. *Dentomaxillofac Radiol* 26(1): 70–73
4. de Sales MA, do Amaral JI, de Amorim RF, de Almeida Freitas R (2004) Bifid mandibular condyle: case report and etiological considerations. *J Can Dent Assoc* 70(3): 158–162
5. Ramos FM, Filho JO, Manzi FR, Boscolo FN, Almeida SM (2006) Bifid mandibular condyle: a case report. *J Oral Sci* 48(1): 35–37
6. Antoniadis K, Hadjpetrou L, Antoniadis V, Paraskevopoulos K (2004) Bilateral bifid condyle. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 97(4): 535–538
7. Szentpetery A, Kocsis G, Marcsik A (1990) The problem of the bifid mandibular condyle. *J Oral Maxillofac Surg* 48(12): 1254–1257
8. Gulati A, Virmani V, Ramanathan S, Verma L, Khandelwal N (2009) Bifid mandibular condyle with temporomandibular joint ankylosis: report of two cases and review of literature. *Skeletal Radiol* 38(10): 1023–1025
9. Balaji SM (2010) Bifid mandibular condyle with temporomandibular joint ankylosis - a full data analyses. *Dent Traumatology* (accepted for publication)
10. Garcia-Gonzales D, Martin-Granizo R, Lopez P (2000) Imaging quiz case 4. Bifid mandibular condyle. *Arch Otolaryngol Head Neck Surg* 126(6): 795–799
11. Balaji SM (2003) Modified temporalis anchorage in craniomandibular reankylosis. *Int J Oral Maxillofac Surg* 32(5): 480–485
12. Menezes AV, de Moraes Ramos FM, de Vasconcelos-Filho JO, Kurita LM, de Almeida SM, Haiteir-Neto F (2008) The prevalence of bifid mandibular condyle in a Brazilian Population. *Dentomaxillofac Radiol* 37(4): 220–223

Source of Support: Nil, **Conflict of interest:** None declared.