CASE REPORT

Osteochondroma of condyle: case discussion and review of treatment modalities

Piyush Arora,¹ Shakti Singh Deora,² Shital Kiran,³ Seema Dinesh Bargale⁴

¹Department of Oral Pathology & Microbiology, Jodhpur Dental College and Hospital, Jodhpur, Rajasthan, India

²SN Medical College, MDM Hospital, Jodhpur, Rajasthan, India

³Department of Pedodontics & Preventive Dentistry, Karnavati School of Dentistry, Gandhinagar, Gujarat, India

⁴Department of Pedodontics & Preventive Dentistry, KM Shah Dental College & Hospital, Vadodara, Gujarat, India

Correspondence to

Dr Seema Dinesh Bargale,
drseemabargale@gmail.com

SUMMARY

Temporomandibular joint (TMJ) forms a synovial articulation between the condyle and the cranium. It is a complex joint and shows hinge and gliding movements. Unlike other articulating heads, condyle grows with intramembranous ossification. TMJ is subjected to excessive loads throughout life as it supports essential functions such as mastication, deglutition, speech and respiration. Traumatic, neoplastic or non-neoplastic pathologies sometimes necessitate joint replacement therapy. Osteochondroma is one such benign tumour originating from condyle which requires surgical replacement of condyle with prosthesis. Various replacement methods have been designed in the past. Alloplastic grafts have been successfully used in joint replacement surgeries like hip joint, knee joint, etc. This case discussion supports the use of titanium-made condylar prosthesis for long-term functional stability of TMJ.

BACKGROUND

Osteochondroma (OSCH) is a rare benign entity in orofacial region which presents as an exophytic growth of condyle, most frequently, and sometimes of coronoid process. Aetiological factors for OSCH include trauma, inflammation, irradiation, etc. Pathogenesis of OSCH is not clearly understood but theory proposed by Lichtenstein¹ is most accepted until today. Various treatment modalities of OSCH have been discussed in the literature. Partial or total condylectomy, vertical ramus osteotomy and adjuvant orthognathic surgery are possible modes of treatment depending on cosmetic defect. Reconstruction depends on case to case and can be performed by upward placement of sagittally or vertically split ramus, locally available bone graft with attached medial pterygoid muscle, costochondral graft or a custom-made titanium graft.²

CASE PRESENTATION

A 38-year-old man reported to a government hospital with chief symptom of inability to chew properly and clicking sound in the joint on mouth opening since 3 months. No significant medical and family history was noted. Clinical inspection revealed facial asymmetry and deviation of jaw on opening. Left side of face showed downward displacement of lower border of mandible (figure 1). Crepitus was heard on palpation in the left temporomandibular joint (TMJ) on opening and closing of jaw. An intraoral inspection revealed open bite on the left side and cross bite on the right side. Clinical features were indicative of

Figure 1 Clinical picture showing facial asymmetry with downward displacement of left mandibular border.

condylar hyperplasia, hemifacial hypertrophy or a benign tumour of condyle or coronoid.

INVESTIGATIONS

CT showed an irregular radio-opaque sessile mass growing from the medial surface of condyle below the zygomatic arch. Three-dimensional reconstruction of CT showed a tumour-like growth of hard tissue on the medial surface of the condyle involving neck also (figure 2). Radiographs were indicative of a benign tumour-like OSCH. Clinical features like painless and slow-growing entity supported with radiographic features of a disproportionately growing, non-invading, uniformly radio-opaque mass on the medial surface led to the provisional radiological diagnosis as OSCH.

DIFFERENTIAL DIAGNOSIS

Clinical differential diagnosis for OSCH of the condyle includes condylar hyperplasia and hemifacial hypertrophy. Radiological differential diagnoses are synovial chondromatosis, osteomas and chondromas of the condyle. Other lesions which may involve condyle are malignancies of connective tissue origin such as osteosarcoma and chondrosarcoma.

