Magnetic resonance imaging assessment of temporomandibular joint soft tissue injuries of intracapsular condylar fracture

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Abstract

We evaluated the soft tissue of the temporomandibular joint (TMJ) with magnetic resonance imaging (MRI) after intracapsular condylar fracture. Eighteen consecutive patients (19 TMJ) were diagnosed between 1 January 2010 and 30 October 2011. They were examined using bilateral sagittal and coronal MRI, which were obtained immediately after injury to assess the displacement of the disc, whether there was a tear in capsule or the retrodiscal tissue, and whether there was an effusion in the joint. On the affected side MRI showed disc displacement in 15 of 19, tears in the capsule in 9, and tears in the retrodiscal tissue in 16. All 19 had joint effusions. It also showed 2 joints with abnormalities on the unaffected side. We conclude that MRI is useful for diagnosis and for estimating the amount of damage to the TMJ, and is helpful in planning treatment.

Keywords: Condyle fracture; Temporomandibular joint; Magnetic resonance imaging

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Introduction

A fracture of the condyle of the temporomandibular joint (TMJ) has been described as the cause of severe changes in the soft tissue structures, and it can affect their functions. Anatomical reduction has been beneficial for the biomechanical function of the TMJ, and reduces the number of complications of open surgery. The degree and sites of soft tissue injuries as shown on MRI could provide detailed information when planning treatment. Several studies have characterised the damage to the soft tissues of the TMJ on MRI, including those to the disc, joint capsule, and retrodiscal tissues, and joint effusions, in patients with fractures of the condyle and subcondyle. We know of only one study that has reported the MRI findings in the soft tissue structures of the TMJ after intracapsular condylar fracture, and could find no paper that reported the extent of injury to the TMJ on the unaffected side. We have evaluated the soft tissue changes to the TMJ after intracapsular condylar fracture using MRI on the affected and unaffected sides.

Patients and methods

Patients

Eighteen patients (19 TMJ) who visited the clinic at the First Affiliated Hospital of WenZhou Medical College, from 1 January 2010 to 30 October 2011 with unilateral or bilateral intracapsular condylar fractures that had been confirmed on computed tomography (CT) were examined by MRI. There were 11 men and 7 women (mean age 30 years, range 17–66). The right side was involved in 10 patients, the left in 7, and both sides in 1. Informed consent was obtained from all patients after we had explained the purpose of the scan. There were no contraindications.

Inclusion criteria

All 18 patients (19 TMJ) met the following inclusion criteria: a unilateral or bilateral intracapsular condylar fracture; no other fractures of the mandible or dentoalveolar injuries; the fracture had occurred within 3–14 days, and the patient had no history of pain or dysfunction in the TMJ before the injury. The fractures were classified, based on the location of the fracture line. Type A was a fracture with displacement of the medial parts of the condyle but maintaining vertical mandibular dimensions; type B affected the lateral condyle with reduction in mandibular height; and type M included high extracapsular fracture dislocations. Any patients who were pregnant, or had a pacemaker, cerebral aneurysm clips, metal implants, neurostimulators, hearing aids, or shrapnel, were excluded.

MRI examination

The TMJ were examined using a 1.5 T MR machine of Excite–II supraconduction mode scanner (GE, USA). Both TMJ with the mouth both open and closed were examined with DUAL coil. The MRI scan followed this sequence: the transsection plane was scanned to find the long axis of the condyle; the sagittal plane was then aligned perpendicular to this long axis, as the coronal plane paralleled the long axis. An oblique sagittal MRI was taken with T1-weighted image (WI) and diffusion (PD)-weighted image fast spin-echo (FSE) sequences. Oblique coronal MRI with T1 and T2-weighted images and FSE sequences followed. The scanning variables of T1WI were FSE sequence: repetition time (TR), 440 ms; echo time (TE), 13.4/ef ms; number of excitations (NEX), 3. The variables of proton density weighted imaging (PDWI) were FSE sequence: TR, 2700 ms; TE, 13.4/ef ms; NEX, 3. The variables of T2WI were gradient echo (GRE) sequence: TR, 340 ms; TE, 15 ms; flip angle 20°; NEX, 3. A slice of 2 mm in thickness with a skip of 0 mm, a matrix of 256 × 160 pixels and field of view, 140 mm × 140 mm were used. At least one of the investigators was present at all MRI to ensure that the quality of the images was good, and the subjects were instructed to keep the teeth in proper contact during the closed-mouth examinations.

MRI evaluation

The normal disc position was defined using the location of the posterior band of the disc at the superior (12 o’clock) position relative to the top of the condyle in the glenoid fossa while in the closed-mouth position. On the T1 and T2 weighted images, capsular tears in the TMJ and tears in the retrodiscal tissue were defined by the presence of a dotted, high-signal area. The joint effusions were defined by a dotted, high-signal area on the diffusion weighted image, and the presence of a dotted, low-signal area on the T1 weighted image. Haemarthrosis was defined by the presence of a dotted, high-signal area on the T1 and diffusion weighted images. All MRI films were interpreted by a clinical specialist and a radiologist who were unaware of the clinical condition of the patient and who regularly evaluated injuries to the TMJ. Both judged the images separately and made similar evaluations. When they had different views, a third specialist evaluated the images.

Results

The 18 patients had 19 joints with intracapsular condylar fractures. Four joints were classified as type A fractures, 14 as type B fractures, and 1 as a type M fracture. Nineteen joints had the following soft tissue changes on MRI: disc displacement in 15/19 (Table 1), and the fractured condyle was also displaced in an antero-inferior direction (Fig. 1). Capsular tears were seen in 9/19 (Table 1), 6 of
Table 1  
Findings on magnetic resonance imaging (MRI) of the temporomandibular joints with intracapsular condylar fractures. Data are number of patients.

<table>
<thead>
<tr>
<th>Findings on MRI</th>
<th>No condylar fracture (n = 17)</th>
<th>Condylar fracture (n = 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc displacement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Capsule tear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Yes</td>
<td>–</td>
<td>9</td>
</tr>
<tr>
<td>Medial aspect</td>
<td>–</td>
<td>3</td>
</tr>
<tr>
<td>Lateral aspect</td>
<td>–</td>
<td>6</td>
</tr>
<tr>
<td>Retrodiscal tissue tear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Yes</td>
<td>–</td>
<td>16</td>
</tr>
<tr>
<td>Joint effusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17</td>
<td>–</td>
</tr>
<tr>
<td>Joint effusion</td>
<td>–</td>
<td>19</td>
</tr>
<tr>
<td>Superior joint cavity</td>
<td>–</td>
<td>19</td>
</tr>
<tr>
<td>Inferior joint cavity</td>
<td>–</td>
<td>8</td>
</tr>
<tr>
<td>Haemarthrosis</td>
<td>–</td>
<td>16</td>
</tr>
<tr>
<td>Condylar injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>–</td>
</tr>
<tr>
<td>Yes</td>
<td>1</td>
<td>19</td>
</tr>
</tbody>
</table>

which were on the lateral side of the joint capsule and 3 on the medial side (Fig. 2). An MRI diagnosis of tears in the retrodiscal tissue was established in 16/19 TMJ (Table 1; Fig. 3). Joint effusion was a common finding in fractured TMJ, 8 of which were at the inferior joint cavity and 19 at the superior cavity (Table 1). Haemarthrosis was seen in 16/19 TMJ (Table 1; Fig. 1). TMJ with intracapsular condylar fractures showed signs of condylar injury on MRI in all (Table 1). Two joints had abnormal signs on non-affected sides, including 1 displaced disc and 1 condylar injury (Table 1; Fig. 4).

Discussion

On the basis of the classification,6 4 were type A, 14 type B; and 1 type M. The intracapsular condylar fracture was caused by the external force to the condyle, the reaction of the joint nodules, the force from the lateral pterygoid muscle and the joint capsule and ligaments. We think that Neff’s is the most popular method for diagnosis and classification of such fractures.6

The amount of soft tissue injury around the TMJ in association with a condylar fracture is gradually being discussed in published papers.1–5,7,8 Li et al.8 acknowledged that damage to the disc and its attachment to the condylar head are...
important factors in the healing of condylar fractures. Zhang and He\textsuperscript{9} and Laskin\textsuperscript{10} discussed whether the displaced disc would play a critical part in early trauma-induced ankylosis of the TMJ. Chuong and Piper\textsuperscript{11} reported a technique of open reduction of condylar fractures and stated that the TMJ disc was predictably dislocated, which emphasised that the disc should be simultaneously repositioned and repaired using microsurgical techniques.

Takaku et al.\textsuperscript{5} suggested that the disc should be correctly repositioned so that it could function, and repositioning of fragments to avoid malposition or malfunction of the disc from a contracture of the damaged capsule and retrodiscal tissue. We think, therefore, that the severity of damage to the disc, capsule, and retrodiscal tissue could be detected using MRI before treatment. It is beneficial in providing additional information and setting up a treatment regimen within the clinic. We have shown that the changes in TMJ soft tissue were mainly the result of disc displacements, joint effusions, abnormal retrodiscal tissues, and joint capsules.

From an anatomical standpoint, the TMJ disc is between the glenoid fossa and the condyle, which can maintain the stability of the joint. The anterior or anteromedial displacement of the disc after injury to the TMJ has previously been reported.\textsuperscript{1,5,10} Our results have shown 15 patients had displaced discs on MRI. The disc was located superiorly to the fragment of the condyle and was anteriorly and inferiorly displaced relative to the remaining condyle,\textsuperscript{12} because the fragment was tightly pulled by the lateral pterygoid muscle.

The capsular tear also had a critical role in the soft tissue injury of the TMJ. Gerhard et al.\textsuperscript{13} reported that the capsular tear was found in 86% of all patients (type IV, V, or VI condylar fracture\textsuperscript{14}), and there was an important correlation between the degree of condylar injury and the capsular tear. Our study showed that only 9 of the intracapsular condylar fractures were associated with capsular tears seen on MRI. This is in accordance with results of other studies described by Takaku et al.\textsuperscript{5} and Sullivan et al.\textsuperscript{15} The lateral aspect of the capsule was affected more than the medial aspect. We thought that the force of the impact, traction from the lateral pterygoid muscle, and damage to the capsule by the bony spur, made it easier to tear the lateral capsule.

These results correspond with the reports of other investigators who described tears in retrodiscal tissue as a common finding on MRI in patients with condylar injuries, the reported figures ranging from 39% to 74%.\textsuperscript{2,5,15} Our figure was higher than that (16/19). The reported incidence of soft tissue injury to the TMJ varies among publications because different clinical and imaging criteria were used to diagnose such injuries. When the retrodiscal tissue was torn, the disc displaced more simply. There might be a parallel between severity of trauma and increased injury to the retrodiscal tissue.\textsuperscript{1}

Joint effusion after condylar fractures has been reported previously.\textsuperscript{1,5,14,16} These authors suggested that an effusion into the TMJ was reflected by bleeding into the joint cavity caused by damage to capsule and retrodiscal tissue.\textsuperscript{5} Takahashi et al.\textsuperscript{16} thought that MRI evidence of joint effusion might serve as a marker for the detection of severe intra-articular damage to the TMJ after a condylar fracture. Gerhard et al.\textsuperscript{13} reported that the finding of a significant relation between the degree of acute condylar injury and the MRI diagnosis of effusion could be compared with that of a previous report that the incidence of effusion in condylar fractures was significantly higher than when there was no condylar injury. Our results confirmed that joint effusions were present with most injuries to the TMJ, and haemarthrosis was found in 16 of 19. The superior joint cavity was affected in all cases, and the inferior in 8. This was similar to the previous report.\textsuperscript{3}

Most papers have ignored the condition of the unaffected side in unilateral condylar fractures of the TMJ before treatment, but we found that 2/19 had abnormal signs. We should therefore pay attention to the non-fractured sides when planning treatment and at follow-up for patients using MRI, to ascertain the problem early and treat it in a timely fashion.

We conclude that MRI can detect the changes in the soft tissue of the TMJ that accompany intracapsular condylar fractures and may affect the non-fractured side, which is important in the planning of treatment.

References


