

## Temporomandibular joint intermittent closed lock: clinic and magnetic resonance imaging findings

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**Objective.** This study was carried out to describe the clinical and magnetic resonance imaging (MRI) findings of patients with intermittent closed lock (ICL) of the temporomandibular joint (TMJ).

**Study design.** This retrospective study included 58 joints with ICL and 526 joints without ICL as controls. We compared the MRI findings between the patients with and without ICL and investigated clinical and MRI finding of ICL patients. We divided ICL patients into 2 groups based on the treatment efficacy: effective and ineffective.

**Results.** There were significant differences in the prevalence of disk deformity between the joints with and without ICL. Masticatory muscle pain was observed in 41.7% of the effective group and in 80% of the ineffective group, respectively.

**Conclusions.** These results suggest that there is a relationship among the onset of ICL and disk deformation. Masticatory muscle pain was significantly observed in the ineffective group. (Oral Surg Oral Med Oral Pathol Oral Radiol 2014;118: 418-423)

Intermittent closed lock usually manifests with clicking because of anterior disk displacement with reduction, and sometimes with limited mouth opening as a result of disk displacement without reduction. It corresponds to the early/intermediate stage of internal derangement of the temporomandibular joint (TMJ) according to Wilkes' staging criteria.<sup>1</sup> Clicking alone does not interfere with activities of daily living; for this reason, some clinicians are of the opinion that no treatment is necessary.<sup>2</sup> However, interference with activities of daily living does occur with intermittent closed lock.<sup>3</sup>

The clinical picture is varied and is not yet fully described. However, in terms of diagnosis and therapy, only a few studies have been concerned with the occurrence of intermittent closed lock in relation to the magnetic resonance imaging (MRI) findings of disk displacement and morphology. Therefore, the aims of this retrospective study were (1) to describe the clinical characteristics and MRI findings of patients with intermittent closed lock and (2) to verify the efficacy of treatments for intermittent closed lock.

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## MATERIALS AND METHODS

### Patients

The patients were 58 consecutive patients with unilateral intermittent closed lock among 1898 temporomandibular disorder (TMD) patients who had been examined between January 2005 and December 2011 in the Department of Oral and Maxillofacial Surgery of Tokyo Medical and Dental University. All patients included in the study were clinically investigated according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I protocol.<sup>4</sup> There were 47 female participants and 11 male participants ages 13 to 64 years (mean 27.5 years; **Table I**). The clinical diagnostic criteria for intermittent closed lock were as follows<sup>5</sup>:

1. The occurrence of times when it was possible to open the mouth widely and times when mouth opening was limited;
2. Spontaneous resolution of the mouth-opening limitation or resolution in response to force exerted by the patient;
3. Absence of pain associated with the mouth-opening limitation or with resolution of the mouth-opening limitation;
4. Occurrence of the mouth-opening limitation just described at least once a month.

## Statement of Clinical Relevance

The aim of this study is to describe the clinical characteristics and magnetic resonance imaging (MRI) findings of patients with intermittent closed lock and to verify the efficacy of treatments for intermittent closed lock.

**Table 1.** Patient demographic characteristics

Variable	Patients with ICL	Patients without ICL
Number of patients	58	461
Male	11	128
Female	47	333
Age (mean $\pm$ SD; years)	27.5 $\pm$ 11.9	29.7 $\pm$ 14.0

ICL, intermittent closed lock; SD, standard deviation.

The patients with pain were excluded for following reasons: (1) Joint pain associated with the mouth-opening limitation indicates closed lock, and (2) joint pain associated with resolution of the mouth-opening limitation indicates anterior disk displacement with reduction of pain.

In the control group, there were 526 joints of 461 patients with anterior disk displacement without intermittent closed lock. The controls had consulted our department during the same period as the study group had consulted us. The control group consisted of 333 female participants and 128 male participants ages 13 to 80 years (mean 29.7 years).

## MRI

MR images were obtained by using a 1.5 Tesla unit (Magnetom Vision; Siemens, Erlangen, Germany) with a 3-inch-diameter bilateral 2 TMJ surface coil. In the closed-mouth position, proton density weighted images were obtained in both the sagittal plane (TR/TE, 1000/20 ms) and the coronal plane (TR/TE, 960/15 ms). In the open-mouth position, proton density weighted images were obtained in the sagittal plane (TR/TE, 1850/15 ms). All images were obtained with a 3 mm section thickness, a field of view (FOV) of 90  $\times$  120 mm, a matrix of 154  $\times$  256 pixels, and 1 to 2 excitations.

MR images were evaluated for the presence or absence of disk displacement and disk morphology. Normal disk position in the sagittal plane was defined as the posterior band of the disk being at the 12 o'clock position relative to the condyle, whereas anterior disk displacement was defined as the posterior band of the disk being in an anterior position relative to the superior part of the condyle. The degree of anterior disk displacement was categorized as slight, moderate, or severe and was defined according to the findings of the closed-mouth images. Slight displacement occurs when the posterior band of the disk is located in the articular surface of the condyle. Moderate displacement occurs when the posterior band of the disk is located in the posterior surface of the eminence yet is not contacting the articular surface of the condyle. Severe displacement occurs when the posterior band of the disk is located at the bottom of the articular eminence. Side-ways displacement was defined as the disk crossing

over one of the lines through the condylar poles in the medial and lateral direction<sup>6</sup> (Figure 1).

Disk morphology was also evaluated in the closed-mouth position. The biconcave type was defined as normal, whereas the other types (biconvex, enlargement of posterior band, even thickness, and reversed) were all considered to be deformities<sup>7</sup> (Figure 2).

## Treatments

The treatment for intermittent closed lock consisted of the disk repositioning exercise<sup>8</sup> combined with the anterior repositioning splint.<sup>9</sup> Arthrocentesis<sup>10</sup> was performed if needed.

The disk repositioning exercise protocol was as follows: (1) opening the mouth maximally with the opening click; (2) closing the mouth along the protrusive border movement path; (3) contacting the teeth in the protruded position; (4) retruding to a contact position just before the click; and (5) opening the mouth maximally again without the opening click. This exercise was repeated for 5 minutes before each meal, and the patient must maintain the disk repositioning mandibular position all day if possible. Repositioning splints were used to keep the disk repositioning mandible position during sleeping. Arthrocentesis was performed for patients who did not experience improvement and for cases wherein troubles in daily life were predicted to shorten the treatment period greatly.

Patients who experienced the complete cessation of locking and absence of clicking during palpation were defined as in the effective group, and patients who had no change in the frequency of locking or progressed to permanent lock were defined as in the ineffective group. In addition, the longevity of the curative effect was judged 3 months after each medical treatment began.

## Data analysis

The clinical data, the treatment method, and the clinical outcome were collected retrospectively from the patients' records. The clinical parameters included pain on clicking and masticatory pain.

We compared the MRI findings between the patients with and without intermittent closed lock by using Fisher's exact test and Pearson's chi-square test. The clinical and MRI findings of the effective group were compared with those of the ineffective group. A comparison examination of both groups was statistically carried out at the time of the initial visit by using Fisher's exact test. Statistical analysis was performed using SPSS 18.0 (SPSS, Chicago, IL). A *P* value of .05 was considered statistically significant.

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