

## Longitudinal MRI follow-up of rheumatoid arthritis in the temporomandibular joint: importance of synovial proliferation as an early-stage sign

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**Abstract** This article describes longitudinal magnetic resonance imaging (MRI) observations in a patient with rheumatoid arthritis of the temporomandibular joint. The characteristic findings included marked synovial proliferation, which was observed before the onset of severe bone destruction. MRI is considered to provide valuable information for the early detection of rheumatoid arthritis of the temporomandibular joint.

**Keywords** Rheumatoid arthritis · Temporomandibular joint · MRI

### Introduction

Rheumatoid arthritis (RA) in the temporomandibular joint (TMJ) generally presents with clinical symptoms such as TMJ pain and limited mouth opening, and shows severe bone destruction of the condyle and articular fossa on MR images. Although the MRI findings of RA in the TMJ have been extensively covered in the literature, their changes over a period of time have not been reported. We report the results of longitudinal MRI observations in a patient clinically diagnosed with RA of the TMJ.

### Case report

A 33-year-old male visited Tokyo Medical and Dental University Dental Hospital in January 2005 with a chief complaint of bilateral TMJ pain. He had no particular previous or family history. He had first noticed slight pain and sounds in the right TMJ when opening his mouth at 1 month before visiting our hospital, and these symptoms subsequently spread to the TMJ on both sides. The maximum interincisal opening distance at the initial visit was 40 mm.

Over a 2-year period following the initial visit, the patient underwent four MRI examinations: at the initial visit, and at 1, 1.5, and 2 years after the initial visit. During this period, the patient did not experience any symptoms except for those in the TMJ. The initial disease diagnosis was osteoarthritis of the TMJ, and splint therapy was performed. Tests for the presence of RA antibodies were negative until the third MRI examination. However, the patient was referred to the Rheumatology Department after the second MRI examination, where the diagnosis of RA was obtained and pharmacotherapy for RA was started.

All the MR images were obtained using a 1.5-T superconducting system (Magnetom Vision; Siemens, Erlangen, Germany) with a 3-inch-diameter bilateral TMJ surface coil. At every examination, sagittal and coronal proton density-weighted images [relaxation time (TR)/echo time (TE) = 1,000/20 and 960/15, respectively] and sagittal T2-weighted images (TR/TE = 2,931/96) were obtained with a slice thickness of 3 mm. At the second MRI examination, axial and coronal T1-weighted images after intravenous administration of 0.2 ml/kg body weight of contrast medium (TR/TE = 690/14) were also obtained with a slice thickness of 3 mm.

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At the first MRI examination on the initial visit (Fig. 1), slight erosion of the cortical bone of both condyles was observed, but no marked deformity was noted. The articular disk showed a normal position in the right TMJ and anterior displacement in the left TMJ. Joint effusion was observed in the joint space of the TMJ on both sides. On coronal images, characteristic synovial proliferation was observed on both sides. At the second MRI examination at 1 year after the initial visit (Fig. 2), marked destruction of the condyle and articular fossa was noted in the TMJ on both sides. On T2-weighted images, the condylar process including the condyle and articular fossa on both sides showed a high signal intensity, suggesting bone marrow edema. Such high signal intensity was also observed in the surrounding soft tissue. On coronal images, marked synovial proliferation, which showed homogeneous contrast enhancement, was observed in the TMJ on both sides. On the third and fourth MRI examinations, bone destruction was confirmed to have progressed on both sides. In particular, at the fourth MRI examination at 2 years after the initial visit (Fig. 3), the normal structure of the right condyle had almost disappeared. Motion artifacts were identified on MR images in the second, third, and fourth examinations because of jaw instability caused by severe bone destruction of the condyle.

