Cone Beam Computed Tomography in the Diagnosis of Unilateral Condylar Hypoplasia: Report of a Case

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INTRODUCTION

Condylar hypoplasia is the underdevelopment or defective formation of the condyle, which can be congenital or acquired. Congenital hypoplasia is present at birth, while acquired condylar hypoplasia occurs from an event that interferes with its normal development. This event can be trauma, infection, radiation, endocrine disorders, or systemic arthropathy (1).

The diagnosis is arrived at by a correlation of the clinical findings with the radiological findings. Plain film radiography is generally inadequate for assessing disorders of the temporomandibular joint [TMJ] (2). This case highlights the im-portance of cone beam computed tomography (CBCT) in arriving at a diagnosis for the patient.

CASE REPORT

This case is that of a 14-year old female (Fig. 1) whose presenting complaint was facial asymmetry and mild clicking on the left side of the jaw. Both the patient and her parents were worried about the increasing levels of facial asymmetry and could vividly recall their daughter always pointing to her right temporomandibular joint indicating that something "didn't feel right".

Fig. 1: Facial asymmetry.

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Her medical history was unremarkable but her mother gave a history of trauma to the chin when she was four years old. Extra oral examination revealed facial asymmetry (Fig. 1) and deviation to the right side on opening (Fig. 2). No tenderness was noted when the condyles were palpated bilaterally. Intraoral examination showed a class I malocclusion on a mild class II skeletal base with increased vertical proportions. There was moderate bimaxillary proclination and the chin point was to the right.

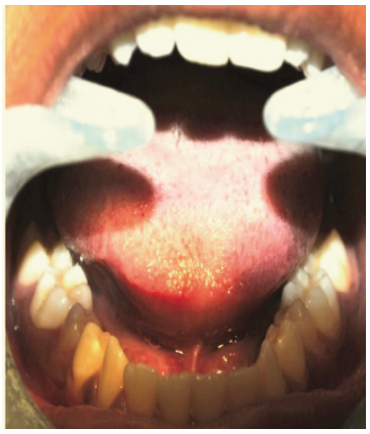

Fig. 2: Mandibular deviation to the right on opening.

The overbite was normal and complete to tooth and the overjet was 4 mm. The lower centreline was 4 mm to the right (Fig. 3).

Fig. 3: Midline shift to the right.

Left molar relationship was class III and the right molar relationship was class I.

All teeth were present from second molar to second molar. On the left side, there was canine guidance and on the right side, group function.

Dental panoramic tomography (DPT) was suggested to assess the general osseous morphology and contour of the condylar heads and necks with a view to looking for variations in shape of the mandibular condyle on the right side or an "old fracture". Although panoramic radiographs are not a reliable method of accurately judging the shape of the mandibular condyle (2) and neither is it the best for an assessment of condylar fractures (3) and degenerative joint disease (4), the investigators felt that some preliminary information would be obtained.

The resultant DPT shown in Fig. 4 reveals the full complement of the permanent dentition with the maxillary and mandibular third molars in stage F of dental maturity.

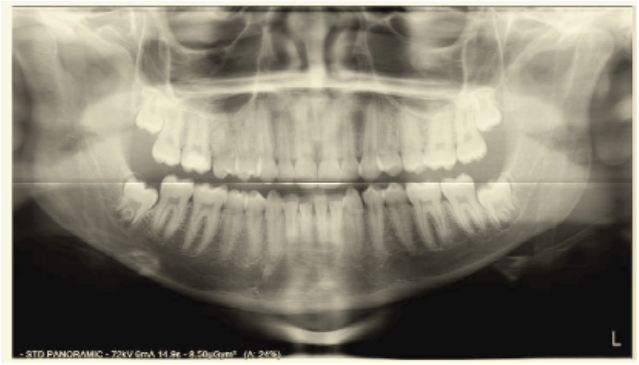

Fig. 4: Dental panoramic radiograph.

The image was of adequate contrast and density. Although the patient was positioned adequately in the image layer, the image showed errors of unequally magnified sides due to the patient's facial asymmetry. The mandibular midline shift to the right side was also noted on the DPT. Due to the patient's facial asymmetry, the "illusion" of rotation errors is inevitable and evident in this DPT view. The left condylar neck and head are of normal morphology and contour whilst the right condylar head and neck actually appear to be short and wide. An oral radiologist's impression was that there was no evidence of an "old fracture", ankylosis or degenerative joint disease. There was, however, evidence that the shape and size of the right condylar head and neck was abnormal. Because of this, CBCT was recommended as it is the imaging technique of choice when investigating potential bony changes of the TMJ (5). The CBCT images of this patient show coronal, sagittal and axial views through her TMJ.

