

A Clinical Study of Internal Derangement of Temporomandibular Joint Diagnosed with Magnetic Resonance Imaging

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Internal derangement of the temporomandibular joint (TMJ) can be defined as an abnormal relationship of the articular disc to the condylar head and articular eminence. Magnetic resonance imaging (MRI) is an excellent method for the primary diagnostic evaluation of TMJ internal derangement. The purpose of this study was to investigate the clinical, radiological, and surgical findings of TMJ internal derangement with the disc position and configuration based upon MR findings and to help diagnosis and treatment of TMJ internal derangement.

In seventy eight patients, who were diagnosed as TMJ internal derangement, TMJ sounds had the majority in clinical symptom and past history. The most common articular disc position and configuration seen by sagittal MRI were anterior disc displacement with reduction in 32.7% and deformed in 76.3%. The disc deformation was closely correlated with the disc position.

Among the treatments, conservative treatment and arthrocentesis was 87.2%, and open TMJ surgery was performed in 12.8%. The better prognosis was shown in 83.3% of all the patients. Of all open TMJ surgeries, discoplasty was 80.0%, and discotomy was 20.0%. The disc displacement and deformation were observed in all surgical joints, with the condylar degenerative change in 70.0% and the perforation in 40.0%.

Key Words: Temporomandibular joint (TMJ), Internal derangement, Magnetic resonance imaging (MRI)

INTRODUCTION

Internal derangement of the temporomandibular joint, defined as a malrelationship of the articular disc to the condylar head and articular eminence, is associated with TMJ pain, TMJ noises, and limited jaw opening. Internal derangement produces the changes in the normal disc position and configuration of the TMJ, and it has been termed disc displacement or dislocation. The articular disc is usually displaced anteriorly or anteromedially with frequent perforation of the posterior attachment. As the condition of internal derangement takes a turn for the worse, the disc may have undergone morphologic change and degenerative bony change (osteoarthritis) may occur¹⁻³.

Most concepts for the etiologic factors of TMJ internal derangement encompass the trauma, macro-trauma or micro-trauma. The complex and numerous factors, such as occlusal disharmony, masticatory muscle dysfunction, abnormal oral habits, and emotional stress, are involved as underlying basis. But, the obvious cause of TMJ internal derangement remains uncertain¹.

The clinical signs and symptoms of TMJ internal derangement are varied and include joint pain, tenderness in the joint and associated musculature, restriction of jaw motion, and joint noises such as clicking and crepitus. Patients may demonstrate temporal headache, otalgia, cervical and/or shoulder pain, joint locking, jaw deviation during mouth opening, and changes in occlusion³.

The differential diagnosis of TMJ internal derangement and MPD (myofascial pain and dysfunction) syndrome is very difficult. Diagnostic options of TMJ radiography include plain radiography, panoramic radiography, tomography, arthro-

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graphy, arthrotomography, computed tomography, and magnetic resonance imaging. MRI, the most recent imaging technique, is an excellent method for the primary diagnostic evaluation of TMJ abnormalities, and seems to be a technique of first choice to identify the disc position and to judge its configuration⁴⁻⁷.

TMJ problems has historically been one of the most difficult conditions to manage and treat. The treatment of internal derangement includes non-surgical and surgical methods. The patients are often treated successfully by conservative treatment. However, some patients do not benefit from these treatments and ultimately require surgical intervention involving discoplasty, discectomy, discectomy with an autogenous or alloplastic disc replacement, eminectomy, high condylectomy, or intraoral condylotomy^{8,9}.

The purpose of this study was to investigate the clinical, radiological, and surgical findings with the disc position and configuration, which have been based upon MR findings of TMJ internal derangement. They would be helpful for diagnosis and treatment of TMJ internal derangement.

MATERIALS AND METHODS

A retrospective analysis of 78 patients, who were diagnosed as TMJ internal derangement with MRI and were followed up above 6 months at Department of Dentistry, Ajou University Hospital, was carried out. The mean age of the patients was 27.1 years, ranging from 12 to 69 years. There were 53 females (mean age, 27.4 years) and 25 males (mean age, 26.9 years). All of the cases underwent closed and open mouth TMJ view and MRI. In addition, 14 patients had lower joint space-injected arthrography, 11 patients had computed tomography, and 17 patients had thermography.