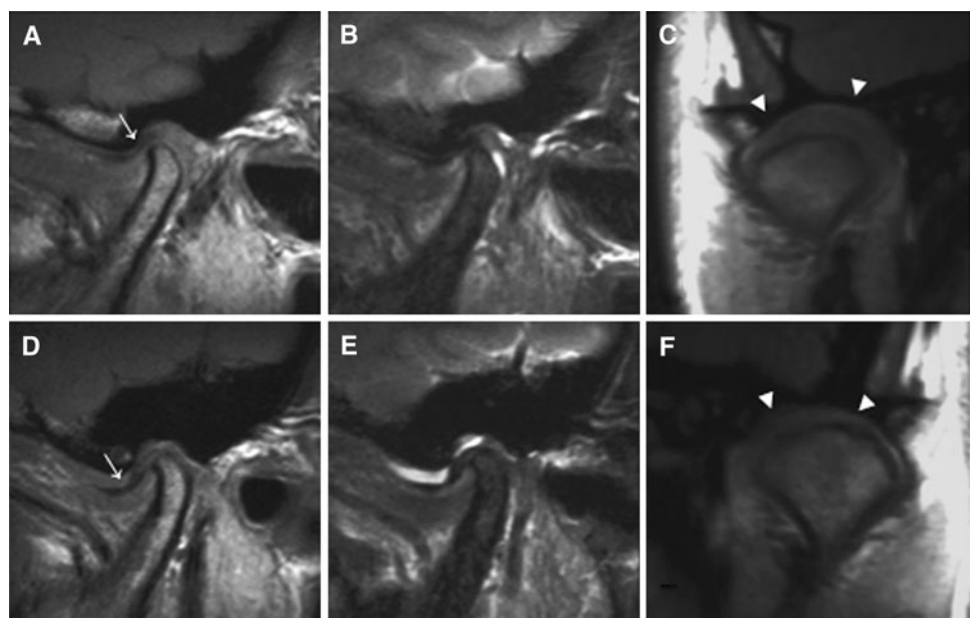
## Discussion

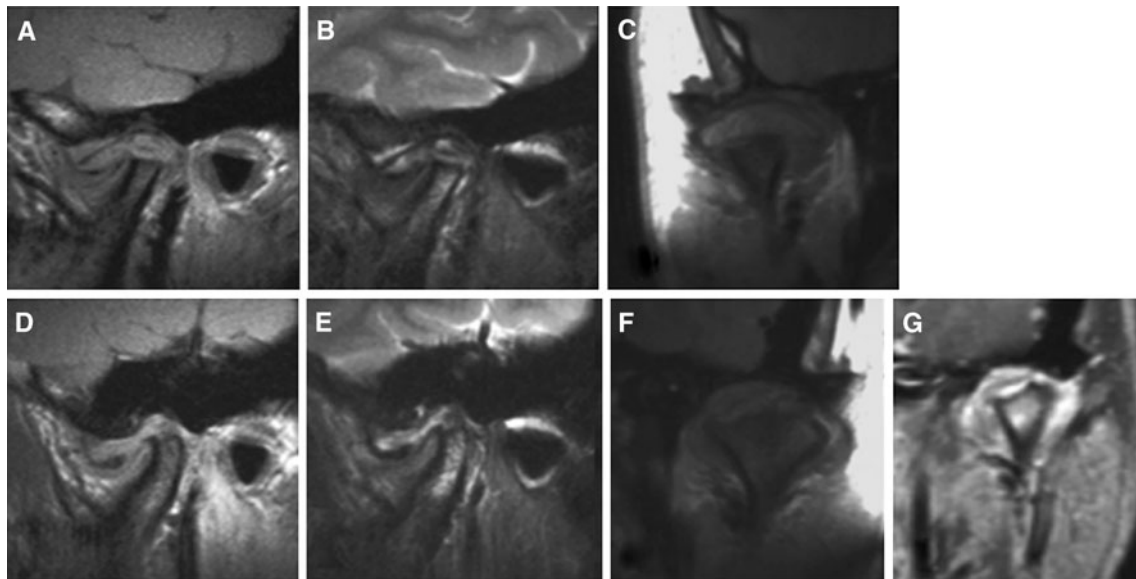
MRI has been widely used in the diagnosis of RA [1–3]. The characteristic MRI findings of RA include marked bone deformity, joint effusion, and pannus [4–8]. Although

similar findings can be seen in RA of the TMJ [1], this is the first study to report the changes in MRI findings over a period of time in a patient with RA of the TMJ. Only slight erosion of the condyle was observed at the first MRI examination. However, it rapidly changed to severe bone destruction of the condyle and articular fossa on both sides in 1 year. Furthermore, the bone destruction progressed, and the normal configuration of the right condyle had almost completely disappeared at 2 years. Generally, bone destruction is known to occur within several years of the onset of RA. The results of the present study may indicate that rapid bone destruction in the early stage of the disease is also common in RA of the TMJ.

