Subarticular, cystlike lesion associated with avascular necrosis of the mandibular condyle: a case report

Jie Lei, DDS,[a,b] Mu-Qing Liu, DDS,[a,b] Adrian U. Jin Yap, PhD, MSc, BDS, GradDip Psychotherapy, FAMS,[c,d,e] and Kai-Yuan Fu, DDS, PhD,[a,b] Beijing, Peoples Republic of China, and Singapore
Peking University, National University of Singapore, SIM University, and Alexandra Hospital and Jurong Medical Centre

Little is known about avascular necrosis of the mandibular condyle, which is necrosis of the epiphyseal or subarticular bone secondary to a diminished or disrupted blood supply in the absence of infection. We present a case of a large subarticular cystlike lesion that was found using cone-beam computed tomography (CBCT). There was an absence of osteoarthrosis, and the condylar articular surface was relatively intact. The patient's history, physical examination, and magnetic resonance images supported the diagnosis of avascular necrosis of the mandibular condyle. After 4 months of conservative therapy, new bone was observed in the cystlike marrow lesion, and a smooth articular surface was reestablished. Subarticular cystlike lesions without the collapse of the articular surface of mandibular condyles may be an early indicator of avascular necrosis. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;115:393-398)

Avascular necrosis (AVN), also known as ischemic necrosis or aseptic necrosis, has been defined as necrosis of the epiphyseal or subarticular bone secondary to a diminished or disrupted blood supply in the absence of infection.[1] The condition affects vulnerable areas such as long-bone epiphyses and usually involves femoral heads and hip joints.[1-3] Although radiographic diagnostic criteria for AVN of the femoral head varies, one specific sign is a demarcating sclerosis and radiolucency that presents as a cystlike lesion without collapse of the femoral head.[1,4]

Seven stages of radiological involvement are identifiable in hips affected with AVN. The stages (0 to VI) are based on the severity of the AVN and involvement of the articular surface.[5] In stage II, radiographs indicate radiolucent, cystlike lesions and sclerotic changes. Normal bone is sometimes demarcated from affected bone by a sclerotic border. In stage IV, flattening of the spherical contour of the femoral head arises from collapse of the necrotic segment compromising the articular cartilage. This frequently results in hip osteoarthritis and progression to stage VI for which there is advanced degeneration and loss of the cortical bony plate of the articular surface. This corresponds somewhat to the Ficat classifications for femoral head: no radiographic abnormality (stage I) to osteoarthritis (stage IV) with the presence of cystlike lesions occurring in stage II.[6] Cystlike lesions may thus be an early indication of AVN with the joint having a radiographic normal contour at this stage.

For the present case, we found (with cone-beam computed tomography [CBCT]) a relatively large, subarticular, cystlike lesion with normal mandibular condyle contours. There was no radiographic evidence of osteoarthrosis/collapse of the articular surface. After 4 months of conservative therapy, new bone was observed in the cystlike marrow lesion and a smooth articular surface was reestablished. Our diagnosis was AVN of the mandibular condyle. Treatment, as well as the differential diagnosis, are presented.

CASE REPORT

In April 2011, a 25-year-old woman presented to the Center for Temporomandibular Disorders and Orofacial Pain, Peking University School and Hospital of Stomatology. The woman complained of pain and of a deviated mandibular opening that had persisted for 2 months. She also reported painless, right temporomandibular joint (TMJ) clicking and for approximately 2 years intermittent closed-locks. Her maximal mouth opening was 31 mm. Mandibular opening was associated with moderate, right-TMJ pain on translation, and mandibular excursion to the left was limited. Head-and-neck examination revealed no evidence of adenopathy, paresthesia, or motor nerve deficiency. The patient's general medical/dental history was unremarkable, and there was no history of trauma, alcohol abuse, previous TMJ surgery, or previous steroid injection into the TMJ.

