Disc position and morphology in patients with nonreducing disc displacement treated by injection of sodium hyaluronate

Shuichi Sato 1, Maya Sakamoto 2, Hiroshi Kawamura 1, Katsutoshi Motegi 1
Departments of 1Oral and Maxillofacial Surgery, 2Oral Diagnosis and Radiology, Tohoku University School of Dentistry, Sendai, Japan

Abstract. Disc position and morphology were examined in 21 patients (22 joints) with nonreducing disc displacement of the temporomandibular joint (TMJ) at more than 12 months after undergoing injection of sodium hyaluronate into the superior joint space. The patients' clinical signs and symptoms improved during the follow-up period. In all patients, the disc was displaced anteriorly on mouth closure and did not reduce into the normal position during mouth opening at follow-up, whereas a normal disc position was found in all the controls. In the patients, the disc deviated from the normal biconcave configuration found in all of the controls on the follow-up magnetic resonance imaging (MRI). Disc displacement apparently is persistent and continued disc deformity common in patients, although the clinical signs and symptoms improved.

Key words: temporomandibular joint; disc displacement; sodium hyaluronate; disc position and morphology.

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Many treatment options have been suggested for the management of nonreducing disc displacement of the temporomandibular joint (TMJ) such as medication, physical therapy 9, occlusal splints with or without manual repositioning 2, 3, 4, surgery 12, 30, and arthrocentesis 13. However, it has been reported that injection of the superior joint space with sodium hyaluronate is effective 1, 11. In a previous study 21, this fact was confirmed. These studies, however, did not examine disc position and morphology in the subsequent period. The purpose of the present study was to examine the disc position and morphology of the articular disc in patients with nonreducing disc displacement who were treated by injection of the superior joint space with sodium hyaluronate.

Material and methods
This study was based on 21 patients (22 joints) (3 men and 19 women; mean age 33.6 years; range 17 to 74 years). Forty-five patients diagnosed as having nonreducing disc displacement of the TMJ underwent injection of sodium hyaluronate, and changes in their signs and symptoms were examined for at least 12 months. Twenty-one of the 45 patients

Table 1. Clinical findings

<table>
<thead>
<tr>
<th>Patients (n=21)</th>
<th>At beginning of this study</th>
<th>At follow-up</th>
<th>Controls (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs and symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of motion at maximal mouth opening (mm)</td>
<td>27.9±5.56</td>
<td>41.2±6.21</td>
<td>51.6±5.08</td>
</tr>
<tr>
<td>Protrusion (mm)</td>
<td>4.9±1.99</td>
<td>7.6±2.33</td>
<td>7.7±2.26</td>
</tr>
<tr>
<td>Lateral excursion to the affected side (mm)</td>
<td>7.0±2.35</td>
<td>8.0±2.05</td>
<td>9.0±2.32</td>
</tr>
<tr>
<td>Lateral excursion to the unaffected side (mm)</td>
<td>6.1±2.34</td>
<td>8.3±1.91</td>
<td>8.4±2.76</td>
</tr>
<tr>
<td>Patients with TMJ tenderness</td>
<td>19 (90.4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Patients with TMJ noise (crepitus)</td>
<td>3 (14.3)</td>
<td>3 (14.3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Patients with tenderness of masticatory muscles</td>
<td>2 (9.5)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>
| Per cent frequencies are shown in parentheses.
Patients agreed to have their affected TMJ examined by magnetic resonance imaging (MRI) at more than 12 months posttreatment and thus, 21 patients were enrolled in the study. Nonreducing disc displacement is clinically characterized by a history of clicking followed by limitation of opening ability without clicking. In all patients, nonreducing disc displacement was confirmed by arthrography at initial visit. After a 22-gauge needle was inserted into the superior joint space of the TMJ, 1 ml of 1% xylocaine was injected and withdrawn several times through the needle and 1 ml of sodium hyaluronate (Artrz®, Seikagaku Kogyo Co., Tokyo, Japan) was then injected following aspiration of most of the synovial fluid. This therapy was repeated once a week for five weeks. None of the patients with limited mouth opening had increased opening immediately after the last injection. The disc position and configuration were examined at a mean follow-up interval of 17.8 months (range 12 to 29 months), using MRI.

