CASE REPORT

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Post-traumatic condylar hyperplasia and temporomandibular joint ankylosis in a single patient: a case report based on cone beam computed tomography images

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ABSTRACT

Objectives: This case report aims to provide information about post-traumatic condylar hyperplasia and temporomandibular joint ankylosis, and its features on CBCT imaging.

Case Report: A 16-year-old female patient visited the Radiology Installation of RSGM Universitas Padjadjaran with a referral for CBCT TMJ scan, prompted by a chief complaint of restricted mouth opening. The patient had a history of a traffic accident two years prior, resulting in multiple facial fractures that were treated through several surgical interventions. CBCT images showed morphological irregularities and enlargement of both right and left condyles, glenoid fossae, and articular eminences. Moreover, the development of fibrous tissue was observed within the joint space, accompanied by bone fusion.

Conclusion: Condylar hyperplasia and temporomandibular joint ankylosis are pathological conditions that can arise as a consequence of trauma to the facial region. This case highlights the importance of radiological evaluation in identifying morphological alterations of the temporomandibular joint complex, such as condylar enlargement, joint space obliteration, and fibrous or bony fusion. These conditions significantly impact the function of the stomatognathic system, emphasizing the necessity for prompt intervention. Early recognition of these radiographic features is essential to support accurate diagnosis, guide appropriate clinical management, and prevent further deterioration of mandibular function.

Keywords: *Temporomandibular joint ankylosis, condylar hyperplasia, cone beam computed tomography (CBCT)*
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INTRODUCTION

The mandibular condyle, in conjunction with the glenoid fossa and accompanying soft tissue elements such as joint ligaments, capsule, disc, and masticatory muscles, comprises the Temporomandibular Joint (TMJ) complex.[1] Bilateral joints, dentition, occlusal loading, and masticatory muscles function synchronously to maintain a healthy stomatognathic system. Disruption of any component within this integrated system can negatively impact TMJ.[2]

Hyperplasia of the condylar process of the mandible is an uncommon pathological condition, leading to excessive enlargement around the condylar head and neck region, which typically results in substantial functional impairments and aesthetic facial deformities. Condylar hyperplasia typically presents unilaterally and occurs more commonly in individuals between the ages of 11 and 30 years, with a male to female ratio of 2:1.[3–5]

TMJ ankylosis refers to the bony fusion between the mandibular condylar head and the base of the skull, which results in a restricted range of motion or complete immobility of the temporomandibular joint, limiting the opening of the mouth.[6–8] TMJ ankylosis is typically present in children under 10 years old, with a male-to-female ratio of 1:1.[5,8,9] Individuals with TMJ ankylosis commonly experience a significant deterioration in their quality of life. This is largely attributed to the deformation of their facial features and the impairment of jaw function, which subsequently impacts their speech, mastication, deglutition, oral hygiene, and occlusion. Furthermore, the acute compromise of their airway exacerbates the overall detrimental effects on their general health.[2,9–11]

The most common etiological factor of condylar hyperplasia and TMJ ankylosis is associated with trauma. Post-traumatic TMJ ankylosis can be attributed to various causal factors, including the fibrotic organization of hematoma with subsequent ossification.[2,10] While the excessive bone regeneration observed following a traumatic event

elucidates the etiology of condylar hyperplasia.[3]

Various conventional imaging modalities have demonstrated differing levels of efficacy in assessing changes to the TMJ resulting from traumatic incidents, degenerative conditions, or anatomical abnormalities,[12,13] such as lateral and posteroanterior skull, panoramic, and transcranial radiographs. However, analyzing the structures of TMJ using these modalities presents significant challenges due to the overlapping nature of the relevant anatomical structures.[14] Cone beam computed tomography (CBCT) is one of the gold standards for precisely depicting preoperative ankylosing masses on TMJ and condylar hyperplasia.[12–14]

Radiographically, temporomandibular joint ankylosis is characterized by the loss of joint space between the mandibular condyle and articular fossa, appearing as a bony bridge connecting the condylar neck and temporal bone.[14,15] Meanwhile, CBCT images in cases of condylar hyperplasia show enlargement of the condylar head and neck in all three planes, accompanied by changes in the shape of the condyle and articular tubercle.[13] This case report aims to provide information about post-traumatic condylar hyperplasia and temporomandibular joint ankylosis, and its features on CBCT imaging.