MRI studies were performed using a dual 3 inch (7.6 cm) surface coil with a GE Medical System (Signa 1.5 Tesla advantage). Coronal T1-weighted and sagittal T1-, T2-weighted MR images of all TMJs in the closed and open mouth positions were made. In all patients, sagittal T1-weighted images were obtained with conventional spin-echo (CSE) imaging in the closed and open mouth positions, and sagittal T2-weighted images were obtained with fast spin-echo (FSE) imaging in the closed and open mouth positions. The degree of mouth opening was fixed with bite blocks, which were available in variable sizes. In the case with clicking TMJ, the

patient was instructed to open the mouth beyond the click.

The parameters for T1-weighted CSE sequence included a TR msec/TE msec of 500/19, 256×192 matrix, 10 cm field of view, 3 mm thick contiguous sections, and two signals averaged. The total imaging time was 3 minutes 20 seconds. The parameters for T2-weighted FSE sequence obtained a TR msec/TE msec of 4000/116, 256×256 matrix, 10 cm field of view, 3 mm thick sections, and two signals averaged. The total imaging time was 3 minutes 28 seconds.

The position of the articular disc in relation to the mandibular condyle was determined in the sagittal plane of MRI. Normal TMJ showed the junction of the posterior band of the disc with the retrodiscal tissues at the 12 o'clock position in the closed position. In the open position, the thinnest portion of the intermediate zone of the disc should articulate with the head of the condyle. An anterior disc displacement in the closed position was shown by the posterior band being anterior to the 12 o'clock position in relation to the mandibular condyle.

Disc displacement with reduction was defined as the disc with anterior displacement to the condyle when the jaw was closed, and with reduction to a normal position over the condylar head when the jaw was opened beyond the click. Disc displacement without reduction was diagnosed when the disc was in an anterior position relative to the condyle, and both when the jaw was closed and when it was maximally opened. Coronal sections of MRI could distinguish between medial and lateral dislocations of the articular disc.

The configuration of the articular disc was judged by sagittal T1-weighted MR images in the closed and open mouth positions, and was categorized as a normal (biconcave or bow-tie), folded, planar, convex, spectacle-shaped, or amorphous (Fig. 1~5). Additionally, the several morphologic changes of the anteriorly displaced disc have been discovered, including atrophy of the anterior band, thickening of the posterior band, and shortening of the entire anteroposterior length.

RESULTS

In the distribution of age and sex, 20~29 years was most common in 46.1%. 30~39 years (26.9%) and 10~19 years (20.5%) were next in order of frequency, and only 6.5% were older than 40 years. The male-female ratio was 1 : 2.1, and

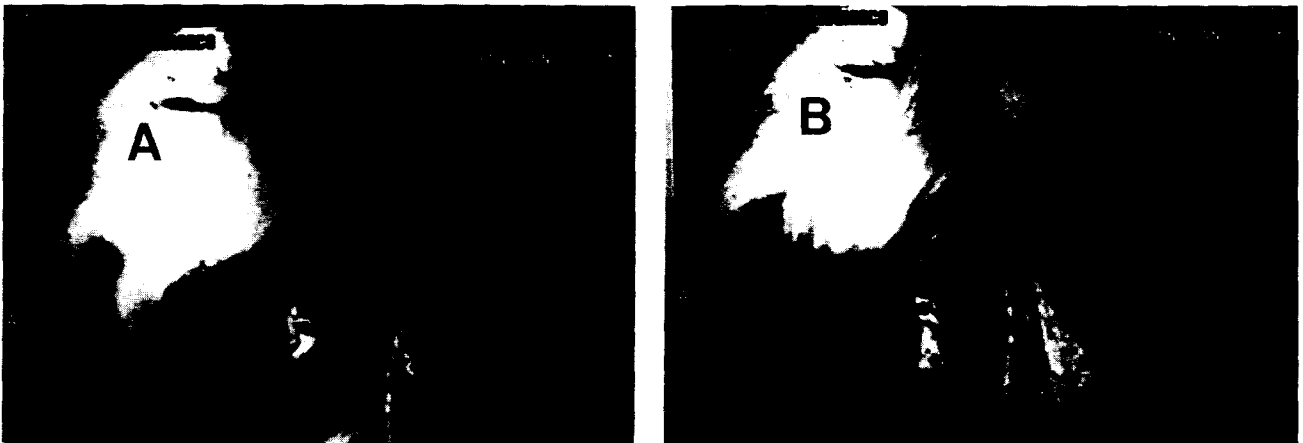


Fig. 1. Folded disc configuration in closed (A) & open (B) mouth seen by T1-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 26-years female.



