MRI Views of the Temporomandibular Joints between Male and Female Volunteers in 20’s

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Abstract: The purpose of this study was to compare image diagnosis made by magnetic resonance imaging with the clinical symptoms of volunteer subjects who did not have temporomandibular disorders (TMD) as chief complaint.

We collected 100 male and 100 female volunteers of the 20~29-years-olds age bracket by random sampling. Each subject self-reported whether or not they had TMJ disease symptoms that include pain, joint noise in his/her TMJ, and limited mouth opening in the range between their upper and lower incisal edges. After these reports, we performed MRI of TMJ at the time of the closing and opening of the jaws. Then we decided the diagnosis and compared the TMJ status between the males and females.

The mean age of males was 24.2 years; and that of females, 23.8 years. The mouth opening range limit incidence of less than 40 mm showed a prevalence of 5.0% for the males and 21.0% for the females. The respective prevalence of joint noise for males and females was 30.0% and 28.0%. Males have a prevalence of sharp pain of 6.0%; and females, 4.0%. Most of the subjects showed no disc displacement (NDD). Anterior disc displacement with reduction (ADDwR) occurred in 17.5% male joints and in 15.0% female joints; and that without reduction in 6.5% male joints and 14.5% female joints (p<0.05). 1.0% male joints and 2.5% female joints showed joint effusion on T2 weighted images, which occurred only in anterior disc displacement without reduction. No individuals had posterior disc displacement. Also, none had edema or osteonecrosis on all of volunteers bone marrow.

The mean values of maximum opening range of NDD, total subjects and of subjects ADDwR were significantly lower in female than in male (p<0.05).

In conclusion, it is demonstrated that there are many individuals who suffered from TMD in patients who did not indicate TMJ problems as a chief complaint.

Thus we plan to analysis many TMJ conditions by using MRI and evaluate with TMD patient cases.

Key words: magnetic resonance imaging, temporomandibular joint, diagnosis

20代ボランティア男女100名を対象とした顔関節MRI画像の比較

小澤 智宣 1, 池 真樹子 2, 坂 英樹 3, 丸山 亮 4
小泉 伸秀 1, 大高 祐聖 1, 井澤 真希 1, 植田 賢次 1
鈴木 達也 1, 芝 規良 1, 奥村 泰彦 1

1 明海大学歯学部病態診断治療学講座歯科放射線学分野
2 新潟大学大学院医歯学総合研究科顔面再建学講座顔面放射線学分野
3 明海大学歯学部病態診断治療学講座歯科法医学分野
4 東海大学医学部外科学系口腔外科学講座
Introduction

As for the characteristic clinical evidence for the temporomandibular disorders (TMD), the 3 major signs are joint sounds, sharp pain, and restriction in mouth opening. It is said that the majority of TMD patients are in their 20’s\(^\text{1−4}\). Magnetic resonance imaging (MRI), introduced clinically in the 1980’s\(^\text{5−8}\), is now often used as a diagnosis method for TMD. And, MRI is common diagnostic methods for the evaluation of disc-condyle relationship. The purpose of this study was to compare diagnosis obtained by MR imaging with the clinical symptoms of the volunteers in 20’s who did not have TMD as a chief complaint.

Materials and Methods

By random sampling, we selected 100 male and 100 female volunteers in the range of 20~29 years, who had come to Meikai University for dental treatment (treatment of caries or/and periodontal disease), excluding those who had indicated TMD as their chief complaint. Each subject reported to us whether or not they had TMJ disease symptoms that included pain, joint noise, in his/her TMJ, and limited mouth opening in the range of between their upper and lower incisal edges\(^\text{6}\). After their responses had been noted, we performed MRI (Ailis mate 0.2 T, HITACHI, Tokyo) with a surface coil on the sagittal axis of TMJ at the time of the closing and opening of their mouth. Imaging included proton density-weighted imaging at the closed and maximum mouth opening positions (repetition time[TR]/echo time[TE]3000 ms/30 ms), and T2 weighted imaging at the closed mouth position (TR/TE 400 ms/19 ms). Next MRI images of the articular disc and surrounding area were examined by 3 dentistry radiologists, after which the correlation between the clinical symptoms and diagnosis obtained by MRI inspection was made (Figs 1, 2). The diagnostic judgments were based on Tasaki’s report\(^\text{10}\). The normal position was noted when the central thin zone of the disc was located between the anterior prominence of the condyle and the posterior aspect of the articular eminence. In most instances the posterior band of the disc was at the top of the condyle, but in some instances it was slightly anterior to the 12 o’clock position. In these cases the relationship between the central thin zone and the disc to the anterior prominence of the condyle overrode the position of the posterior band. All judgments were made by the majority rule. This research was approved by the Human Research Ethics Committee of Meikai University (No.A 0803), and a signed informed consent form was

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obtained from each subject after they had received a detailed explanation of the research protocol. The chi-square test (SPSS Statics 18, IBM Japan, Tokyo) was used for the analysis of the differences between males and females with respect to the status of TMJ findings. And, the unpaired Student’s t-test was used for the analysis of the differences between males and females with respect to the mean value of maximum opening range according to articular disc status obtained by MR imaging.

**Results**

The mean ages of the male and female subjects are indicated in Table 1.

**Table 1** shows the prevalence of 3 major signs for males and females. Number of sample in prevalence of limited mouth opening are 100 samples, and prevalence of clicking sounds from the TMJ and prevalence of sharp pain are 200 samples on each gender. The prevalence of limited mouth opening defined as less than 40 mm was 5% for the males and 21% for the females. The prevalence of clicking sounds from the TMJ was 30% for the males and 28% for the females. The prevalence of pain incidence was 6% for the males and 4% for the females.