CASE REPORT

A 16-year-old female patient visited the Radiology Installation of RSGM Universitas Padjadjaran with a referral for CBCT TMJ scan, prompted by a chief complaint of restricted mouth opening. The patient had a history of a traffic accident two years prior, resulting in multiple facial fractures that were treated through several surgical interventions.

Following multiple facial surgical interventions, the patient was subsequently directed to an Oral and Maxillofacial Surgeon for treatment of the temporomandibular joint, due to a reported limitation in mouth opening resulting from the accident.

Figure 1. Extraoral examination

Extraoral examination revealed facial asymmetry and limited mouth opening of approximately 5 mm (Fig. 1). Furthermore, the patient experienced pain during mouth opening. Intraoral examination confirmed a fracture involving the maxillary anterior teeth and displacement of the mandibular anterior teeth.

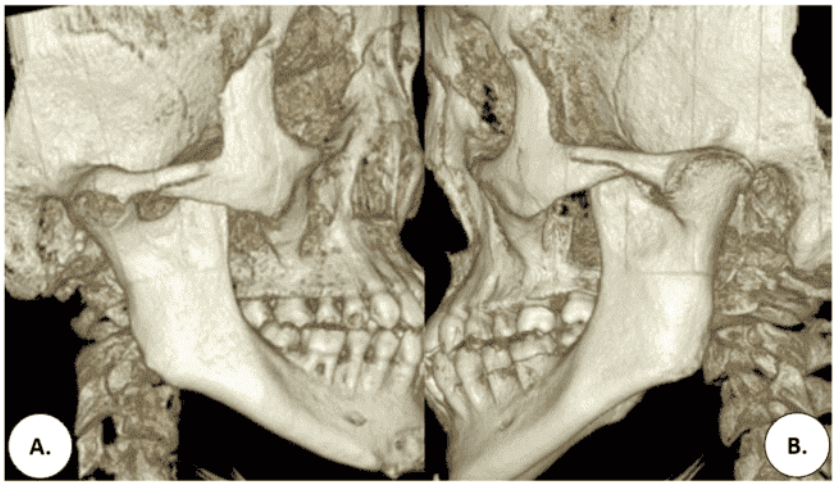

Figure 2. 3D reconstruction view during closed mouth position. **(A)** Right side, **(B)** Left side.

CBCT radiography was performed on patients using an Orthopantomograph® OP300, field of view (FOV) of 13x13, 66 kV, and 10.0 mA. 3D reconstruction view of CBCT images during closed mouth position revealed irregular morphology of the condyle, glenoid fossa, and articular eminence on both the right and left sides. It also showed enlargement and size differences between the right and left condylar heads (Fig. 2).