As a control, 30 joints in 15 persons (8 men and 7 women; mean age 29.3 years; range 24 to 47 years) who had no current or previous TMJ symptoms were studied. The disc position and configuration were examined only once using MRI. Clinical findings in patients and controls are shown in Table 1.

Axial images were first obtained to select the settings for sagittal imaging perpendicular to the long axis of the condyle. Sagittal images were obtained in the closed as well as in the open mouth position. The degree of mouth opening was fixed with a bite block, available in various sizes. All MRIs were performed with a 1.5 Tesla System (Magnetom Vision, Siemens-Asahi, Tokyo, Japan) using dual-surface coils. Proton density weighted images were acquired with a fast, low-angle shot (FLASH: a repetition time (TR) of 450 ms, an echo time (TE) of 11 ms, a flip angle 30°, field-of-view of 150 mm, and a scanning matrix of 256×256 mm) or fast spin echo (FSE: TR of 1100 ms, TE of 12 ms, an echo train length 3, a field-of-view of 150 mm, and a scanning matrix of 256×256 mm) pulse sequences as described previously. The slice thickness was 3 mm without interslice gap.

Normal disc position in the sagittal plane was defined as the posterior band of the disc being located at the superior, or 12 o'clock, position relative to the condyle as described by Katzberg and Katzberg et al. Disc configuration was evaluated in the closed mouth position and was classified into five types: biconcave, enlargement of the posterior band, even thickness, convex, and folded.

### Table 2. The disc position of the TMJ on MRI

<table>
<thead>
<tr>
<th></th>
<th>ADD without reduction</th>
<th>Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient TMJ (n=22)</td>
<td>22 (100)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Control TMJ (n=30)</td>
<td>0 (0)</td>
<td>30 (100)</td>
</tr>
</tbody>
</table>

Per cent frequencies are shown in parentheses.
ADD: anterior disc displacement.

### Table 3. The disc configuration of the TMJ on MRI

<table>
<thead>
<tr>
<th></th>
<th>Patient TMJ (n=22)</th>
<th>Control TMJ (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biconcave</td>
<td>0 (0)</td>
<td>30 (100)</td>
</tr>
<tr>
<td>Enlargement of posterior band</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Even thickness</td>
<td>8 (36.4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Convex</td>
<td>8 (36.4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Folded</td>
<td>5 (22.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Obscure</td>
<td>1 (4.5)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Per cent frequencies are shown in parentheses.
Fig. 3. MR images (FLASH) of left TMJ in sagittal plane in 26-year-old female patient at follow-up. Anterior disc displacement at mouth closing (A) does not reduce to normal at mouth opening (B). The disc has even thickness.

Fig. 4. MR images (FLASH) of right TMJ in sagittal plane in 19-year-old female patient at follow-up. Anterior disc displacement at mouth closing (A) does not reduce to normal at mouth opening (B). The disc has convex configuration.

Discussion

In previous studies, it has been observed that in some patients with nonreducing disc displacement of the TMJ, clinical signs and symptoms improved without any treatment \cite{19,20,23} and that in such patients disc displacement was persistent and disc deformity was still common on MRI \cite{22}. It was, however, also shown that the frequency of improvement of clinical signs and symptoms in patients who received injection of the superior joint space with sodium hyaluronate was significantly higher than that in a group without any treatment, though clinical signs and symptoms improved in both patient groups \cite{21}.

In this study, the patients’ clinical symptoms improved and the range of motion for maximal mouth opening increased during the follow-up period, although the disc displacement was persistent and disc deformity was still common. This suggests that injection of the superior joint space with sodium hyaluronate does not necessarily improve displacement and deformity of the disc, but that symptoms can be resolved and the range of motion for maximal mouth opening can increase, even if disc displacement and disc deformity are still present.