**Table 2** shows distribution of the status of TMJ findings for both subject groups. No disc displacement (NDD) was the predominant status in either group. Anterior disc displacement with reduction (ADDwR) was found in 35 male joints and in 30 female ones. The anterior disc displacement without reduction (ADDwoR) occurred in 13 male joints and 29 female joints. And ADDwoR was significantly different between males and females (p<0.05). Joint effusion on T1 weighted images was seen in a total of 5 female and 2 male joints, but only in subjects with ADDwoR. No one had posterior disc displacement, edema or os-

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**Table 1**  Sex distribution of the volunteers.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of volunteers</th>
<th>Mean age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>100</td>
<td>24.2 ± 2.3</td>
</tr>
<tr>
<td>Female</td>
<td>100</td>
<td>23.8 ± 1.8</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>24.0 ± 2.1</td>
</tr>
</tbody>
</table>

**Table 2** The prevalence of 3 major signs for males and females.

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitation presence (≤40 mm)</td>
<td>5.0%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Click presence</td>
<td>29.5%</td>
<td>28.0%</td>
</tr>
<tr>
<td>Pain presence</td>
<td>5.5%</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Number of sample in limitation prevalence are 100 samples, and click prevalence and pain prevalence are 200 samples on each gender.
teonecrosis in their bone marrow.

Table 4 shows the mean value of maximum mouth opening range according to the status of MR imaging for males and females. Maximum opening in NDD, ADDwR subjects and that in total subjects of females were significantly lower in female than in male lower than that males (p < 0.05).

Discussion

MRI which does not use X-ray and occur radioactive surgical invasion is more superior than X-ray imaging and Computed Tomography in terms of contrast in soft tissues, is now widely used for the diagnosis TMJ diseases. MRI provides a huge diagnosis advantage for not only the TMJ disc but also for assessing surround tissues, joint effusion and characteristics of mandibular bone marrows. MRI is the modality of choice for the assessment of internal derangement of the TMJ in patients with TMD. There are many reports in the literature indicating that females have a greater prevalence of TMD than males. This present study proved that there were many cases of TMD among the volunteer subjects, none of which had indicated TMJ problems as their chief complaint.

There were more females subjects with limited mouth opening than males. The reason for this difference may be that the female skeleton is naturally smaller than the male11, 12. Also, there were more ADDwoR cases in the females than in the males. Totally around 30% of subjects had TMJ sounds, prevalence similar to that other reported by other groups13, 14. It is likely that TMJ sound is closely related to disc position. Evaluation of pain is very difficult because of the subjective of the nature of the symptom, and TMJ pain is closely related to pain in surrounding tissues such as ears, cheeks, head, neck, sinuses15. Therefore we need more analysis in detail not only symptom in TMJ pain.

Another interesting finding was in terms of the ADDwoR status between sexes; i.e., females showed a 2-fold higher prevalence of ADDwoR than males (p < 0.05). In this study we could not find evidence of osteonecrosis or edema in any of the subjects. But ADDwoR patients are known to have osteonecrosis or edema sometimes16. As an ADDwoR patient gets older, it becoming osteonecrosis and edema of the condylar marrow occurs, because of the constant rubbing that occurs between the condyle and articular tubercles17. Therefore, older TMD patients would have more osteonecrosis and edema than younger ones18, 19. Also females have potentially a greater risk of osteonecrosis and edema than males.

TMJ effusion primarily occurs in joints with disc displacement and is strongly associated with joint pain20. In fact in this study joint effusion was found on only in subjects in ADDwoR on T2 weighted images. T2 signal strength will depend on the type of tissue being examined. We have noted that MRI evidence of joint effusion is frequently found in painful joints with disc displacement, but rarely in normal joints21. The maximum mouth-opening range was significantly different (p < 0.05) between males and females except ADDwoR. The reason that articular disc in ADDwoR had limited mouth opening movement...
and pain (joint effusion). And the other reason is no limited articular disc movement in other status because of female skeleton is naturally smaller than the male ones. If a strong association between the presence of joint effusion and abnormal disc displacement and painful joint could be established, this could be the basis for valuable additional diagnostic information from MRI imaging of the TMJ.

Other clinical reports have emphasized the high ratio of TMD in female than male\(^{22}\). The reason for higher prevalence of TMD signs and symptoms in women is likely that the higher numbers of females using health care services and taking sick leaves than males\(^{27}\). Our study is a rare one examining the same number of males and females. Other reports have suggested that the frequency of TMD is similar in both genders\(^{24-26}\), but females were overrepresented in those studies. Our results were not in line with those studies. But we agree with the studies indicating that females show more assessed signs and symptoms than do males\(^{27,28}\), as our results indicated the same, except in the case of joint noise, where males had a slightly greater prevalence of clicking sounds than the females. TMJ effusion, which typically appears as a bright signal on T\(_2\) weighted MRI, has been recognized as a possible sign related to pain in patients with TMJ disorders. However, we could not find serious joint effusion in our study groups in their 20's (age 20 to 29). There are earlier reports showing that older people have a higher frequency of objective signs of TMD than younger people\(^{29}\). In the future we will examine more cases including older people for MR imaging.

In this study, the participants did not describe their oral habits and TMJ situation in detail. Also this study did not use X-ray imaging which would have been better modality than MRI with respect to cases of bone transformation. Therefore, we would like to compare imaging of TMJ’s by MRI and that by X-rays which can correctly detect in our next study. We plan to increase the number of cases in such a study to confirm the diagnostic accuracy.

**Conclusion**

In summary, our findings indicated that there were many patients with actual TMD who had not indicated TMD as a chief complaint. In near future, we plan to perform more studies on TMJ status by using MRI.

**References**

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