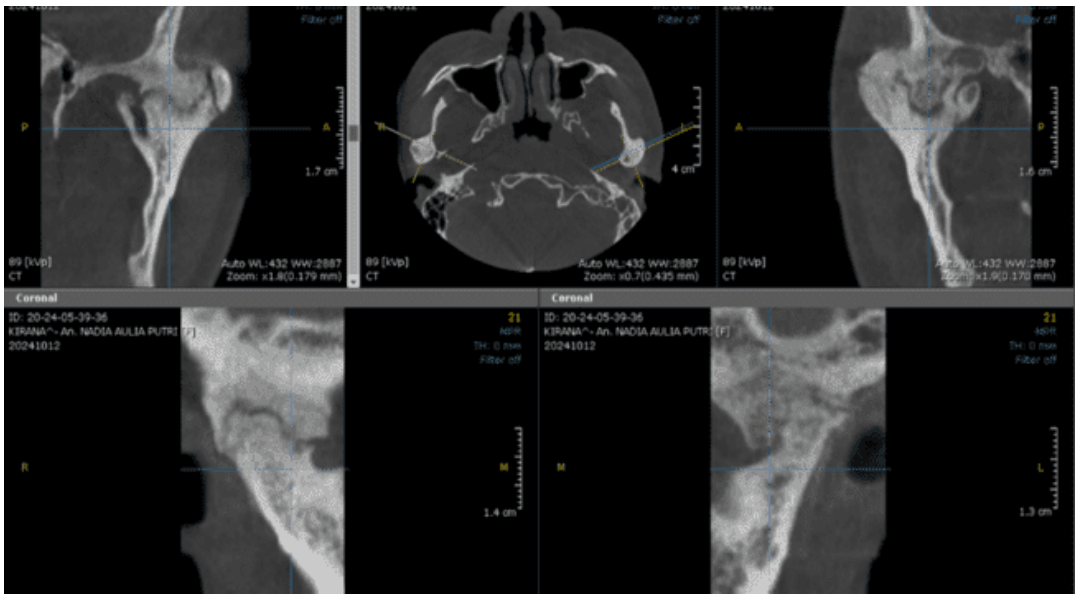

Figure 3. Bilateral TMJ CBCT images during closed mouth position

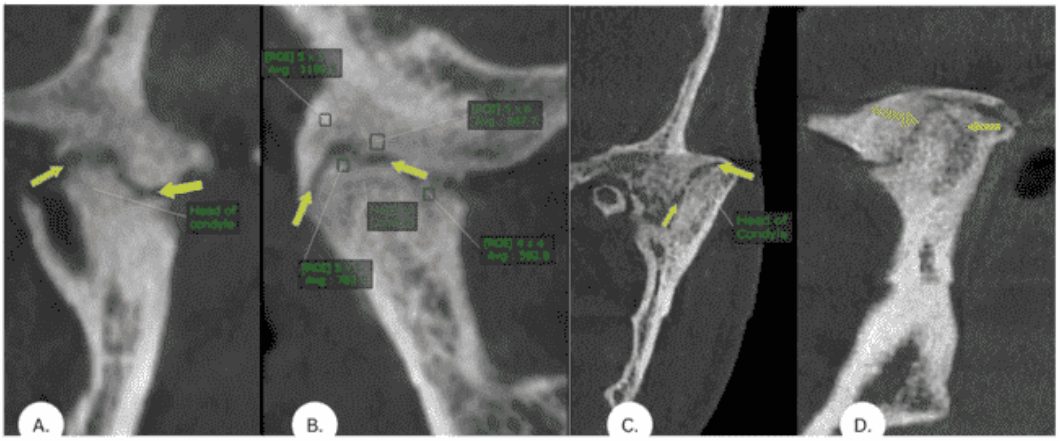

Figure 4. Cone beam computed tomography images during closed mouth position. **(A)** Coronal section of the right joint, **(B)** Sagittal section of the right joint, **(C)** Coronal section of the left joint, **(D)** Sagittal section of the left joint

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Morphological changes and enlargement of the temporomandibular joint complex were also evident in sagittal and coronal sections (Fig. 3-6). Yellow arrows indicated a narrowing of the joint space in both the anterior and posterior regions. Density evaluations revealed the formation of fibrous tissue within the joint space, accompanied by bone fusion between the articular eminence and condylar head on both the right and left sides (red arrow).

