Characteristic MR Finding of Temporomandibular Disorders in Children

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Abstract

The purpose of this study was to evaluate the characteristic magnetic resonance (MR) finding of temporomandibular disorders (TMD) in children. Two hundred fifty-six temporomandibular joints (TMJs) in 130 patients less than 15 years of age of MR images of 1278 TMJs in 653 patients with disc displacement who underwent MR imaging for suspected TMD were studied retrospectively as children’s group. These MR images of children’s group were compared with those of adult’s group concerning disc displacement with or without reduction, joint effusion, and bony change. Logistic multivariate regression analysis demonstrated that reduction (odds ratio = 2.23, \( p = .0001 \)), joint effusion (odds ratio = 1.73, \( p = .0012 \)), and bony change (odds ratio = 2.44, \( p = .0003 \)) were significant variables. These results suggest that characteristic MR findings of TMD in children are disc displacement with reduction, without joint effusion, and without bony change.

Introduction

Temporomandibular disorders (TMD) are relatively uncommon in patients less than 15 years of age. Although the mandibular and temporal components of the temporomandibular joint (TMJ) are calcified by 6 months of age, complete calcification of cortical borders may not be completed until 20 years of age (1). As a result, radiographs of condyles in children may show little or no evidence of a cortical bonder. Bony changes involving the condyle and temporal bone often occur as sequel of disc displacement (2). Imaging evidence of bony change can be seen in teenagers with disc displacement without reduction (3).

Prevalence figures of TMD signs and symptoms reported in epidemiologic studies of children are lower than in adults (4). Most of the signs and symptoms have been characterized as mild and often fluctuating. TMJ clicking, one of the most frequent findings, has been discussed as a potentially severe symptom that may develop into TMJ locking, disc displacement, or bony change.

Much interest in epidemiologic research of TMD has focused on longitudinal studies in children and adolescents (5–8). The results from these investigations have shown that signs and symptoms of TMD in children are of low prevalence and are mostly of a mild character, that prevalence increases with age on a group basis from childhood to young adulthood, levels out in middle age, and decreases in older individuals.

Magnetic resonance (MR) imaging is frequently used in the region of the TMJ, particularly to examine disc position and configuration, posterior disc attachment, and bone marrow status, and to assess the presence of joint effusion (9–15). However, few studies have been concerned with the evaluation of characteristic MR finding of TMD in children. The purpose of this study was to evaluate the characteristic MR finding of TMD in children.

Materials and Methods

Subjects

Of MR images of 1278 TMJs in 653 patients (141 males, 512 females; age 6 to 78 years, mean age 29.1 years) with disc displacement who underwent MR imaging for suspected TMD in our hospital from January 2001 to January 2004, 256 TMJs in 130 patients less than 15 years of age (39 males, 91 females; age 6 to 14 years, mean age 11.5 years) were studied as children group, and 1022 TMJS in 523
patients (102 males, 421 females; age 15 to 78 years, mean age 33.7 years) were studied as adults group. The MR images with no abnormal finding in the TMJ were not included in the study. Then, patients with systemic conditions e.g. juvenile rheumatoid arthritis were not included in the study. Informed consent was received from all subjects.

**MR imaging**

MR imaging was performed with a 0.5-Tesla superconductive MR unit (Toshiba Flexart; Tokyo, Japan) with a surface coil for the TMJ. Imaging included proton-density-weighted sagittal imaging at the closed-mouth (repetition time (TR)/echo time (TE) 2000/20msec) and the respective maximum mouth-opening positions (TR/TE 1500/20 msec), and T2-weighted sagittal imaging at the closed-mouth (TR/TE 2000/100msec) position. T2-weighted imaging was performed with a double echo in proton-density-weighted imaging. Other parameters were as follows: field of view (FOV) 12.0×12.0cm, matrix size 192×256, and 1 acquisition. These MR images of children group were compared with those of adults group concerning disc displacement with or without reduction (3), with or without joint effusion (11), and with or without bony change (2), such as cartilage erosion and bone production. All images were independently evaluated by three oral radiologists. The examiners were blinded to the patients, and any differences were resolved by forced consensus.