Figure 5 shows the left condylle with normal osseous morphology and contour which is convexly round at the superior margin. The cortical margins are unremarkable and there is no evidence of osteophyte formation or subchondral sclerosis. The joint space is normal (3 mm) and the cortical

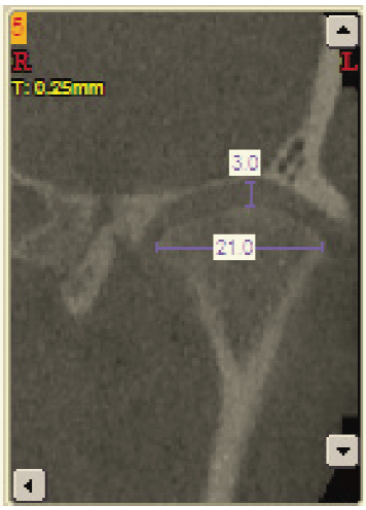

Fig. 5: Coronal view through the left condyle.

margin of the glenoid fossa (squamous aspect of the temporal bone) is of normal appearance. The mediolateral width of the left condylar head is 21 mm in its maximum dimension.

Figure 6 shows the coronal view through the right condylar head. When compared to the left side, there is a decrease in the mediolateral width of the right condylar head in its maximum dimension by 3 mm and an increase in joint space by 2.5 mm from the superior aspect of the condyle to the roof of the glenoid fossa.

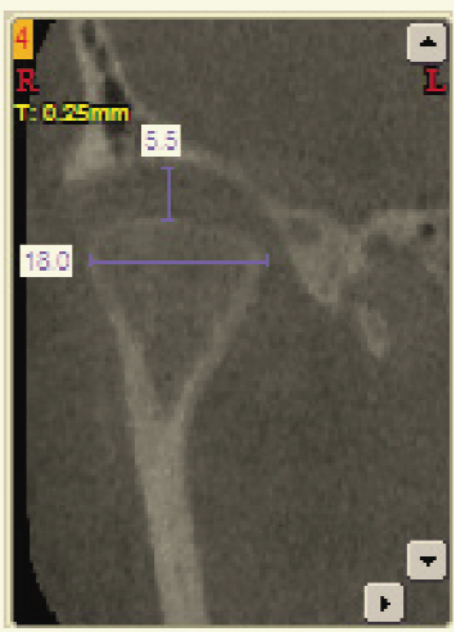

Fig. 6: Coronal view through the right condyle.

Figure 7 shows the sagittal view through the right TMJ and confirms the enlarged joint space (5.3−5.5 mm).

The length of the right condylar neck from the sigmoid notch to the most superior aspect of the condyle is 18.3 mm.

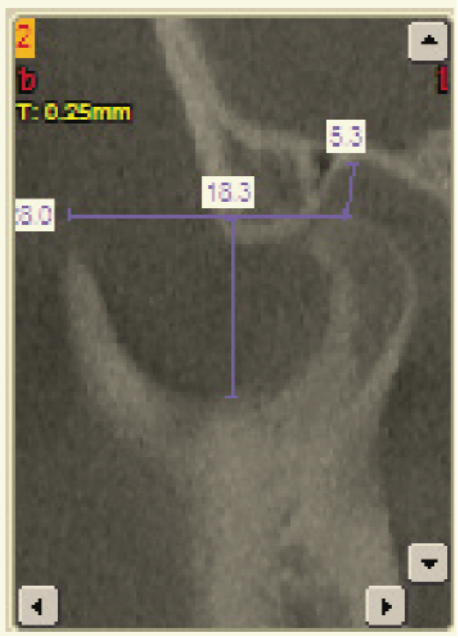

Fig. 7: Sagittal view of the right temporomandibular joint.

Figure 8 shows a normal joint space height of 3.0 mm in sagittal view of the left TMJ. When compared to the length of the condylar neck on the right side (Fig. 7), the length of the condylar neck from the sigmoid notch to the most superior aspect of the condyle is 21.8 mm. This represents a difference of 3.5 mm. This equates to the approximate 4 mm midline shift to the affected side.

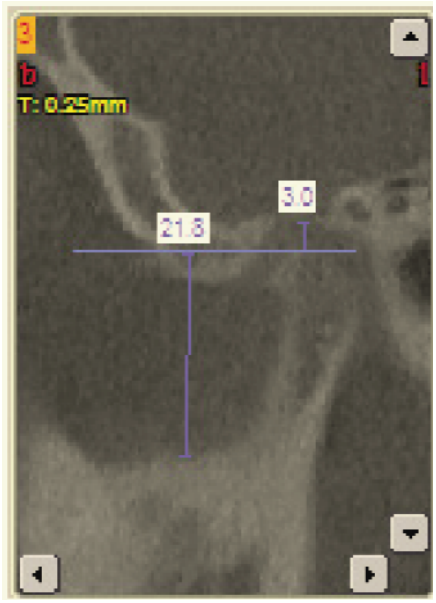

Fig. 8: Sagittal view of the left temporomandibular joint.