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[a]Center for TMD and Orofacial Pain, Peking University School and Hospital of Stomatology, Beijing, Peoples Republic of China.
[b]Department of Oral & Maxillofacial Radiology, Peking University School and Hospital of Stomatology, Beijing, Peoples Republic of China.
[c]Faculty of Dentistry, National University of Singapore, Singapore.
[d]School of Science and Technology, SIM University, Singapore.
[e]Alexandra Hospital and Jurong Medical Centre, Jurong Health Services, Singapore.
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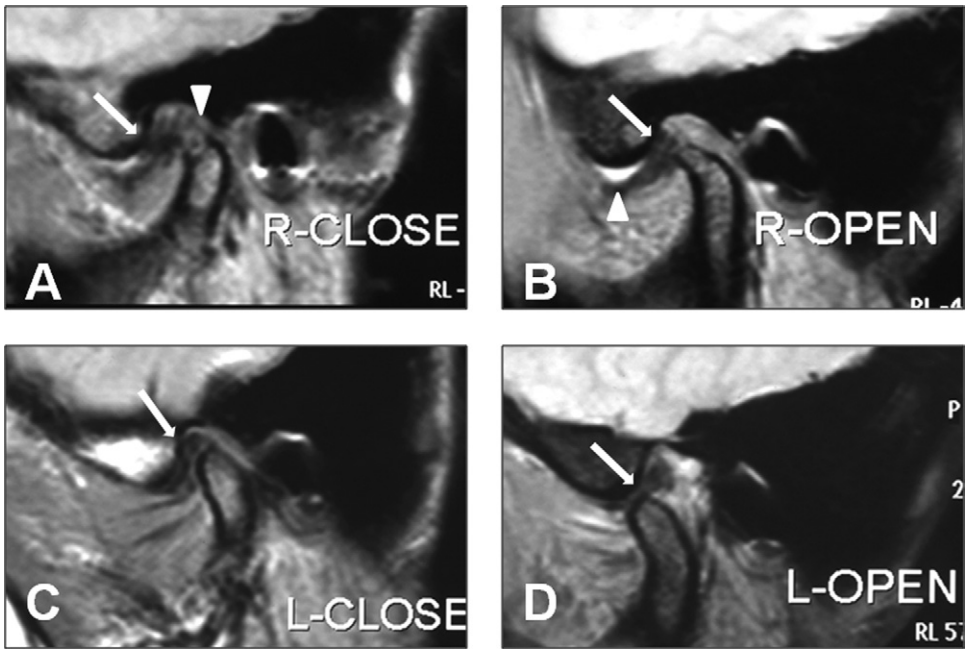

Fig. 1. MR proton-density-weighted images of the bilateral TMJs. **A,** Right TMJ in the closed-mouth position. The disk was anteriorly displaced (*arrow*) and the dark signal in condylar, articular, cortical bone was absent. A focal abnormal signal area in the subchondral region was observed with a low signal in the center. The round lesion was surrounded by a low-signal band demarcating a line with bone marrow of the condyle (*arrowhead*). **B,** Right TMJ in the opened-mouth position. The disk was still anteriorly displaced without reduction (*arrow*), and there was joint effusion in the upper compartment of the joint space (*arrowhead*). **C,** Left TMJ in the closed-mouth position;**D,** left TMJ in the opened-mouth position. Both show normal disk position (*arrow*) and condylar contours.

Magnetic resonance (MR) imaging (1.5 Tesla; Siemens Sonata, Erlangen, Germany) was performed in a local hospital. Proton-density (repetition time 3490 ms, echo time 17 ms) weighted images (3-mm thick, 16-cm field of view) formatted in oblique sagittal planes in both the closed- and open-mouth positions indicated anterior disk displacement without reduction in the right TMJ (Figure 1, *A* and *B*). The left TMJ was normal (Figure 1, *C* and *D*). A localized round abnormal area in the subarticular region (displaying intermediate signal intensity with a low signal in the center) was observed. The round lesion was surrounded by a low-signal band demarcating a line with the bone marrow of the condyle (Figure 1, *A*). As degenerative changes of the condyles were suspected, CBCT (3DX MultiImage micro CT; J. Morita Mfg Corp., Kyoto, Japan) of the bilateral TMJs was performed.