Fig. 2. Planar disc configuration in closed mouth seen by T1-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 18-years male.



Fig. 3. Convex disc configuration in closed mouth seen by T1-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 29-years female.



Fig. 4. Spectacle-shaped disc configuration in open mouth seen by T1-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 24-years male.

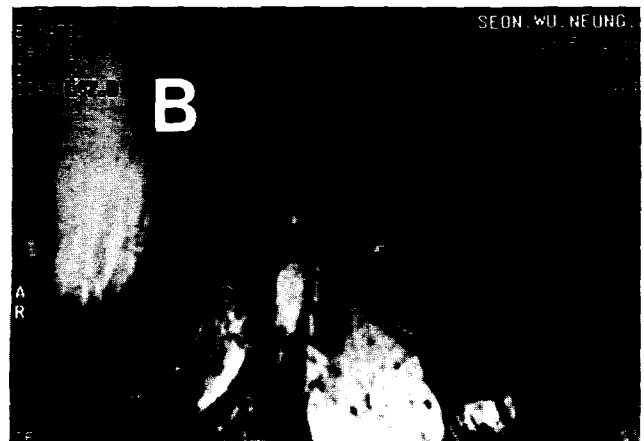


Fig. 5. Amorphous disc configuration in closed (A) & open (B) mouth seen by T1-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 33-years female.

female was more common than male (Table 1).

In affected TMJ sites of 78 patients, right TMJ was 38.5% (male, 40.0% and female, 37.7%), left TMJ was 35.9% (male, 32.0% and female, 37.7%), and both TMJ was 25.6% (male, 28.0% and female, 24.6%).

The most common clinical symptom was TMJ sounds in 79.5%. TMJ pain (78.2%), limited jaw opening (57.7%), jaw deviation with mouth opening (52.6%), masticatory muscle pain (44.9%), and headache (34.6%) were next in order of frequency. The occurrence of all of these clinical symptoms in the same patient was not unusual, and the majority of the

Table 1. Distribution of age and sex in the patients with internal derangement of temporomandibular joint

Age	Number of males	Number of females	Number of patients(%)
10 ~ 19 years	5	11	16(20.5)
20 ~ 29 years	14	22	36(46.1)
30 ~ 39 years	4	17	21(26.9)
40 ~ 49 years	0	2	2(2.6)
50 ~ 59 years	1	1	2(2.6)
60 years above	1	0	1(1.3)
Total	25	53	78(100.0)

patients had combinations of two or more clinical symptoms (Table 2).

The range of durations of clinical symptoms was from 4 days to 10 years. The most common duration was more than 1 year in 52.6% (male, 56.0% and female, 50.9%), and only 6.4% were less than 1 week.

The most common past history of 78 patients was TMJ sounds in 48.7%. Hard food chewing (37.2%), jaw clenching (32.1%), previous therapy (28.2%), and unilateral chewing (25.6%) were next in order of frequency. Parafunctional abnormal jaw habits, including bruxism, jaw clenching, unilateral chewing, and hard food chewing seemed to be important in past history. The majority of the patients had combinations of two or more past histories in the same patient (Table 3).

The most common disc position seen by sagittal MRI in 156 joints was partially or completely anterior disc displacement with reduction in 32.7%. Anterior disc displacement without reduction (26.9%) and anterior disc displacement without reduction & osteoarthritis (22.4%) were in nearly similar frequency (Table 4).

Table 2. Distribution of clinical symptoms in the patients with internal derangement of temporomandibular joint

Clinical symptom	Number of males	Number of females	Number of patients(%)
TMJ sounds	20	42	62(79.5)
clicking	18	36	54(69.2)
crepitus	2	6	8 (10.3)
TMJ pain	17	44	61(78.2)
Limited jaw opening	11	34	45(57.7)
Jaw deviation with mouth opening	6	13	41(52.6)
Masticatory muscle pain	9	26	35(44.9)
Headache	4	23	27(34.6)
Cervical and/or shoulder pain	5	11	16(20.5)
Emotional tension	1	8	9(11.5)
TMJ locking	3	4	7(09.0)
Otalgia	1	5	6(7.8)
	25	53	78(100.0)