Pain is generally caused by the effects of trauma. Injury produces an inflammatory reaction with release of pain mediators such as bradykinin, histamine, substance P etc. These mediators attach to and stimulate nerve-endings. In the TMJ, it seems reasonable that the pain originates from pressure and traction on the disc attachments. In joints with anterior disc displacement, the loose tissue in the posterior attachment is displaced between the condyle and fossa and could be compressed or stretched during function \cite{25}. Mediators produced here might stimulate nerve-endings in the TMJ. QUINN & BAZAN \cite{15} identified prostaglandin E_2 and leukotriene B_4 in the synovial fluid from patients with painful dysfunctional TMJ joints, and they observed a strong correlation between the levels of these chemical mediators of pain and inflammation and an index of clinical joint pathology. They suggested that prostaglandin E_2 and leukotriene B_4 are among the factors which evoke TMJ symptoms.

Results

In all the controls, the disc was situated normally on the condyle in both the closed mouth and open mouth position. In the patients, the disc was still displaced anteriorly on mouth closing and did not reduce into a normal relation between the condyle and temporal bone during mouth opening at follow-up (Fig. 1) (Table 2).

In all 30 control TMJs, the disc had a biconcave shape (Fig. 2). In the patients, the disc was of an even thickness in 8/23 (36.4%), convex in 8/23 (36.4%), folded in 5/23 (22.7%), and obscure in 1/23 (4.5%) at follow-up (Figs. 3, 4, and 5) (Table 3).
pain. In our patients, the aspiration of synovial fluid of the superior joint space might have excluded these chemical mediators. Hyaluronic acid is a major natural component of synovial fluid that plays an important role in lubrication of synovial tissues. Sodium hyaluronate has been reported to improve joint pain3 and prevent intra-articular adhesions4.

WESTESSON27 observed deformation of the disc in 83.1% of 77 TMJs with nonreducing disc displacement using double-space contrast arthrography at initial visit. Deformation of the disc was observed in 66.7% of 96 TMJs with nonreducing disc displacement by SU-gami et al.24 using double-space contrast arthrography, and in 77.3% of 67 TMJs by WAJIMA et al.26 using double-space contrast arthrography at initial visit.

WESTESSON27 also found that a convex shape was the most common disc configuration in the TMJs with nonreducing disc displacement at initial visit, while WAJIMA et al.26 cited enlargement of the posterior band as the most common finding. These differences in results might be due to differences in the patient populations studied. In this study, the most common disc configuration included even thickness and convexity. The disc condition at the beginning of the study in patients was examined only by inferior joint space arthrography. This method was not useful for detecting disc configuration, though it was useful for detecting presence or absence of disc displacement. Therefore, it is not possible to state whether there were changes of disc position and configuration between the beginning of the study and at follow-up. Condylar mobility have increased between the beginning of this study and follow-up. Because mouth opening increased, it is likely that the anteriorly displaced disc moved even somewhat more anteriorly, followed by increased disc deformation.

Although we did not observe disc displacement and deformity in any of the control subjects, some investigators8,10,17,28 have observed anterior disc displacement even in asymptomatic subjects without TMJ dysfunction using MRI or arthrography. KIRKOS et al.10 found anterior disc displacement in 13 out of 42 asymptomatic joints using MRI. As in our study, KAPLAN et al.3 did not find disc displacement in 31 asymptomatic volunteers without TMJ dysfunction using arthrography. They, however, also found that the disc was concave in 32% of the joints and flat in 68%.

In conclusion, in the patients with nonreducing disc displacement of the TMJ who underwent injection of the superior joint space with sodium hyaluronate, disc displacement is persistent and disc deformity is still common at follow-up, even though clinical signs and symptoms have improved.

References


Address:
Shuichi Sato
Department of Oral and Maxillofacial Surgery
Tohoku University School of Dentistry
4-1 Seiryo-machi, Aoba-ku
Sendai 980-8575
Japan
Tel: +81 22 717 8350
Fax: +81 22 717 8354
e-mail: shuichi@mail.cc.tohoku.ac.jp