After scanning the TMJ, serial images (1.0-mm slice thickness and interval) of the condyle were axially, sagittally, and coronally reconstructed. All images were viewed digitally, and 2 typical images in axial, coronal, and sagittal sections were analyzed (Figure 2). CBCT images showed the bony structures, including the cortical bone on the articular surface, as well as the subcortical cancellous trabecular structure. A cystlike radiolucent lesion about 5.0 × 4.8 mm in size (coronal images) was detected under the articular surface of the right condyle. A demarcating sclerosis was seen around the cyst, and the overlying cortical bone was discontinuous (Figure 2, *A* and *B*). The contour of the affected condyle was, however, almost normal, and no other radiographic sign of osteoarthrosis was found. There was also no radiographic evidence of osteoarthrosis on the temporal side of the joint.

Based on all the information obtained and MR diagnostic criteria,[7,8] a diagnosis of AVN of the right mandibular condyle was made. The patient was treated by arthrocentesis,[9] using 0.9% saline under local anesthesia followed by pharmacotherapy with nonsteroidal anti-inflammatory drugs for a week. Physical therapy including laser therapy, home moist-heat treatment, and patient self-care instructions were given. Four months later, the patient re-visited our clinic and reported improvement of her jaw health with decreased joint pain, normal mandibular function, and a maximal mouth opening of 40 mm. Her follow-up CBCT indicated that the destructive changes of the condyle had almost resolved (Figure 3). A smooth articular surface was reestablished, and new bone formation was observed within the cystic lesion (Figure 3, *A* and *B*).

DISCUSSION

AVN of the mandibular condyle was first reported in 1979.[10] Subcortical radiolucencies in lateral tomograms were later confirmed by histologic examination as AVN.[10] CBCT images provide superior reliability and greater accuracy than tomography and panoramic projections in the detection of condylar bone.[11] CBCT