TMJ=temporomandibular joint

In the disc configurations of open mouth seen by sagittal MRI in 156 joints, deformed disc was 76.3%, and the disc configuration was closely correlated with the disc position. The most common deformed disc of internal derangement was folded in 22.4%. Amorphous (19.2%), convex (17.3%), planar (12.3%), and spectacle-shaped (5.1%) were next in

Table 3. Distribution of past histories in the patients with internal derangement of temporomandibular joint

Past history	Number of males	Number of females	Number of patients(%)
TMJ sounds	11	27	38(48.7)
Hard food chewing	6	23	29(37.2)
Jaw clenching	7	18	25(32.1)
Previous therapy	4	18	22(28.2)
Unilateral chewing	6	14	20(25.6)
Emotional Tension	2	12	14(17.9)
Bruxism	5	4	9(11.5)
TMJ locking	5	4	9(11.5)
TMJ trauma	5	4	9(11.5)
TMJ dislocation	4	3	7(9.0)
	25	53	78(100.0)

TMJ=temporomandibular joint

Table 4. Articular disc positions seen by sagittal MRI of both TMJs in the patients with internal derangement of temporomandibular joint

TMJ disc position	Number of joints(%)
No disc displacement	28(18.0)
PADDR	24(15.4)
CADDR	27(17.3)
ADD	42(26.9)
ADDO	35(22.4)
Total	156(100.0)

MRI=magnetic resonance imaging

TMJ=temporomandibular joint

PADDR=partially anterior disc displacement with reduction

CADDR=completely anterior disc displacement with reduction

ADD=anterior disc displacement without reduction

ADDO=anterior disc displacement without reduction & osteoarthritis

Table 5. Articular disc configurations seen by sagittal MRI of both TMJs in the patients with internal derangement of temporomandibular joint

TMJ disc configuration	Number of joints(%)
Normal	37(23.7)
Deformed	119(76.3)
Folded	35(22.4)
Planar	19(12.3)
Convex	27(17.3)
Spectacle-shaped	8(5.1)
Amorphous	30(19.2)
Total	156(100.0)

MRI=magnetic resonance imaging
TMJ=temporomandibular joint

order of frequency (Table 5).

Abnormal bony changes seen by MRI of both TMJs in 156 joints was 22.4%, and the most common bony change was degenerative change (bony erosion/flattening) in 15.4%. The fluid or inflammatory change seen by T2-weighted image was shown in 32.7%. The decreased MR signal intensity from retrodiscal tissue was shown in 22.4%. The demarcation of posterior band and bilaminar zone was not definitive in 26.9%. The range of condylar motion was hypomobile in 35.3%, and was hypermobile in 13.8% (Table 6).

Non-surgical treatment involving arthrocentesis was 87.2%, and open TMJ surgery was performed in 12.8% of all patients. In the prognosis, conservative treatment had better prognosis of 82.7%, arthrocentesis and conservative treatment had 81.2%, and open TMJ surgery had 90.0%. Consequently, the better prognosis of TMJ internal derangement was shown in 83.3% of all patients (Table 7).

Concerning the techniques of open TMJ surgery of 10 joints, discoplasty (disc repositioning) was 3 joints (30.0%), discoplasty and eminectomy and/or high condylectomy were 5 joints (50.0%), and discectomy and eminectomy and/or high condylectomy were 2 joints (20.0%). Consequently, discoplasty was performed in 80% of all open TMJ surgery.

Concerning the surgical findings of open TMJ surgery of 10 joints, disc displacement and deformation were 3 joints (30.0%), disc displacement and deformation and condylar

Table 6. Other findings seen by MRI of both TMJs in the patients with internal derangement of temporomandibular joint

Other MR finding	Number of joints(%)
Bony change	
No bony change	121(77.6)
Degenerative change (bony erosion/flattening)	24(15.4)
Degenerative change with osteophyte	11(7.0)
Fluid or inflammatory change (T2-weighted image)	
Yes	51(32.7)
No	105(67.3)
Decreased MR signal intensity from retrodiscal tissue	
Yes	35(22.4)
No	121(77.6)
Demarcation of posterior band and bilaminar zone	
Definitive	114(73.1)
No definitive	42(26.9)
Range of condylar motion	
Normal	81(51.9)
Hypomobility	55(35.3)
Hypermobility	20(13.8)
Total	156(100.0)

MRI=magnetic resonance imaging
TMJ=temporomandibular joints

degenerative change were 3 joints (30.0%), and disc displacement and deformation, perforation of posterior attachment, and condylar degenerative change were 4 joints (40.0%). Consequently, disc displacement and deformation were shown in all joints of open TMJ surgery, and condylar degenerative change was shown in 70.0%.