Another characteristic finding observed in this patient with RA of the TMJ was marked synovial proliferation, which was observed from the initial visit. On post-contrast MR images, marked enhancement was observed in the synovium and condyle. Many studies have reported that synovitis and pannus can be observed in RA [4, 6, 8]. However, few studies have reported synovial proliferation in RA of the TMJ. One exception is a study by Suenaga et al. [9], who reported that synovial proliferation was observed in 59% of patients with painful RA of the TMJ. On the other hand, Matsumura et al. [10] reported that synovial proliferation might be observed in patients with temporomandibular disorder (TMD), but was quite uncommon and only seen in TMJs exhibiting strong inflammation. The synovial proliferation in RA of the TMJ may be more frequent and more severe than that in TMD. Furthermore, our study clearly showed that the synovial proliferation was present prior to the onset of the severe bone destruction. Therefore, we consider that synovial

**Fig. 1** MR images of the TMJ at the initial visit. **a–c** Right TMJ, **d–f** left TMJ. **a, d** Sagittal proton density-weighted images; **b, e** sagittal T2-weighted images; **c, f** coronal proton density-weighted images. The sagittal MR images revealed slight erosion of the condyle and joint effusion in the joint space of the TMJ on both sides. The coronal proton density-weighted images clearly revealed synovial proliferation (*arrowheads*) on both sides (**c, f**). The disk (*arrows*) was in a normal position in the right TMJ (**a**) and showed anterior displacement in the left TMJ (**d**)

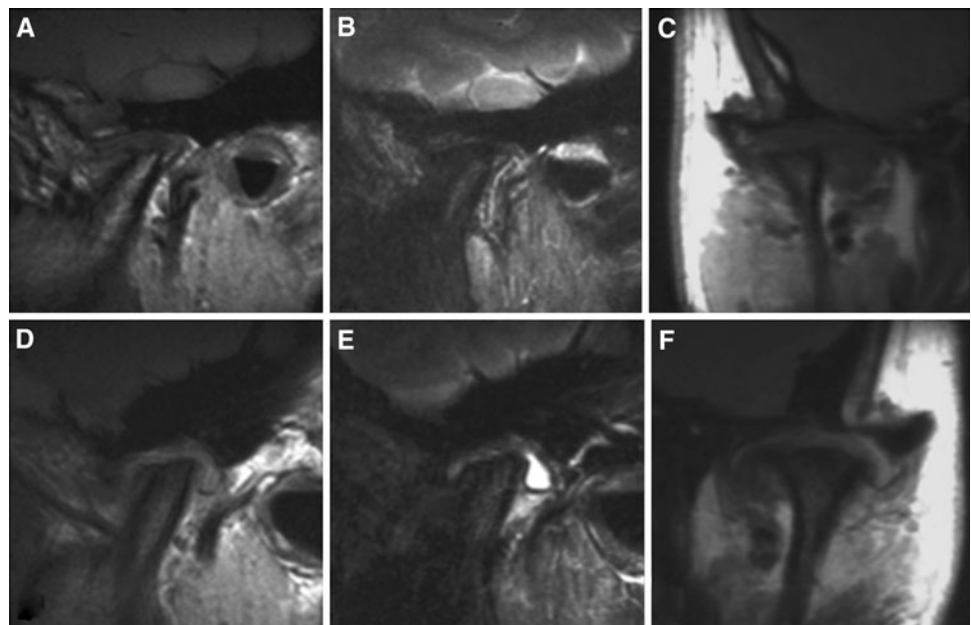




**Fig. 2** MR images of the TMJ at 1 year after the initial visit. **a–c** Right TMJ, **d–f** left TMJ. **a, d** Sagittal proton density-weighted images; **b, e** sagittal T2-weighted images; **c, f** coronal proton density-weighted images of the right TMJ; **g** post-contrast coronal T1-weighted image of the left TMJ. The sagittal MR images revealed marked deformity of the condyle and articular fossa on both sides. An

abnormal signal intensity of the condyle was also noted on the sagittal T2-weighted images (**b, e**). The coronal proton density-weighted images revealed marked synovial proliferation with bone destruction of the condyle (**c, f**). On the post-contrast image (**g**), the synovium and condyle showed strong enhancement

**Fig. 3** MR images of the TMJ at 2 years after the initial visit. **a–c** Right TMJ; **d–f** left TMJ. **a, d** Sagittal proton density-weighted images; **b, e** sagittal T2-weighted images; **c, f** coronal proton density-weighted images. Compared with the findings at 1 year after the initial visit (Fig. 2), the bone destruction of the condyle had progressed on both sides. The synovial proliferation had also become more marked (**c, f**)



proliferation may be an important finding for detecting RA of the TMJ in its early stage. Further clinical studies are required to confirm this hypothesis.