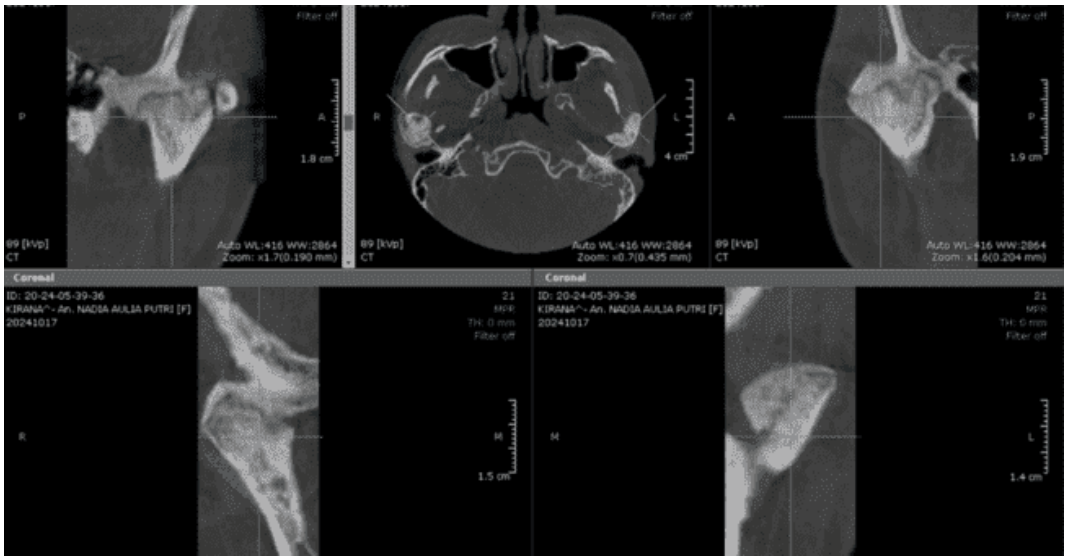

Figure 5. Bilateral TMJ CBCT images during opened mouth position

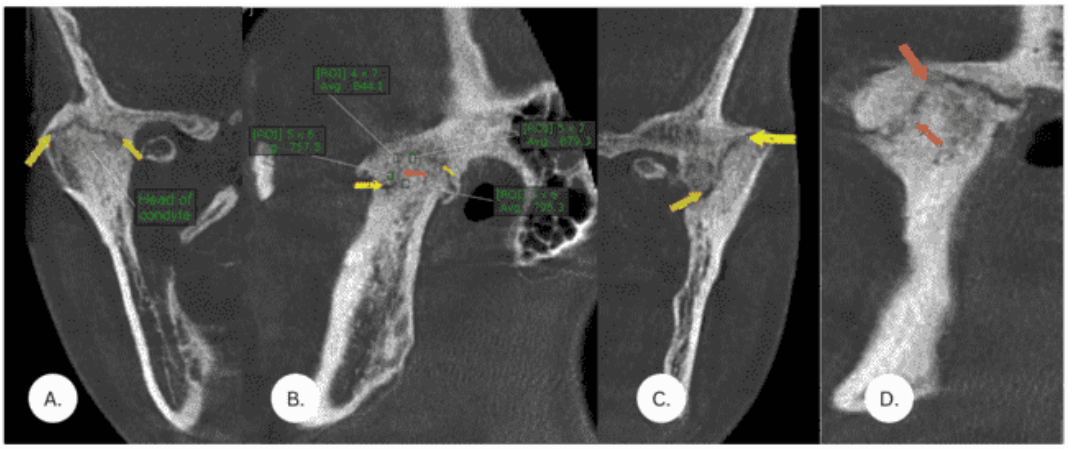

Figure 6. Cone beam computed tomography images during the open-mouth position. **(A)** Coronal section of the right joint, **(B)** Sagittal section of the right joint, **(C)** Coronal section of the left joint, **(D)** Sagittal section of the left joint

The CBCT scans obtained during the open-mouth position demonstrated no movement of the condylar head (Fig. 5,6). The condylar head, which should be located below the articular eminence, was instead positioned within the glenoid fossa, with a joint space width similar to that observed in the closed mouth position. Hence, the diagnosis of condylar hyperplasia and temporomandibular joint ankylosis was made for both the right and left sides.

DISCUSSION

Condylar hyperplasia is a gradually progressing idiopathic deformity characterized by progressive enlargement of the mandibular condyle, which can lead to secondary remodelling of the mandibular fossa to accommodate the abnormal condyle.[2,16,17] This condition is commonly observed in teenagers and young adults, typically occurring within the age range of 10 to 30 years.[2,17] The potential etiologic factors include hormonal effects, trauma, infectious agents, genetic predisposition, prenatal developmental influences, and hypervascularity.[16] The phenomenon may arise due to excessive or persistent cartilage production, resulting in increased thickness throughout the cartilaginous and pre-cartilaginous layers of the mandibular condyle.[16,17]

Although condylar hyperplasia frequently manifests unilaterally,[2] but the patient described in this case report was found to have bilateral condylar hyperplasia. This enlargement may provoke a range of symptoms, such as temporomandibular joint dysfunction and restricted or deviated mouth opening, which can subsequently impair mastication and speech production.[2–5,16,17]

Radiographic examinations of patients with condylar hyperplasia commonly demonstrate an increase in the overall size of the condyle, exhibiting

diverse condyle head morphologies (normal shape but enlarged, conical, spherical, elongated, lobulated, or irregular), enlargement of the glenoid fossa and articular eminence as a result of remodelling due to compensation of larger condylar head. Additionally, the increased bone volume can make the condylar head appear more radiopaque. However, the cortical thickness and trabecular pattern of the enlarged condyle are typically normal.[16,17]

Radiographically, Wolford et al. classified condylar hyperplasia into (Figure 7): Type (1), an increased vertical length of the condylar head and neck. In the coronal view, the crown of the condyle may be more rounded than a normal condyle; Type (2A) shows increased vertical height of the condylar head and neck; Type (2B) shows the exophytic growth from the head of the condyle. There is significant vertical growth and enlargement of the right mandibular condyle, neck, ramus, and body of the mandible.[18]