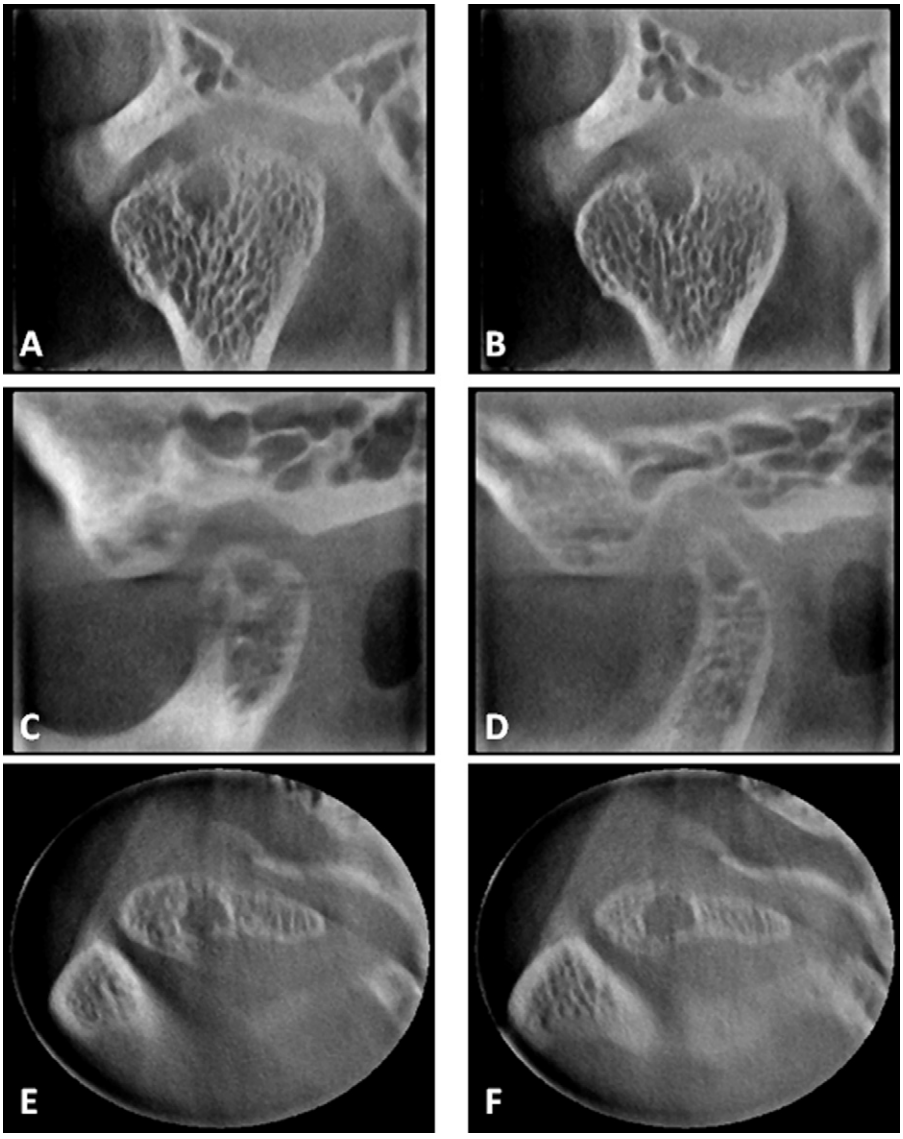

Fig. 2. April 2011, right-condyle CBCT images that indicate a cystlike, radiolucent, 5.0 × 4.8-mm lesion with the overlying cortical bone discontinuous but with normal condylar contours. **A** and **B,** Coronal sections; **C** and **D,** sagittal sections; **E** and **F,** axial sections.

could be a more sensitive radiographic technique for the early diagnosis of AVN of the mandibular condyle, which presents as a subcortical cystlike lesion with an intact cortical bony plate.[12] For the present case, CBCT images revealed a cystlike radiolucent lesion (within the cancellous bone) that was associated with a fairly intact articular surface, which had no osteoarthritic change. MR imaging revealed abnormal marrow signal density in the right TMJ. This further confirmed the diagnosis of AVN of the condylar head. As cystlike lesions are an early sign of AVN of the femoral head (before femoral-head collapse), cystlike lesions may also be an early sign of AVN of the mandibular condyle.[5,6]

The etiology of AVN is not clear, and little is known about factors that trigger it. In the present case, the disk was anteriorly displaced without reduction in the affected right TMJ. Joint effusion in the upper compartment of the joint cavity was also observed in the right TMJ, whereas the left was normal. This finding was consistent with the speculation that internal derangement (especially when advanced) in conjunction with joint effusion may be risk factors for AVN of the mandibular condyle.[7,8,13]

AVN has been suggested as a precursor to osteoarthrosis.[8,12,14] AVN of the mandibular condyle is an infrequent condition characterized by primary subarticular osseous breakdown of the condyle with second-