DISCUSSION

Many epidemiologic studies^{10~13} evaluating the incidence of TMJ disorders have performed with the range from 14% to 60%. TMJ disorders include internal derangement, MPD syndrome, and inflammatory or growth disorders. Based upon the definition of TMJ internal derangement as a faulty relationship between the condyle and the disc, this study

Table 7. Treatment and prognosis in the patients with internal derangement of temporomandibular joint

Treatment	Number of patients(%)	Prognosis	Number of patients(%)
Conservative treatment	52(66.7)	Worse	0
		Originally	9(17.3)
		Better	43(82.7)
Arthrocentesis and conservative treatment	16(20.5)	Worse	1(6.3)
		Originally	2(12.5)
		Better	13(81.2)
Open TMJ surgery and conservative treatment	9(11.5)	Worse	0
		Originally	1(11.1)
		Better	8(88.9)
Open TMJ surgery, conservative treatment and arthrocentesis	1(1.3)	Worse	0
		Originally	0
		Better	1(100.0)
Total	78(100.0)	Total	78(100.0)

TMJ=temporomandibular joint

demonstrated a high incidence of internal derangement to be diagnosed with MRI. MR findings have demonstrated that TMJ internal derangement are seen in a high frequency of the patients who have TMJ symptoms.

Most reports have described the diagnosis and treatment of TMJ internal derangement based upon the unilateral finding without consideration of the possibility of contralateral joint problem. However, the jaw acts as a unit with both TMJs connected by the mandible, therefore, a mechanical dysfunction on one side can potentially affect the other side, and a single injury to the jaw can affect both TMJs simultaneously¹⁴. Unilateral TMJ internal derangement may cause bilateral TMJ pain and noise because the non-deranged joint compensates for opening deviation and limitation with abnormal excursions. Extensive movement of the condyle at jaw opening may thus be seen on the non-affected side, because the condyle moves beyond the normal confines of the disc. And, in long-standing cases, the condyle will produce hypermobility on the non-affected side, and will produce possibly internal derangement of this joint¹⁵.

In this study, 74.4% had one side that was normal and the other side abnormal, and 25.6% had bilateral internal

derangement. On the other hand, in Sanchez-Woodworth's study¹⁴, 21% had unilateral internal derangement, and 50% had bilateral. These two studies showed that bilateral internal derangement was significant in the patients with TMJ internal derangement.

Of the signs and symptoms of internal derangement, pain is clinically most important, but the evaluation of pain is difficult because of the subjective nature of the symptoms. Furthermore, distinguishing the location of pain between the masticatory muscles and joint may sometimes be more difficult. The pain can be evaluated both on chewing and at rest, therefore, the pain on chewing is more representative for the joint pain than the pain at rest.

Pain in TMJ internal derangement occurs when the condyle is being forced backward, causing pressure on the neurovascular tissues of the posterior attachment and capsule. The sensory nerve endings of the auriculotemporal nerve and branches of the masseteric and posterior deep temporal nerves innervate the capsule and mediate the pain coming from the joint area during function.

The closed and open mouth lateral TMJ views provide valuable informations with regard to the condylar morphology and symmetry, the condyle position within the glenoid fossa, the presence or absence of degenerative bony changes with exophyte, and the range of condylar motion. In the closed position of the TMJ, the abnormal condylar position within the joint results from the condyle's upward and backward position in the glenoid fossa by the functional abnormalities, or from the long-term effects of abnormal mandibular movements. The joint space is reduced posteriorly and/or superiorly in TMJ internal derangement. This radiographic technique, however, is limited to interpretation of hard tissue, and the disc with surrounding soft tissues cannot be detected.

MRI is the first imaging procedure in most circumstances requiring the disc imaging, because it provides accurate information about the disc position and configuration in a non-invasive manner, and is superior in the soft tissue contrast resolution compared with other techniques. However, disc perforation and joint adhesion are not detectable with MRI. If disease progression is suspected and the posterior attachments appear attenuated, arthrography should be performed to resolve the question of perforation.