**Statistical Analysis**

Statistical analyses for the comparison of MR finding of TMD, such as disc displacement with or without reduction, with or without joint effusion, and with or without bony change, between children group and adults group were performed using the \( \chi^2 \) test with Fisher’s exact test. The odds ratios for children group versus adults group were analyzed using logistic multivariate regression analysis in relation to MR findings, such as disc displacement with or without reduction, joint effusion, and bony change. These analyses were performed with the statistical package SPSS version 14.0 (SPSS Japan Inc., Tokyo, Japan). A probability level of .05 was considered statistically significant.

**Results**

Table 1 shows TMJs distribution in characteristics of MR finding of temporomandibular disorders. The incidence of disc displacement with reduction was significantly different between children (84.0%) and adults (59.7%) group \((p=.000)\). The incidence of without joint effusion was significantly different between children (75.8%) and adults (57.6%) group \((p=.000)\). The incidence of without bony change was significantly different between children (91.0%) and adults (73.7%) group \((p=.000)\). Logistic multivariate regression analysis demonstrated that reduction (odds ratio=2.23, \(p=.0001)\), joint effusion (odds ratio=1.73, \(p=.0012\)), and bony change (odds ratio=2.44, \(p=.0003\)) were significant variables (Table 2).

**Discussion**

MR imaging is the modality of choice for the assessment of internal derangement of the TMJ in patients with TMD (10). TMJ internal derangement describes an abnormal positional relationship between the articular disc and the

<table>
<thead>
<tr>
<th>Reduction With(%)</th>
<th>Reduction Without(%)</th>
<th>Joint effusion With(%)</th>
<th>Joint effusion Without(%)</th>
<th>Bony change With(%)</th>
<th>Bony change Without(%)</th>
<th>Total(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>215(84.0)</td>
<td>41(16.0)</td>
<td>62(24.2)</td>
<td>194(75.8)</td>
<td>23(9.0)</td>
<td>233(91.0)</td>
</tr>
<tr>
<td>Adults</td>
<td>595(59.7)</td>
<td>401(40.3)</td>
<td>422(42.4)</td>
<td>574(57.6)</td>
<td>262(26.3)</td>
<td>734(73.7)</td>
</tr>
<tr>
<td>Total</td>
<td>810(63.4)</td>
<td>442(36.6)</td>
<td>484(39.9)</td>
<td>768(60.1)</td>
<td>285(24.3)</td>
<td>967(75.7)</td>
</tr>
</tbody>
</table>

Table 2 Logistic multivariate regression analysis in characteristics of MR finding of temporomandibular disorders in children

<table>
<thead>
<tr>
<th></th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction</td>
<td>2.23</td>
<td>1.50–3.32</td>
<td>0.0001</td>
</tr>
<tr>
<td>Joint effusion</td>
<td>1.73</td>
<td>1.24–2.42</td>
<td>0.0012</td>
</tr>
<tr>
<td>Bony change</td>
<td>2.44</td>
<td>1.51–3.94</td>
<td>0.0003</td>
</tr>
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MR, magnetic resonance; TMJ, temporomandibular joint.
mandibular condyle and the articular eminence. The disorder has been associated with characteristic clinical findings such as pain, joint sounds, and irregular or deviating jaw function (16–18). Harms et al. (9) showed that disc displacement and arthrosis were the most common findings on MR images of the TMJ in patients with signs and symptoms of a TMJ disorder. Westesson et al. (11) indicated that joint effusion primarily occurred in joints with disc displacement. In this study, MR images of children group were compared with those of adults group concerning disc displacement with or without reduction, joint effusion, and bony change.