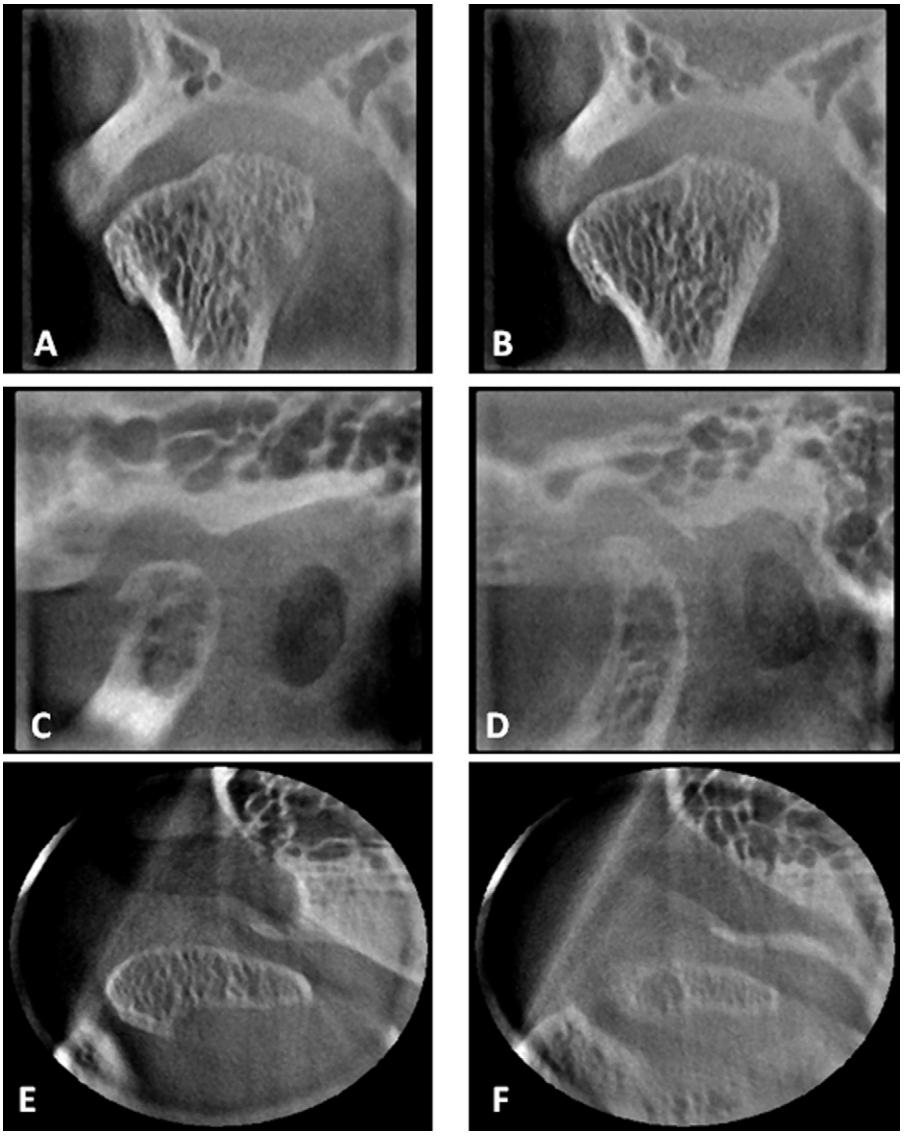

Fig. 3. August 2011, right-condyle CBCT images that show new bone deposition in the cystlike lesion and a smooth articular surface. **A** and **B,** Coronal sections; **C** and **D,** sagittal sections; **E** and **F,** axial sections.

ary articular surface collapse. When the articular surface collapses, it is impossible to differentiate AVN from advanced osteoarthrosis.[12,14] Osteoarthrosis is a noninflammatory, degenerative disease of moveable joints.[15,16] The process of the disease is characterized by degenerative changes, and it is universally recognized that articular cartilage deterioration is the first change in osteoarthrosis.[17,18] The radiographic characteristics of osteoarthrosis include erosion of cortical bony plate on the articular surfaces, sclerosis of the condyle (and/or articular eminence), flattening of the articular surfaces, osteophytes, and/or subchondral-bone, cystlike lesions.[15,19] Radiographic cystlike lesions have also been observed in joints, including the TMJ, with advanced osteoarthrosis. These subchondral-bone, cystlike lesions are, however, always accompanied by other radiographic signs of advanced osteoarthrosis, including severe joint deformation.[15-17,20-24] In the present case, the right mandibular condyle maintained its normal contour with no other radiographic evidence of osteoarthrosis. This supports the diagnosis of AVN rather than osteoarthrosis. Simple bone cysts may also have similar radiographic and MR manifestations.[25-28] They are, however, frequently located in the mandibular body or symphysis and seldom in the mandibular condyle. When located in the condyle, they present as relatively large lesions occupying the whole condyle.[25-28]