Arthrography with videofluoroscopy is superior to MRI in detecting the capsular adhesions and presence or absence of

perforation of the disc or posterior attachments¹⁶⁻¹⁹. The four disc perforation cases of this study were also discovered by arthrography with videofluoroscopy, not by MRI. And it was confirmed with the surgical findings of open TMJ surgery.

The bony abnormalities of the TMJ are less clearly visualized on MR images, compared with multi-directional computed tomography. However, it appears that MRI provides passable information about osseous changes, since the bony demarcation is possible because of the differences of signal intensity from surrounding structures. The earliest degenerative changes of the mandibular condyle, such as erosion and loss of fibrocartilage covering, can be detected with MRI. And, loosening of the disc border, flattening of the posterior band, and holes in the disc surface can be seen in degenerative cases.

With disease progression, the condyle have undergone considerable changes in morphology, or have exhibited regressive remodeling, joint collapse, and erosion of the glenoid fossa²⁰. The degree of osteoarthritic change in the joint reflects the severity and chronicity of disc damage. The similar results, in which the majority of disc displacement without reduction had the condylar degenerative change, and had long duration of clinical symptoms, had been shown in this study. The condylar degenerative change was closely associated not only with the disc deformation but also with the disc position.

T1-weighted and T2-weighted images were used for diagnosing TMJ internal derangement in this study. T1-weighted scans including coronal and sagittal planes provide increased soft tissue contrast because of the higher signal of fat relative to muscle. The cortical bone has a very low signal, and bony abnormalities, such as osteophytes, are high-lighted because they are adjacent to intermediate signal of soft tissues. And, the marrow fat within the condyle, zygomatic process, and articular eminence is well illustrated because of the high signal.

The soft tissues in the retrodiscal tissue and lateral pterygoid muscle have an intermediate signal. T2-weighted scans including sagittal plane are helpful in identifying the areas of increased fluid content that may be due to edema or inflammation by increasing the signal from water content relative to fat²¹.

In the sagittal plane, TMJ disc position was decided as serving a referred classification of Westesson and Rohlin^{22,23}.

In this study, anterior disc displacement with reduction was 32.7%, and anterior disc displacement without reduction was 49.3%. The majority of TMJ internal derangement complaining clinical symptoms was anterior disc displacement without reduction. Anterior disc displacement without reduction & osteoarthritis, the most advanced process, was common in 22.4%. MRI in the coronal plane is very useful for confirming the medial and lateral disc displacement, and multi-section sagittal MRI is particularly suited for distinguishing between partially and completely anterior disc displacement with reduction.

The value of MRI in confirming the disc displacement is equal to that of arthrography, but in the disc configuration is superior to arthrography. Many studies^{6,16-18} have shown that the normal disc on MRI is depicted as a biconcave or bow-tie configuration in the sagittal plane. And, because a considerable difference exists between disc configurations in the open and closed mouth positions, the presence of altered disc configuration should best be judged on the open mouth position.

In advanced cases of TMJ internal derangement, the articular disc may show a biconvex configuration with a tendency to fold onto itself. All discs that were permanently displaced had lost their original biconcave configuration, and showed a decrease of the anteroposterior length of the disc. Deviating disc configurations have been defined as biplanar and biconvex. To be able to appropriately classify the disc configuration with a long-existing permanent displacement, it is necessary to add, apart from the folded configuration, the convex, spectacle-shaped, and amorphous configurations.

Westessen, Bronstein, and Leidberg²⁴ in 1985 described that disc deformation was preceded by anterior position, and the joints with completely anterior disc displacement showed disc deformation in 77%. The degree of disc deformation is related to the degree of anterior displacement, and especially in permanent displacement, the anteroposterior length of the disc shortens, and its volume decreases over time.

In this study, many disc deformations were observed in the order of folded (22.4%), amorphous (19.2%), convex (17.3%), planar (12.3%), and spectacle-shaped (5.1%). Folded disc deformation was shown in the majority of anterior disc displacement with reduction, and amorphous have been mainly observed in the joints of anterior disc displacement without reduction, especially osteoarthritis. Disc deformation

is closely associated with disturbed joint function. Therefore, the early causal treatment to correct symptomatic internal derangement can lead to decrease the possibility of development of disc deformation. Disc deformation should be an important consideration when planning the treatment of TMJ internal derangement²⁵⁻²⁷.