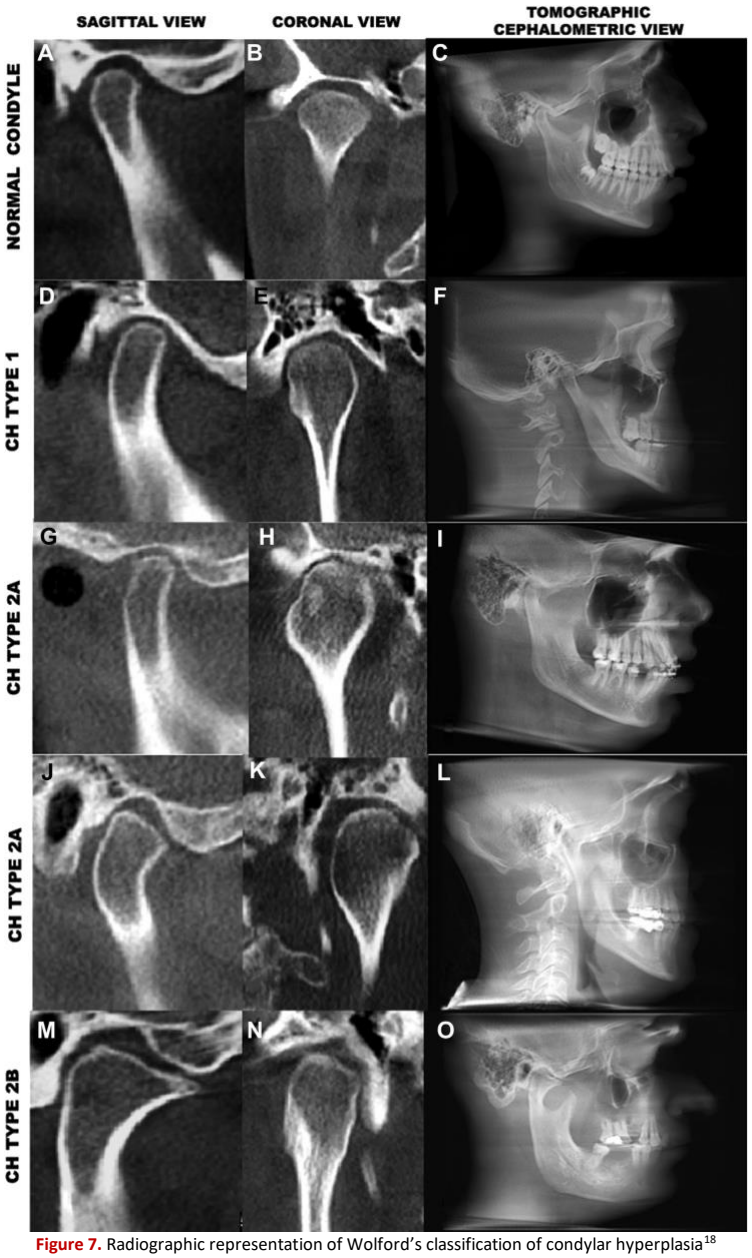

Figure 7. Radiographic representation of Wolford's classification of condylar hyperplasia[18]

Temporomandibular joint (TMJ) ankylosis is a pathological condition characterized by limited mobility of the mandibular condyle due to the formation of a fibrous or osseous fusion between the mandibular condyle and the temporal bone.[2,6–8,14] TMJ ankylosis is predominantly attributed to trauma (67.8%-85.7), followed by the development of localized infectious processes (17%-40%) or systemic medical conditions (10%), as well as instances arising from undetermined causes.[6,9,14,15] Road traffic accidents and falls are recognized as prominent contributors to the development of TMJ ankylosis in children, accounting for a documented 86% of cases.[9]

TMJ ankylosis occurring in early childhood can impede typical mandibular growth, culminating in progressive limitations in mandibular mobility, speech impairment, challenges with mastication,

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suboptimal oral hygiene, disruptions to facial and mandibular development, malocclusion, and potential acute airway compromise.[2,9–11,14,19]

The development of traumatic TMJ ankylosis is influenced by a combination of factors, including the patient's age, the severity of the initial injury, the specific pattern of the condylar fracture, the duration of joint immobilization, and the location of the displaced articular disc.[20] According to Perren's strain theory, strain tolerance of bone, cartilage, and fibrous tissue areas is a predisposing factor leading to TMJ ankylosis. Pathogenesis of bone formation following trauma is due to extravasation of blood into the joint space, called hemarthrosis.[2] This predisposes the joint to calcification, which can lead to a reduction in joint space. Furthermore, the initial fibrous tissue often undergoes consolidation or ossification, ultimately leading to a fusion of fibrous tissue or bone between the mandibular condylar head and the glenoid fossa.[2,7]

Patterns of TMJ ankylosis were determined according to the Topazian classification as follows: Stage (I) Ankylotic bone limited to the condylar process; Stage (II) Ankylotic bone extending to the sigmoid notch; and Stage (III) Ankylotic bone extending to the coronoid process.[2,9] The patient described in this case report was found to be in stage I for both the right and left condyles, as the damage was confined to the condylar region.