As described above, we routinely obtain sagittal and coronal proton density-weighted and sagittal T2-weighted MR images for diagnosing diseases of the TMJ. In the present case, we also obtained contrast-enhanced T1-weighted images, which clearly showed the proliferating

synovium with strong enhancement. However, we consider that contrast enhancement is not routinely necessary for RA of the TMJ, because non-contrast-enhanced MR images obtained using the TMJ surface coil usually have sufficient resolution to allow assessment of the synovial proliferation.

Regarding the treatment of RA, it is important to administer antirheumatic drugs, immunosuppressive agents, and/or biological products from an early stage. The timing of

the start of drug administration is known to influence the treatment effects [11]. In the early stage of onset, RA of the TMJ may show similar clinical symptoms to TMD, and it is considered important to be able to distinguish between these two conditions [12, 13]. Although MRI is not adopted in the diagnostic criteria for rheumatism of the American Rheumatism Association (1987), it can clearly reveal severe osseous changes and synovial proliferation, and is considered to provide valuable information for the early diagnosis of RA.

In conclusion, this is first report of the changes in MRI findings over a period of time in a patient with RA of the TMJ. We believe that MRI plays an important role in detecting RA of the TMJ in its early stage.

## References

- Smith HJ, Larheim TA, Aspestrand F. Rheumatic and nonrheumatic disease in the temporomandibular joint: gadolinium-enhanced MR imaging. *Radiology*. 1992;185:229–34.
- Poleksic L, Zdravkovic D, Jablanovic D, Watt I, Bacic G. Magnetic resonance imaging of bone destruction in rheumatoid arthritis: comparison with radiography. *Skeletal Radiol*. 1993;22:577–80.
- Sugimoto H, Takeda A, Masuyama J, Furuse M. Early-stage rheumatoid arthritis: diagnostic accuracy of MR imaging. *Radiology*. 1996;198:185–92.
- McGonagle D, Conaghan PG, O'Connor P, Gibbon W, Green M, Wakefield R, et al. The relationship between synovitis and bone changes in early untreated rheumatoid arthritis. *Arthritis Rheum*. 1999;42:1706–11.
- Nordahl S, Alstergren P, Eliasson S, Kopp S. Radiographic signs of bone destruction in the arthritic temporomandibular joint with special reference to markers of disease activity. A longitudinal study. *Rheumatology*. 2001;40:691–4.
- Narváez JA, Narváez J, Roca Y, Aguilera C. MR imaging assessment of clinical problems in rheumatoid arthritis. *Eur Radiol*. 2002;12:1819–28.
- Hermann KA, Backhaus M, Schneider U, Labs K, Loreck D, Zühlendorf S, et al. Rheumatoid arthritis of the shoulder joint: comparison of conventional radiology, ultrasound, and dynamic contrast-enhanced magnetic resonance imaging. *Arthritis Rheum*. 2003;48:3338–49.
- Ejbjerg B, Narvestad E, Rostrup E, Szkudlarek M, Jacobsen S, Thomsen HS, et al. Magnetic resonance imaging of wrist and finger joints in healthy subjects occasionally shows changes resembling erosions and synovitis as seen in rheumatoid arthritis. *Arthritis Rheum*. 2004;50:1097–106.
- Suenaga S, Ogura T, Matsuda T, Noikura T. Severity of synovium and bone marrow abnormalities of the temporomandibular joint in early rheumatoid arthritis: role of gadolinium-enhanced fat-suppressed T1-weighted spin echo MRI. *J Comput Assist Tomogr*. 2000;24:461–5.
- Matsumura Y, Nomura J, Murata T, Inui M, Nagai K, Yanase S, et al. Magnetic resonance imaging of synovial proliferation in temporomandibular disorders with pain. *J Comput Assist Tomogr*. 2004;28:73–9.
- Keystone E, Freundlich B, Schiff M, Li J, Hooper M. Patients with moderate rheumatoid arthritis (RA) achieve better disease activity states with etanercept treatment than patients with severe RA. *J Rheumatol*. 2009;36:522–31.
- Helenius LMJ, Tervahartiala P, Helenius I, Al-Sukhun J, Kivisaari L, Suuronen R, et al. Clinical, radiographic and MRI findings of the temporomandibular joint in patients with different rheumatic diseases. *Int J Oral Maxillofac Surg*. 2006;35:983–9.
- Bessa-Nogueira RV, Vasconcelos BC, Duarte AP, Góes PSA, Bezerra TP. Targeted assessment of the temporomandibular joint in patients with rheumatoid arthritis. *J Oral Maxillofac Surg*. 2008;66:1804–11.