The retrodiscal tissues appear bright on T1-weighted MR images, and lower signal intensity have been observed in some patients with disc displacement, especially disc displacement without reduction. The clinical significance of the decreased signal intensity in the retrodiscal tissue is unclear, but there has been speculation that the fibrosis of the retrodiscal tissue could be associated with decreased joint pain. This fact reminds us of the suggestion that the fibrosis of the retrodiscal tissue is a part of the late remodeling process that occurs in disc displacement without reduction^{28,29}.

In this study, some patients who have shown the decreased MR signal intensity from the retrodiscal tissue, don't have been frequently observed joint pain in same joint. And, sometimes this joint was not symptomatic joint which the patient complained. On the other hand, a slightly increased T2-weighted signal intensity from the retrodiscal tissue have been observed in some painful patients. This may indicate a higher degree of vascularity in the retrodiscal tissue in the painful joints compared with the non-painful joints³⁰.

TMJ MR imaging could visualize the changes in volume and content of the synovial fluid by inflammation through T2-weighted images only (Fig. 6). Therefore, careful notation

is made to find out the presence of joint effusion on T2-weighted images. Such inflammatory changes are one of the factors causing TMJ pain. It is imaged as joint effusion, which is a high signal intensity within the joint cavities, and edema of the posterior attachment. Joint effusion may be important in the choice of the method and prognosis of TMJ treatment. In this study, severe joint effusion represented the painful joint regardless of disc displacement during jaw movements. And, it was mostly treated by arthrocentesis after conservative treatment, especially in joint effusion with anterior disc displacement with or without reduction.

The disc definition, with attention to the clarity between the fibrocartilaginous disc tissue anteriorly and the fibrofatty vascular bilaminar zone posteriorly in the sagittal plane, is verified in T1-weighted images of the closed mouth. A clear demarcation might reflect the greater fat and water content in the bilaminar zone than in the darker discal tissue. Less clear demarcation is noted in the abnormal condition, raising the possibility of histologic and/or biochemical changes in this region³¹. Unclear demarcation could display the damage between the disc and retrodiscal tissues due to disc displacement, and it is similar to the results of this study.

The treatment of TMJ internal derangement has been directed mainly at symptomatic relief. In many cases, the patients have been left with only temporary improvement and uncertain prognosis. Therefore, the primary approach for the treatment of TMJ internal derangement should be through the consideration of pain control, occlusal discrepancy, muscular

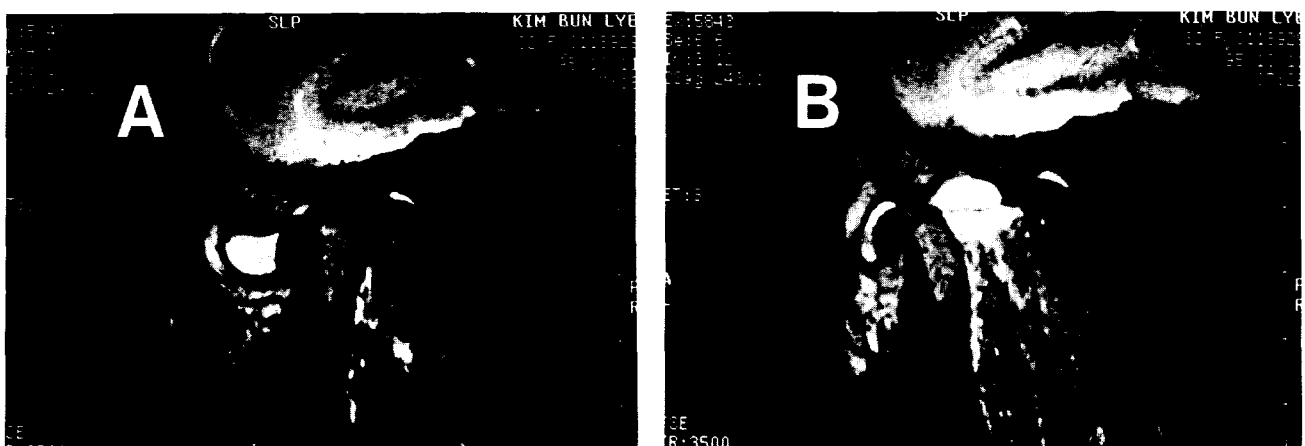


Fig. 6. Joint effusion in closed (A) & open (B) mouth seen by T2-weighted sagittal MR image of anterior displacement without reduction of the temporomandibular joint in 32-years female.

imbalance, soft tissue joint derangement, psychophysiologic disorder, and combinations of some of these¹⁵.