TREATMENT

Clinical features of a benign entity, supported with radiographs led to the conclusive diagnosis as OSCH. Condylectomy with alloplastic condylar prosthesis of titanium was planned. Custom-made titanium prosthesis with ramus extension was

CrossMark

To cite: Arora P, Deora SS, Kiran S, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-200759

Figure 2 (A) Three-dimensional CT showing a deformed condyle with bony exostosis from medial surface. (B) Coronal CT section showing a dense radiopaque proliferation of condyle in superomedial direction on the right side.

fabricated (figure 3). A deep preauricular incision was placed to expose condyle. Condylectomy was performed and the resected specimen was obtained with great difficulty due to its extension below the zygomatic arch. Reduction of articular eminence was performed to prevent dislocation of artificial condylar prosthesis. Intermaxillary fixation was performed to achieve and stabilise the desired occlusion. Submandibular incision was placed subsequently to expose ramus of mandible. Condylar prosthesis was placed and fixed with implant screws over ramus. Gross specimen received was 4 cm×4 cm×3 cm hard tissue of irregular shape which was sectioned and subjected to decalcification. H&E-stained sections revealed a thick hyalinised cap with lacunae and cells forming cancellous trabeculae in the centre. Cells within cap are immature chondroblasts (figure 4). Radiating trabeculae show basophilic cartilaginous core. This histological picture was diagnostic feature of OSCH.

Figure 3 Titanium condyle prosthesis with elongated arm and fixation screws.

OUTCOME AND FOLLOW-UP

The patient regained normal jaw related with correction of occlusion postsurgery. Open bite on the diseased side and cross bite on the right side of the face were corrected and facial symmetry was regained after the surgery. Prosthetic acceptance was reviewed, after fortnight which was found to be good. The titanium prosthesis articulated with glenoid fossa; therefore, the occlusion and normal movements of the jaw were restored.

DISCUSSION

OSCH is considered to be a benign neoplasm, arising in axial skeleton other than head and neck. In fact, it is considered the most frequently arising bone tumour in the axial skeleton.³ In head and neck region, condyles are involved most commonly, followed by the coronoid process. Clinical data available state that craniofacial OSCH are rare and accounts for less than 1% of all cases. OSCH shows a slight female predilection and arises more commonly on left side (1:1.4). The mean age of occurrence is 38.4 years.⁴

OSCH are bony exostoses which bud off from the surface of condyle. It may be a sessile or pedunculated mass attached to condyle. It may involve different surfaces of condyle and may grow in different directions with variable potential. Medial surface of condyle is most commonly involved. Tumour mass

Figure 4 Histopathological section showing thick reserve cell layer with hyperchromatic nuclei differentiating into chondroblasts (×100 magnification).

most frequently grows medially or superomedially. It may present with variable shapes such as oval, mushroom-like, florid or irregular lobulated mass. Tumour mass sometimes causes remodelling of bones in vicinity and displaces articular cartilage.⁵

Pathogenesis of OSCH of the head and neck is not clear due to lack of cases. Most suitable theory of pathogenesis is that pluripotent cells of periosteum have the potential to differentiate into osteoblasts and chondroblasts, but the initiating factor is still debatable. Though it arises in early ages but a hamartomatous pathogenesis is ruled out as all cases in the literature had unilateral presentation.² OSCH is the most common tumour of bone arising at sites with endochondral ossification-like metaphysis of the femur and tibia, but mandible and condyles show intramembranous ossification. A positive history of trauma associated with OSCH is well documented in the literature.⁴ Chronic irritation to TMJ due to inflammation or malocclusion could be either an aetiological cause or effect of disease process. Therapeutic irradiation in the head and neck region for an underlying condition is also associated with increased incidences of OSCH.⁶

Common clinical symptoms are pain, deformity, altered sensation and function in the form of facial asymmetry, TMJ pain, clicking sound or hypomobility of jaw. Other signs are malocclusion, joint crepitus on auscultation, muscle tenderness, deviated path of jaw opening, and rarely tinnitus, hearing loss and stenosis of external auditory canal are reported. Tumour mass proliferation leads to increase in ramus height on the affected side causing facial asymmetry, deviated path of opening and malocclusion. It usually causes open bite on the affected side and crossbite on the unaffected side.⁷ Tumour mass may displace cartilage cap of TMJ. Tumour mass sometimes proliferate medially underneath the zygomatic arch and may cause hypomobility of jaw. Posterior growth of mass may displace joint in forward direction causing severe malocclusion.