Management of AVN of the mandibular condyle with decompression corticotomy of the condyle has

been proposed.[29] It is widely accepted that corticotomy or core decompression may be beneficial in the early stages of AVN of the hip joint[13]; however, the treatment guidelines for hip joints cannot be directly applied to the TMJ for 3 reasons[13]: (1) the hip joint is a heavy weight-bearing joint, whereas the TMJ is a load-bearing joint with a load that is far less compared with that of the hip joint; (2) functions of the 2 joints are different with hyaline cartilage on the hip joint and fibrous cartilage on the TMJ; and (3) any treatment proposals for the TMJ require well-designed clinical trials and long-term follow-up before they can be routinely used in clinical practice. There is currently no accepted treatment protocol for AVN of the mandibular condyle. It is, however, suggested that once a diagnosis of AVN of the mandibular condyle is made that immediate unloading of the mandibular condyle be undertaken to alleviate condylar stress.[7] This and other conservative measures may help the joint repair itself in the early stages of AVN before irreversible joint deformity occurs.[30]

Early AVN with cystlike lesions adjacent to and directly under the articular surface of the femoral head are likely to collapse immediately after the onset of AVN and have a poor prognosis.[4] In the present case, physical therapy may have improved the blood supply. At any rate, the condition appeared to have been resolved after 4 months, as indicated by new bone formation in the cystlike marrow lesion and the presence of a smooth articular surface. The favorable outcome may also be attributed in part to patient education and self-care. Early diagnosis and proper management of AVN in young patients is particularly important, as prognosis is good owing to optimal general health and good repair capacity of the condyle.[31]

In summary, subarticular, cystlike lesions without collapse of the articular surface of mandibular condyle may be an early indicator of AVN, which can be detected using CBCT. Prognosis is considered good with appropriate conservative therapy.