Bony change have been considered as an excessive remodeling process of the articular cartilage and the subchondral bone in synovial joints. Widmalm et al. (19) showed that TMJ arthrosis was more frequent in older than in younger persons. Ishibashi et al. (20) showed age-related changes in the normal human mandibular condyle. However,
Wiberg et al. (21) indicated that bony change of the TMJs was found in 66% of 131 patients ranging in age from 12 to 30 years. Westesson (2) showed that structural hard-tissue changes frequently occurred in TMJs displaying anterior disc displacement without reduction but seldom in joints showing displacement with reduction. In this study, the incidence of disc displacement with reduction was significantly different between children (84.0%) and adults (59.7%) group \( (p = .000) \). The incidence of bony change in the present study was significantly different between children (9.0%) and adults (26.3%) group \( (p = .000) \). We therefore consider that disc displacement with reduction is more frequent in children group than in adults group, and bony change is more frequent in adults group than in children group.

Juvenile rheumatoid arthritis is a chronic inflammatory involvement of the joint lining that has an onset before the age of 16 years (22). The disease occurs predominantly in girls, with a female-male ratio of 1.2 to 1.3, and it has two peaks of onset, one between the ages of 1 and 3 years and the other between the ages of 8 and 12 years. Although the early radiographic changes of juvenile rheumatoid arthritis of the TMJ may not be visible on a conventional radiograph, these changes can be detected on MRI, and include cortical bone erosion, disc thinning and perforation, reduction of the joint space, and pannus and effusion in the joint. However, patients with systemic conditions e.g. juvenile rheumatoid arthritis were not included in the study.

Joint effusion, which typically appears as a bright signal on T2-weighted MR images, has been recognized as a possible sign related to pain in patients with TMJ disorders (11). In the present study, the incidence of joint effusion was significantly different between children (24.2%) and adults (42.4%) group \( (p = .000) \). We therefore consider that joint effusion is more frequent in adults group than in children group.

Westesson et al. (11) indicated that joint effusions were seen more often in joints with more advanced stages of disc displacement (displacement without reduction) than in normal joints or in joints with earlier stage of disc displacement (displacement with reduction). Joint effusion probably represents an inflammatory response to the dysfunction of the displaced disc. Furthermore, Westesson et al. (11) also showed that the prevalence of joint effusion was lower in joints with arthrosis than in those with disc displacement. These results suggested that most effusions were seen before arthrosis developed. In this study, logistic multivariate regression analysis between children group and adults group demonstrated that reduction (odds ratio=2.23, \( p = .0001 \)), joint effusion (odds ratio=1.73, \( p = .0012 \)), and bony change (odds ratio=2.44, \( p = .0003 \)) were significant variables. These results suggest that characteristic MR findings of TMD in children are disc displacement with reduction, without joint effusion, and without bony change.

Much interest in epidemiologic research of TMD has focused on longitudinal studies in children and adolescents (5–8). The results from these investigations have shown that signs and symptoms of TMD in children are of low prevalence and are mostly of a mild character. Yamamoto et al. (23) showed a significant difference in the joint effusion between painful and nonpainful joints in the group of disc displacement without reduction. Ogura (15) indicated that TMJ pain was related to disc displacement without reduction and joint effusion on MR images. We consider that signs and symptoms of TMD in children may be of low prevalence and mostly of a mild character, because characteristic MR findings of TMJs in children are disc displacement with reduction, without joint effusion, and without bony change. Furthermore, the follow-up in these children is important for the future study.

The relationship between the dental occlusion and the function of the masticatory system has been of great interest for at least the past 50 years (24). During this time, the field of occlusion experienced explanatory shifts as the scientific and practicing communities strove to obtain a better match between clinical observations and theoretical predictions. Different types of functional malocclusion may be responsible for signs and symptoms of TMD on children, for example unilateral crossbite. This would be a nice approach to evaluate the relationship between the dental occlusion and TMD in children.

References

3. Westesson PL, Yamamoto M, Sano T, Okano T.