Histologically, a mature condyle is primarily composed of cancellous bone covered by a thin layer of hyaline cartilage. It is covered by a thin layer of undifferentiated cells which differentiate into chondroblasts on the inner surface. The central portion of the section shows cancellous bony trabeculae originating from cartilage. The marrow space is composed of fibrous and adipose tissue. Condyle in growth phase shows a dense layer of undifferentiated reserve cells in a homogenous connective tissue matrix. These cells show hyperchromatic nuclei. Reserve cells divide and differentiate into chondroblasts. The chondroblastic layer is thick and cellular.⁸

Histopathologically, OSCH presents as a hyperplastic cartilage with radiating trabeculae on the inner side (figure 4). Hyperplastic cartilaginous matrix shows lacunae with multiple chondroblasts, arranged in a haphazard manner unlike normal condyle in growth phase (figure 5). Cartilage is covered with an accentuated layer of darkly staining reserve cells (figure 4). Radiating trabeculae are immature and show haematoxyphilic chondroid masses with chondrocytes. These cancellous masses show different phases of ossification and maturation (figure 6). Osteoma shows striking histological similarity to OSCH. Differentiating features include absence of reserve cell layer and chondroblastic layer in osteoma. Osteoma shows a dense compact bony shell covered with periosteum. Bony trabeculae show intramembranous ossification unlike endochondral ossification in OSCH.⁹

OSCH is a benign tumour arising most commonly in condyle. It shows an outgrowth of bony mass most frequently in antero-medial or superomedial direction. They are to be differentiated

Figure 5 Histological section showing areas with multiple chondrocytes in lacunae and ossification in the surrounding matrix (×400 magnification).

from lesions involving condyles or TMJ complex. Condylar hyperplasia mimics OSCH clinically but radiologically condylar hyperplasia shows a proportionate growth of the involved condyle as a whole, with elongation of neck of condyle sometimes. OSCH, on other hand, shows an exophytic growth from condyle. Conventional radiographs can differentiate between OSCH and synovial chondromatosis as it presents with radiopaucities within joint space, but osteomas and chondromas of condyle are difficult to differentiate. Osteomas of condyle mimics OSCH most closely. They may grow as a sessile or pedunculated mass from condyle.⁹ Differentiation can be made on following points. Multiple radiopaque lesions in the jaws are indicative of osteomas. Osteomas are slow growing and present in much smaller size as compared with OSCH. MRI may be of help in differentiating tissues with varying radiodensities. MRI will show a uniform radiodensity of hard tissue in osteoma but variable densities in OSCH, depicting osseous and chondroid components. MRI will also demonstrate the thickness of cartilage cap in OSCH.

Other possible tumours arising at condyle are chondroblastoma, haemangioma, chondromyxoid fibroma and malignant tumours such as chondrosarcoma and osteosarcoma. Chondroblastoma is a predominantly radiolucent tumour with sclerotic borders and few scattered radiopacities inside. Osteoblastomas are solitary lesions which show expansion within marrow spaces.¹⁰ Malignant neoplasms such as osteosarcoma and chondrosarcoma are biologically very active tumours. Typical clinical features are pain, paraesthesia and swelling which is tender. They usually show rapid and extensive cortical expansion with loss of cortical integrity at places. Radiographic

Figure 6 Histological section showing different phases of ossification. Periphery is basophilic chondroid tissue and central is osseous tissue (×200 magnification).

features such as sunburst appearance and Codman's triangle are strongly associated with osteosarcomas and chondrosarcomas. Periosteal bone deposition pattern also indicates the pathological behaviour. A homogenous new cortex without lamellae formation is indicative of benign process while osteosarcoma shows perpendicular radiating spicules of dysplastic osteoid. Symmetric widening of periodontal ligament space is seen in osteosarcoma arising in tooth-bearing regions.¹¹ Clinical features and detailed history regarding symptoms and rate of growth of tumour may provide a clue to differentiate benign and malignant tumours but a representative surgical specimen should be obtained to rule out malignancy and arrive at definitive diagnosis.