Figure 9 is an axial view through both left and right temporomandibular joints. The view clearly shows the discrepancy in dimension between the right and left condyle. There is marked asymmetry in the mediolateral and antero-

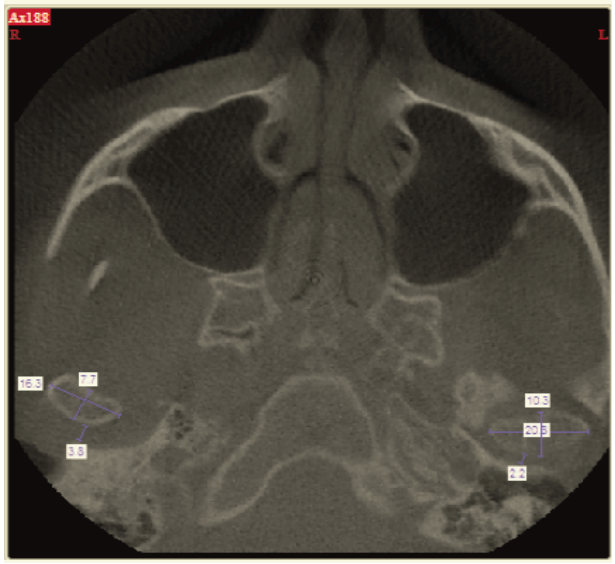

Fig. 9: Axial view through the maximum width of the temporomandibular joints.

posterior dimensions of the condylar heads. The dimensions of the medial aspect of joint spaces when compared are significantly different.

Cone beam CT has definitively diagnosed a case of symptomatic unilateral right sided condylar hypoplasia in a 14-year old secondary to mandibular trauma in early childhood.

A subsequent referral was made to an oral and maxillofacial surgeon for further management.

DISCUSSION

This case demonstrates the importance of undertaking a thorough radiological and orthodontic assessment of all patients and highlights the need to consider alternative, advanced imaging techniques. There was a suspicion based on the clinical assessment that the condylar heads required further investigation. The status of the mixed dentition was evaluated using a DPT but it was unable to show the precise osseous morphology and contour of the mandibular condyles. Additionally, this plain film radiographic view was unable to show the true lengths and mediolateral widths of the condyles, the size of the posterior and medial joint spaces and slope of the articular eminence. A definitive diagnosis of unilateral condylar hypoplasia could not be arrived at based on DPT radiography alone.

In keeping with the current CBCT guidelines and selection criteria developed from the SEDENTEXCT project [2008−2011] (6), a project supported by The Seventh Framework Programme of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2007 to 2011), CBCT was used to accurately arrive at a diagnosis for this patient.

The condylar region is one of the most difficult areas to detect fractures, especially for many clinicians who are inex-

perienced at interpreting mandibular fractures. The failure to recognize the presence of a condylar fracture, especially in children may lead to late complications including facial deformity and TMJ ankylosis. Although there was no real evidence on the DPT of juvenile degenerative joint disease in this case, juvenile idiopathic arthritis (JIA) is a chronic inflammatory disease of unknown aetiology that starts before the age of 16 years. We must keep in mind that early degenerative changes cannot be detected on a DPT (4).

Acquired condylar hypoplasia is due to an interference of the growth process within the articular cartilage (1). The articular cartilage is avascular and is dependent upon the diffusion of nutrients through the synovial fluid. Mandibular trauma, as reported by the patient highlighted in this case report, can cause intra-articular haemorrhage, which often induces synovial hypertrophy and acute synovitis. This may cause the synovial fluid volume to increase, which pushes the capsule against the subsynovial capillary network, restraining the blood flow to the joint and thereby decreasing the oxygen tension within the synovial fluid. Depression of cellular synthesis then follows (7). The severity of condylar hypoplasia is related to the growth phase of the condyle (before birth until approximately age 25 years). Condylar growth is most active during the earlier years and disturbances during these years will produce more pronounced condylar hypoplasia.

The diminished condylar growth in this case has produced a facial deformity characterized by shortness of the mandibular body, unilateral fullness of the face, and deviation of the chin to the affected side. On the contralateral side, the body of the mandible is elongated and the face appears flattened. The degree of mandibular and facial deformity relates to the severity of the hypoplasia and the age at which it occurred. The diagnosis in this case was based on the history of progressive facial deformity during the growth period, and CBCT radiographic evidence of condylar deformity.

If the condition is recognized during the growth period, replacement of the condyle with a costochondral graft may be indicated (8). In adults, either shortening of the normal side or lengthening of the abnormal side by orthognathic surgery and distraction osteogenesis is aesthetically and functionally corrective. Prior orthodontic therapy is often necessary to establish a normal occlusion. For this reason, this patient has begun orthodontic treatment.

Panoramic radiographs should be used with caution in making absolute measurements or relative comparisons of anatomic structures (9). It is not the gold standard for the investigation of TMJ morphology. Advanced imaging techniques like CBCT must be considered in the investigation of the osseous morphology of the temporomandibular joint.

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