Conservative treatment is the treatment of choice, and is obviously a successful treatment modality in certain cases. This includes joint rest, soft diet, exercises, manipulation, medications (sedatives, analgesics, antiinflammatory agents, and muscle relaxants), physical therapy (hot pack, ultrasound, TENS), occlusal splint, occlusal equilibration, and prosthetic dental reconstruction. The fact that conservative treatment is non-invasive and reversible, makes it a very applicable vehicle in the area of TMJ dysfunction management. All the patients with TMJ internal derangement were treated by conservative treatment at first. The patients who had been treated by conservative treatment in this study was 66.7%, and 82.7% showed better prognosis. The remainders of 33.3% had been treated by arthrocentesis and/or open TMJ surgery.

The frequency of surgical intervention for the treatment of TMJ internal derangement showed a range from 1% to 25% in various published studies³²⁻³⁴. Discoplasty involving a wedge excision in the bilaminar zone with posterior disc repositioning and sometimes combining with a simultaneous eminectomy and/or high condylectomy, is the surgical treatment of choice by McCarty and Farrar³⁵ to prevent the development of osteoarthritis and to preserve the disc, when conservative treatment have failed³⁶.

On the other hand, many authors³⁷⁻⁴¹ advocated that discectomy is the method of choice, when surgery is necessary. Of 10 joints that performed with open TMJ surgery, discoplasty (disc repositioning) was 8 joints, and discectomy was 2 joints, and 90.0% showed better prognosis. Open TMJ surgery was largely performed in the perforated joint which was confirmed by arthrography and in the joint which was not improved by conservative treatment.

It would be desirable to replace the disc to avoid the development of morphologic or arthrotic change of the articular surfaces and to maintain the stability during the movement created by the double joint function. Although an autogenous graft or alloplastic disc implant has been used for replacement after removal of the TMJ disc^{42,43}, an ideal disc replacement material is not available. However, the successful management of TMJ internal derangement, although it is primarily surgical treatment, must be a part of the multifaceted programs of treatment to decrease the upward and backward positioning of the condyle, and to reduce the

parafunctional stresses on the TMJ, preoperatively and postoperatively.

CONCLUSION

This is a retrospective study of 78 patients, who were diagnosed as TMJ internal derangement having signs and symptoms of temporomandibular disorder, and were followed up more than 6 months at Department of Dentistry, Ajou University Hospital. The purpose of this study was to investigate the clinical, radiological, and surgical findings with the disc position and configuration based upon MR findings of 156 joints and to help diagnosis and treatment of TMJ internal derangement. The results obtained were as follows.

- 1) The average age was 27.1 years with the range of 12 to 69 years, and 93.5% of the patients were younger than 40 years of age. The male-female ratio was 1:2.1, and females of 20~29 years (28.1%) were most common.
- 2) We could not find any difference in affected TMJ sites, and the patients who complained clinical signs and symptoms bilaterally were 25.6%.
- 3) The most common clinical symptom and past history were TMJ sounds in 79.5% and 48.7%, and in duration of clinical symptoms, 52.6% were more than 1 year.
- 4) The most common articular disc position and configuration seen by sagittal MRI were anterior disc displacement with reduction in 32.7%, and deformed in 76.3%. The disc deformation was closely correlated with the disc position.
- 5) Of the other findings seen by MRI, the bony change was shown in 22.4%, the fluid or inflammatory change seen by T2-weighted images was observed in 32.7%, the decreased MR signal intensity from retrodiscal tissue was shown in 22.4%, the demarcation of posterior band and bilaminar zone was not definitive in 26.9%, and the hypomobility of condylar motion was observed in 35.3%.
- 6) Among the treatments, conservative treatment and arthrocentesis was 87.2%, and open TMJ surgery was performed in 12.8%. Concerning the prognosis based on the change of clinical signs and symptoms, the better result was shown in 83.3% of all the patients.
- 7) Of all open TMJ surgeries, discoplasty was 80.0%, and discectomy was 20.0%. Concerning the surgical findings, the disc displacement and deformation were observed in all

surgical joints, with the condylar degenerative change in 70.0% and the perforation in 40.0%.

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