Treatment is designed keeping in mind goals like restoration of form, function, preservation of vital structures in vicinity, prevention of recurrence and consent of patient after informing disease and possible outcomes of treatment. Treatment for OSCH varies from partial to total condylectomy, sometimes requiring adjuvant orthognathic correction.⁴ Conservative procedures are employed in cases where tumour involves the head of condyle but spares the neck of condyle.⁷ Other factors to be considered are the amount of condylar head involved and type of attachment of tumour to condyle.¹² Improper case selection for partial/conservative condylectomies can lead to recurrence of lesion or rarely malignant transformation. Also, conservative osteotomy may require additional occlusal and gnathic asymmetry corrections which include orthodontic treatment and selective osteotomies for facial asymmetry corrections.⁷ Total condylectomy creates necessity of reconstruction. Reconstruction of condyle can be performed in different ways. Use of costochondral grafts is advocated for its easy host acceptance and cost-effectiveness, but such an autograft is non-vascularised and requires long-duration immobility, thus chances of failure are high. Donor site morbidity is also a point of concern in such cases. Reports of pneumothorax secondary to costochondral graft retrieval have been discussed in the literature. A possibility of ankylosis of autograft at TMJ also prevails.¹³

Second treatment modality is advocated for the use of a vascularised autograft along with prevention of second surgical procedure. The technique is known as vertical ramus osteotomy. Use of pedicled bone graft with muscle attachment has its said advantages but few limitations also. It requires extensive planning and case selection using high-end radiographic techniques. A limited height correction can be obtained after condylectomy. Injudicious use of this technique may cause injury to inferior alveolar nerves and vessels, inadequate height of reconstructed condyle or a displaced condyle from fossa. This may ultimately lead to secondary orthognathic and masticatory disorders.¹⁴

Third method of reconstruction is use of alloplastic grafts. Allografts commonly used are custom-made titanium or stock prosthesis. These prostheses are based on principle of osseointegration. Osseointegration means direct incorporation of graft into bone similar to primary healing of fracture.¹⁰ Titanium-made allografts have high acceptance and better results. Replacement of condyle along with neck eliminates the attachment of lateral pterygoid and temporalis muscles, thus reducing functional load on prosthesis. Long-term results depend on surgeon's implantation technique, maintenance of asepsis and postoperative immobility for the required period of time.¹³ Micromotion of graft provides space for fibrous tissue growth at graft–bone interface causing failure of implant screw.¹⁵

Most important point of concern in use of allograft is case selection. Younger adults have shown higher failure rate. Patients with parafunctional disorders deliver excessive load

over prosthesis causing failure. Prostheses are not recommended in growing age as they do not have the potential to grow. Patients with systemic conditions like diabetes or joint degenerative disorders are a criterion for case rejection.¹⁶

Advancement in surgical techniques has introduced another novel facility of use of endoscope for minimally invasive surgery. Endoscope-assisted surgery allows intraoral approach with small incision for access which prevents vital structures in vicinity like facial nerve and parotid duct. It also allows access to tumour on medial surface and healing is uneventful without a facial scar, but the traditional approach of preauricular incision provides clear direct access for surgical manoeuvre and prevents coronoidectomy which is essential in intraoral approach to condyle. Loss of muscle attachment on medial surface is prevented in extraoral approach.¹⁷

Condylar replacement in cases with OSCH can be performed in different ways. Use of alloplastic condylar prosthesis may have few limitations but proper case selection followed by aseptic surgery keeping in mind the fundamental kinetics of TMJ may show excellent results.