Meanwhile, Sawhney's classification of TMJ ankylosis based on radiographic findings is as follows (Figure 8): Type (I): Extensive fibrous adhesions around the joint. Condylar head is present without much distortion; Type (II) Bony fusion at the outer edge of the articular surface, but no fusion within the medial area of the joint. No involvement of sigmoid notch and coronoid process; Type (III) Bony bridge between the mandible and the zygomatic arch. Medially, an atrophic dislocated fragment of the former condyle head can be found. Elongation of the coronoid process; Type (IV) Complete osseous block between ramus and skull base. Normal TMJ anatomy is completely disrupted.[2,7] The present report belongs to type II, as it exhibits morphological changes on the condylar head and bony fusion in the anterior and posterior regions, without extension toward the sigmoid notch or coronoid process.

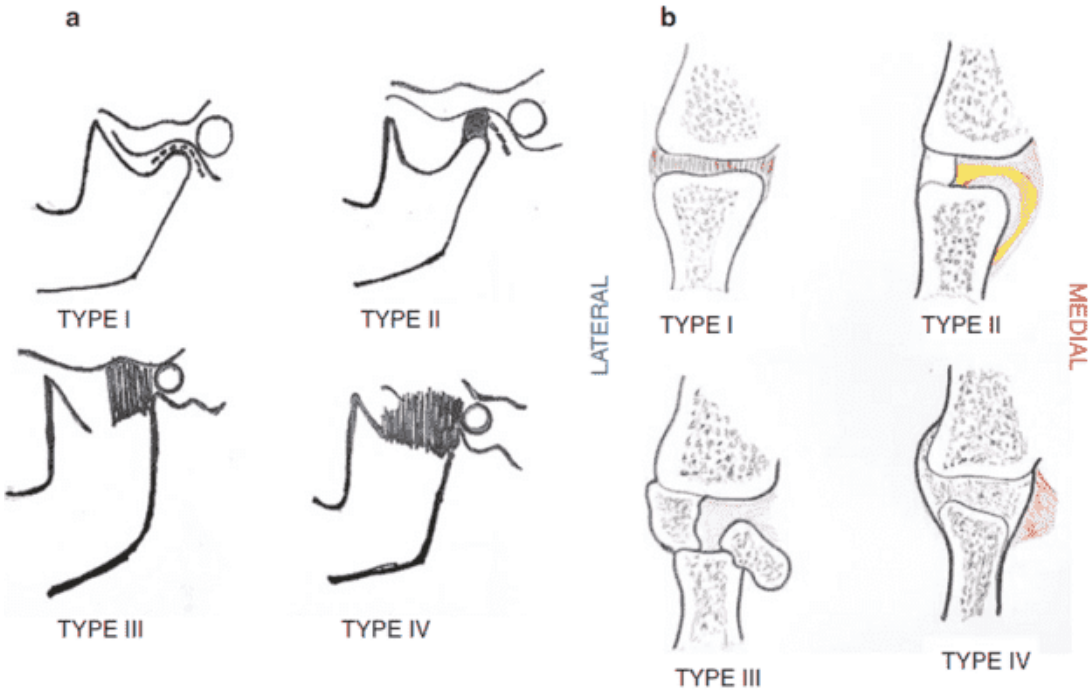

Figure 8. Diagrammatic illustration of Sawhney's classification of TMJ ankylosis. (A) Lateral view, (B) Coronal or anteroposterior view.[2]

CONCLUSION

Condylar hyperplasia and temporomandibular joint ankylosis are pathological conditions that can arise as a consequence of trauma to the facial region. These conditions significantly impact the function of the stomatognathic system, emphasizing the necessity for prompt intervention. This case highlights the importance of radiological evaluation in identifying morphological alterations of the temporomandibular joint complex, such as condylar enlargement, joint space obliteration, and fibrous or bony fusion. Early recognition of these radiographic features is essential to support accurate diagnosis, guide appropriate clinical management, and prevent further deterioration of mandibular function.

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FOOTNOTES

All authors have no conflict of interest to declare for this article. Informed consent was obtained from the patient for being included in this case report.

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