REFERENCES

1. Sugano N, Atsumi T, Ohzono K, Kubo T, Hotokebuchi T, Takaoka K. The 2001 revised criteria for diagnosis, classification, and staging of idiopathic osteonecrosis of the femoral head. J Orthop Sci 2002;7:601-5.
2. Mulliken BD. Osteonecrosis of the femoral head: current concepts and controversies. Iowa Orthop J 1993;13:160-6.
3. Lafforgue P. Pathophysiology and natural history of avascular necrosis of bone. Joint Bone Spine 2006;73:500-7.
4. Ohzono K, Saito M, Takaoka K, Ono K, Saito S, Nishina T, Kadowaki T. Natural history of nontraumatic avascular necrosis of the femoral head. J Bone Joint Surg Br 1991;73:68-72.
5. Steinberg ME, Hayken GD, Steinberg DR. A quantitative system for staging avascular necrosis. J Bone Joint Surg Br 1995;77:34-41.
6. Ficat RP. Idiopathic bone necrosis of the femoral head. Early diagnosis and treatment. J Bone Joint Surg Br 1985;67:3-9.
7. Schellhas KP, Wilkes CH, Fritts HM, Omlie MR, Lagrotteria LB. MR of osteochondritis dissecans and avascular necrosis of the mandibular condyle. AJR Am J Roentgenol 1989;152:551-60.
8. Larheim TA, Westesson PL, Hicks DG, Eriksson L, Brown DA. Osteonecrosis of the temporomandibular joint: correlation of magnetic resonance imaging and histology. J Oral Maxillofac Surg 1999;57:888-98; discussion 899.
9. Guarda-Nardini L, Manfredini D, Ferronato G. Arthrocentesis of the temporomandibular joint: a proposal for a single-needle technique. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:483-6.
10. Reiskin AB. Aseptic necrosis of the mandibular condyle: a common problem? Quintessence Int Dent Dig 1979;10:85-9.
11. Honey OB, Scarfe WC, Hilgers MJ, Klueber K, Silveira AM, Haskell BS, Farman AG. Accuracy of cone-beam computed tomography imaging of the temporomandibular joint: comparisons with panoramic radiology and linear tomography. Am J Orthod Dentofacial Orthop 2007;132:429-38.
12. Fu KY, Li YW, Zhang ZK, Ma XC. Osteonecrosis of the mandibular condyle as a precursor to osteoarthrosis: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:e34-8.
13. Sano T, Westesson PL, Larheim TA, Takagi R. The association of temporomandibular joint pain with abnormal bone marrow in the mandibular condyle. J Oral Maxillofac Surg 2000;58:254-7; discussion 258-9.
14. Chuong R, Piper MA, Boland TJ. Osteonecrosis of the mandibular condyle. Pathophysiology and core decompression. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;79:539-45.
15. Zarb GA, Carlsson GE. Temporomandibular disorders: osteoarthritis. J Orofac Pain 1999;13:295-306.
16. Landells JW. The bone cysts of osteoarthritis. J Bone Joint Surg Br 1953;35-B:643-9.
17. de Leeuw R, Boering G, Stegenga B, de Bont LG. Radiographic signs of temporomandibular joint osteoarthrosis and internal derangement 30 years after nonsurgical treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;79:382-92.
18. De Bont LG, Boering G, Liem RS, Havinga P. Osteoarthritis of the temporomandibular joint: a light microscopic and scanning electron microscopic study of the articular cartilage of the mandibular condyle. J Oral Maxillofac Surg 1985;43:481-8.
19. Bullough PG, Bansal M. The differential diagnosis of geodes. Radiol Clin North Am 1988;26:1165-84.
20. Plewes LW. Osteoarthritis of the hip. Br J Surg 1940;27:682-95.
21. Link TM, Steinbach LS, Ghosh S, Ries M, Lu Y, Lane N, Majumdar S. Osteoarthritis: MR imaging findings in different stages of disease and correlation with clinical findings. Radiology 2003;226:373-81.
22. Rhaney K, Lamb DW. The cysts of osteoarthritis of the hip: a radiological and pathological study. J Bone Joint Surg Br 1955;37-B:663-75.
23. Milgram JW. Morphologic alterations of the subchondral bone in advanced degenerative arthritis. Clin Orthop Relat Res 1983;173:293-312.
24. Gu ZY, Fu KY, Zhang ZK, editors. Temporomandibular disorders. Beijing: People's Medical Publishing House; 2007. p. 131-3.
25. Hatakeyama D, Tamaoki N, Iida K, Yonemoto K, Kato K, Makita H, et al. Simple bone cyst of the mandibular condyle in a child: report of a case. J Oral Maxillofac Surg 2012;70:2118-23.

26. Warner BF, Luna MA, Robert Newland T. Temporomandibular joint neoplasms and pseudotumors. Adv Anat Pathol 2000;7: 365-81.
27. Saia G, Fusetti S, Emanuelli E, Ferronato G, Procopio O. Intraoral endoscopic enucleation of a solitary bone cyst of the mandibular condyle. Int J Oral Maxillofac Surg 2012;41:317-20.
28. Tanaka H, Westesson PL, Emmings FG, Marashi AH. Simple bone cyst of the mandibular condyle: report a case. J Oral Maxillofac Surg 1996;54:1454-8.
29. Chuong R, Piper MA. Avascular necrosis of the mandibular condyle-pathogenesis and concepts of management. Oral Surg Oral Med Oral Pathol 1993;75:428-32.
30. Baykul T, Aydin MA, Nasir S. Avascular necrosis of the mandibular condyle causing fibrous ankylosis of the temporomandibular joint in sickle cell anemia. J Craniofac Surg 2004;15:1052-6.
31. Liu MQ, Chen HM, Yap AU, Fu KY. Condylar remodeling accompanying splint therapy: a cone-beam computerized tomography study of patients with temporomandibular joint disk displacement. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2012;114:259-65.

Reprint requests:

Kai-Yuan Fu, DDS, PhD
Center for TMD and Orofacial Pain
Department of Oral & Maxillofacial Radiology
Peking University School and Hospital of Stomatology
Beijing 100081, P. R. China
kqkyfu@bjmu.edu.cn