Learning points

- ▶ Osteochondroma (OSCH) of condyle is a rare slow-growing benign tumour difficult to diagnose due to lack of knowledge of this rare entity.
- ▶ OSCH appears as a bony exostosis most commonly from the medial surface of condyle.
- ▶ CT and MRI scans reveal the location and mineralisation pattern helpful in diagnosis and treatment planning.
- ▶ Titanium allograft prostheses have high acceptance and long-term stability.

Contributors PA involved in the case diagnosis and manuscript preparation. SSD involved in the investigation and surgical part. SK involved in surgical part and manuscript preparation. SDB involved in diagnosis and manuscript preparation. All the authors approved the manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Lichtenstein L. *Bone tumors*. 5th edn. St Louis, MO: CV Mosby, 1977.
- 2 Holmlund AB, Gynther GW, Reinholt FP. Surgical treatment of osteochondroma of the mandibular condyle in the adult. A 5-year follow-up. *Int J Oral Maxillofac Surg* 2004;33:549–53.
- 3 Dahlin DC, Unni KK. *Bone tumours: general aspects and data on 8542 cases*. Springfield, IL: Thomas, 1986:18.
- 4 Roychoudhury A, Bhatt K, Yadav R, et al. Review of osteochondroma of mandibular condyle and report of a case series. *J Oral Maxillofac Surg* 2011;69:2815–23.
- 5 Meng Q, Chen S, Long X, et al. The clinical and radiographic characteristics of condylar osteochondroma. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012;114:e66–74.
- 6 De Melo WM, Pereira-Santos D, Sonoda CK, et al. Conservative condylectomy for management of osteochondroma of the mandibular condyle. *J Craniofac Surg* 2013;24:e209–11.
- 7 Wolford LM, Mehra P, Franco P. Use of conservative condylectomy for treatment of osteochondroma of the mandibular condyle. *J Oral Maxillofac Surg* 2002;60:262–8.
- 8 Eslami B, Behnia H, Javadi H, et al. Histopathologic comparison of normal and hyperplastic condyles. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003;96:711–17.
- 9 Kondoh T, Seto K, Kobayashi K. Osteoma of the mandibular condyle: report of a case with a review of the literature. *J Oral Maxillofac Surg* 1998;56:972–9.

- 10 Venturin JS, Shintaku WH, Shigeta Y, *et al.* Temporomandibular joint condylar abnormality: evaluation, treatment planning, and surgical approach. *J Oral Maxillofac Surg* 2010;68:1189–96.
- 11 Arora P, Rehman F, Girish KL, *et al.* Osteosarcoma of mandible: detailed radiographic assessment of a case. *Contemp Clin Dent* 2013;4:382–5.
- 12 Chen MJ, Yang C, Qiu YT, *et al.* Local resection of the mass to treat the osteochondroma of the mandibular condyle: indications and different methods with 38-case series. *Head Neck* 2013;36:273–9.
- 13 Mercuri LG. Condyle replacement after tumor resection: comparison of individual prefabricated titanium implants and costochondral grafts. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;108:153–5.
- 14 Yang X, Hu J, Zhu S, *et al.* Computer-assisted surgical planning and simulation for condylar reconstruction in patients with osteochondroma. *Br J Oral Maxillofac Surg* 2011;49:203–8.
- 15 Mercuri LG. Alloplastic temporomandibular joint replacement: rationale for the use of custom devices. *Int J Oral Maxillofac Surg* 2012;41:1033–40.
- 16 Mercuri LG, Anspach WE III. Principles for the revision of TMJ prostheses. *Int J Oral Maxillofac Surg* 2003;32:353–9.
- 17 Yu HB, Sun H, Li B, *et al.* Endoscope-assisted conservative condylectomy in the treatment of condylar osteochondroma through an intraoral approach. *Int J Oral Maxillofac Surg* 2013;42:1582–6.

Copyright 2014 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow