Association of Temporomandibular Joint Pain According to Magnetic Resonance Imaging Findings in Temporomandibular Disorder Patients

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Purpose: This study investigated the associations between magnetic resonance imaging (MRI) findings and pain in the temporomandibular joint (TMJ).

Materials and Methods: The study included 646 TMJs of 323 consecutive patients with temporomandibular disorders; of these, 222 (34.4%) had TMJ pain whereas 424 (65.6%) had no TMJ pain. MRIs were used to evaluate disc position, osteoarthritis, joint fluid, and bone marrow edema. Internal derangement was classified as normal, anterior disc displacement with reduction, and anterior disc displacement without reduction (ADDWOR); condylar morphology was classified as normal, moderate bony change, and severe bony change. The odds ratio (OR) for each MRI variable for nonpainful versus painful TMJs was computed using logistic regression analysis.

Results: Compared with joints with normal disc position, the OR of those with ADDWOR was 2.74 ($P < .001$) for TMJ pain. Similarly, compared with joints with normal condylar morphology, the OR of those with severe bony change was 4.62 ($P = .02$) for TMJ pain. In addition, the risk of TMJ pain increased by 2.37 in joints with joint fluid ($P < .001$) and by 2.34 in joints with bone marrow edema ($P = .006$). The risk of TMJ pain increased significantly with ADDWOR in combination with severe bony change, joint fluid, and bone marrow edema.

Conclusions: These results suggest an association between TMJ pain and ADDWOR, severe bony change, joint fluid, and bone marrow edema. Thus, combining various MRI variables may improve the diagnostic accuracy of TMJ pain.

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Once disc displacement occurs, internal derangement (ID) almost certainly facilitates the progression of pathology, particularly the development of bony changes observed in the condyle. The pathologic changes, including those in the disc, have been well described by Wilkes and illustrate the progressive

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nature of the disease. A previous study reported that osteoarthritis (OA) of the temporomandibular joint (TMJ) is the progression of ID, particularly of anterior disc displacement (ADD) without reduction (ADD-WOR).2 Degenerative bony changes are characterized by deterioration of articular tissue with concomitant osseous changes in the condyle and articular eminence, such as osteophytes, erosion, subchondral cysts, and generalized sclerosis. Although such alterations are considered radiologic signs of OA, the clinical significance of these alterations is not fully clear. On the other hand, magnetic resonance imaging (MRI) findings of ID and OA have been substantially related to TMJ pain,3 but MRI characteristics of ID and OA have also been observed in asymptomatic TMJs.4-7 The lack of concordance between structural changes on MRI and TMJ pain raises questions about the validity of MRI in the diagnosis and management of temporomandibular disorder (TMD). Westesson and Brooks8 suggested that joint fluid represents an inflammatory response to a dysfunctional disc–condyle relationship. Several studies have reported a significant association between TMJ pain and joint fluid8-10; however, Adame et al11 reported that MRI evidence of joint fluid failed to correlate with TMJ pain and described joint fluid as being related to MRI findings of ID and OA. Larheim et al12 reported that the histologic findings of core biopsy specimens from the bone marrow of the mandibular condyle were correlated to preoperative MRI observations in patients undergoing surgery for painful IDs. Several authors have suggested an association between TMJ pain and bone marrow edema of the mandibular condyle.9,13 However, the etiology of bone marrow abnormalities in the mandibular condyle is still controversial.

Most previous studies have compared TMJ pain and MRI findings by using simple paired tests; however, the results were affected by multiple factors related to each comparator. Thus the purpose of this study was to investigate the relationship between TMJ pain and disc displacement, OA, joint fluid, and bone marrow edema, as well as to analyze MRI findings as a predisposing factor for TMJ pain.

Materials and Methods

PARTICIPANTS

The study included 646 TMJs in 323 patients who underwent MRI of the TMJ for TMD-related symptoms, such as TMJ pain and noise, among 595 patients with TMD who had been examined between January 2011 and December 2013 at the Department of Oral and Maxillofacial Surgery of Tokyo Medical and Dental University. Of these 323 patients, 25 had bilateral TMJ pain and 172 unilateral. Among the 646 joints of the 323 patients, 222 joints had TMJ pain with a frequent association with myalgia, clicking, or crepitus; 208 joints showed joint clicking or crepitus alone and were occasionally associated with myalgia; and 216 contralateral joints in the patients with unilateral clinical symptoms had no prior or present TMJ symptoms. All patients included in the study were clinically investigated according to the Diagnostic Criteria for Temporomandibular Disorders axis I protocol.14 The criteria for TMJ pain were reports of orofacial pain referred to the TMJ, with the presence of unilateral or bilateral TMJ pain during palpation, function, or unassisted or assisted mandibular opening. Patients with collagen vascular disease and patients with a history of trauma or TMJ surgery were excluded. Overall, 251 female and 72 male patients aged between 15 and 85 years (mean, 44.8 years) participated in the study. Among the 502 joints of the 251 female patients, 180 (35.9%) had TMJ pain, whereas 322 (64.1%) had no TMJ pain. Among the 144 joints of the 72 male patients, 42 (29.2%) had TMJ pain, whereas 102 (70.8%) showed no TMJ pain (Table 1).

This retrospective cross-sectional study complied with the principles laid down in the Declaration of Helsinki. Approval for this study was obtained from the Ethics Committee at the Faculty of Dentistry, Tokyo Medical and Dental University.

MAGNETIC RESONANCE IMAGING

MRI was acquired using a 1.5-T unit (Magnetom Vision; Siemens, Erlangen, Germany) with a 3-inch-diameter surface coil. In the oblique sagittal plane, proton density-weighted turbo spin-echo images were obtained in the closed- and open-mouth positions (repetition time [TR] of 1,000 milliseconds and echo time [TE] of 20 milliseconds and TR of 1,850 milliseconds and TE of 15 milliseconds, respectively), and T2-weighted turbo spin-echo images were obtained in the closed-mouth position (TR of

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<th>Table 1. AGE AND GENDER DISTRIBUTION IN 646 TMJS OF 323 PATIENTS</th>
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Note: P values were determined by use of the Mann-Whitney U test and χ² test.
Abbreviation: TMJs, temporomandibular joints.
* Median (25th, 75th percentile).

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