

— 原著 —

Imaging Analysis of the Temporomandibular Joint after Intraoral Vertical Ramus Osteotomy for Treatment of Patients with Reducible Disc Displacement

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Abstract: In order to clarify the mechanism of improving signs and symptoms after intraoral vertical ramus osteotomy (IVRO) in patients with reducible disc displacement of the temporomandibular joint, post-operative changes of the mandibular head and disc in eight patients ranged in age from 17 to 25 years (Ave. 20.0 years) were evaluated using lateral transcranial radiographs and computed tomography (CT).

IVRO resulted in antero-inferior repositioning of the mandibular head with an increase in the joint space. Clinical signs and symptoms were improved in all cases, but disc position was unchanged. In five joints, a double contour line of the mandibular head was observed on CT.

In conclusion, it was considered that this procedure was effective in alleviating signs and symptoms of patients with reducible disc displacement of the TMJ, and it was suggested that the condylar position to the articular fossa played a more important role in appearance of signs and symptoms than the disc position in these patients.

抄録：顎関節内障，復位を伴う関節円板前方転位症例に対する下顎枝垂直骨切り術（IVRO）の効果機序を明らかにすることを目的に，側斜位経頭蓋撮影法およびCTを用いて手術前後の顎関節部の骨形態変化や下顎頭・関節円板の位置変化について画像的に検討した。対象は，顎関節症状を主訴に新潟大学歯学部附属病院第二口腔外科を受診し，復位を伴う関節円板前方転位の診断にて，IVROを施行した8名（男性1名，女性7名）9関節である。症例の手術時年齢は17～25歳（平均20.0歳），術後の再調査までの期間は6～20か月（平均10.2か月）であった。その結果，術後患側下顎頭は前下方に移動し，関節隙の拡大が認められた。術前に認められた顎関節症状は術後には完全に消失したが，全例関節円板は依然復位を伴う前方転位の状態を呈していた。また，5関節で下顎頭後上方の骨添加像が観察された。以上の結果から，復位を伴う関節円板前方転位症例にIVROを施行した際，関節円板の解剖学的な整位が得られなくとも，術後の下顎頭の位置変化に伴い関節隙が拡大することにより顎関節症状が改善されるものと考えられた。

Introduction

Recently, intraoral vertical ramus osteotomy (IVRO) has been applied for treatment of internal derangement of the temporomandibular joint (TMJ),

and several successful cases have been already reported¹⁻⁶⁾. However, the mechanism of improving signs and symptoms after IVRO is uncertain. We evaluated pre- and post-operative images of the TMJ using lateral transcranial radiographs and computed tomography (CT), and discussed the mechanism of the

effects of IVRO for treatment of patients with reducible disc displacement.

Subjects and Methods

Subjects (Table 1) were eight patients (one male and seven females) referred to our department complaining of TMJ symptoms, occlusal disturbance and/or mandibular asymmetry. The patients ranged in age from 17 to 25 years with an average of 20.0 years. In nine joints of eight patients with TMJ symptoms, internal derangement with reducible disc displacement was diagnosed using CT⁷⁾. Post-operative morphology of the mandibular head, and position of the mandibular head and articular disc were compared with pre-operative ones using lateral transcranial radiographs and CT. CT (SIEMENS, SOMATOM DR3) was taken parallel and at 45-60 degree to Reid's basal line with 2mm slice width / interval with the mouth closed and opened. The position of a disc was evaluated with the soft tissue display mode (window width 250HU / window level 40HU). Morphology of the mandibular head was analysed with the bone display mode (super-high resolution mode, window width 4094HU / window level 1000HU).

Operation and post-operative physical therapy

IVRO was performed in nine sides with TMJ internal derangement. Sagittal splitting ramus osteotomy (SSRO) was conducted in the remaining seven sides without internal derangement in order to obtain post-operative occlusal stability. On IVRO, the masseter

No	sex	age (years)	IVRO side	IMF* period (weeks)	follow-up (months)
1	F	18	R	6	6
2	F	18	L and R	6	6
3	F	20	R	4	14
4	F	25	L	4	6
5	F	19	R	5	10
6	F	19	L	6	20
7	F	24	L	4	15
8	M	17	L	4	8

L : left side, R : right side

*IMF : intermaxillary fixation

muscle was detached from the lateral surface of the mandibular ramus which was cut vertically using a reciprocating saw. Then, the inferior part of the medial pterygoid muscle was also detached from the condylar segment. We performed neither repositioning nor fixation of the condylar segment. On SSRO, each condylar segment was not fixed rigidly with several screws bicortically but fixed mildly with a mini-plate. After surgery, intermaxillary fixation (IMF) was maintained for 4-6 weeks. Immediately after release of IMF, physical therapies including mouth opening exercise were initiated, while intermaxillary elastics were placed during the night to maintain occlusal stability for about one month. The duration of follow-up after surgery ranged from 6 to 20 months with an average of 10.6 months.

Table 2. pre- and post-operative clinical signs and symptoms

No	side	MMO(mm)*		TMJ click**		TMJ pain		muscle pain	
		pre	post	pre	post	pre	post	pre	post
1	R	46	45	HR	(-)	(+)	(-)	(+)	(-)
2	L	46	48	HR	(-)	(+)	(-)	(+)	(-)
	R	46	48	HR	(-)	(+)	(-)	(+)	(-)
3	R	32	44	HR	(-)	(+)	(-)	(+)	(-)
4	L	46	41	HR	(-)	(+)	(-)	(+)	(-)
5	R	32	44	SS	(-)	(+)	(-)	(-)	(-)
6	L	48	40	SR	(-)	(+)	(-)	(-)	(-)
7	L	49	50	SR	(-)	(+)	(-)	(-)	(-)
8	L	50	44	SS	(-)	(+)	(-)	(-)	(-)

* MMO : maximum mouth opening range

** HR : hard reciprocal click

SR : soft reciprocal click

SS : soft single click

Results

Clinical signs and symptoms

Clicking sounds and pain associated with mandibular movement, which were found in all cases before surgery, were completely disappeared. Muscle pain, which was found in five cases, were also disappeared. None of patients complained of difficulty in opening the mouth more than 40mm after surgery (Table 2).

Condylar position

Spontaneous antero-inferior repositioning of the mandibular head resulted in widening of the joint space in all cases as shown in figure 1. Subsequent change of the position of the mandibular head was maintained through the follow-up in all cases.

Disc position

Post-operatively, a disc still remained anteriorly with the mouth closed on CT in all joints with anterior disc displacement (Figure 2, 3).

Morphologic changes of the mandibular head

There were no detectable bony changes of the mandibular head before surgery. After surgery, in 5 joints of 4 patients, a double contour line on the postero-superior part of the mandibular head was observed on CT (Figure 4, 5). But any other abnormal bony changes such as erosions and osteophytes were found in none of our cases.

Discussion

The mechanism of improving signs and symptoms associated with reducible disc displacement after IVRO

From recent post-operative studies with MRI, it has become clear that the displaced disc was still remained in most cases even if signs and symptoms of the TMJ had improved after open surgeries or arthroscopic surgeries⁸⁻¹⁰, furthermore in wearing of the anterior repositioning appliance despite of a widening joint space¹¹. On the other hand, Hall et al.⁵ reported that 72 percent of 43 joints were found to have a normal disc-condylar relationship after IVRO. In the present study, recapturing a displaced disc was estab-

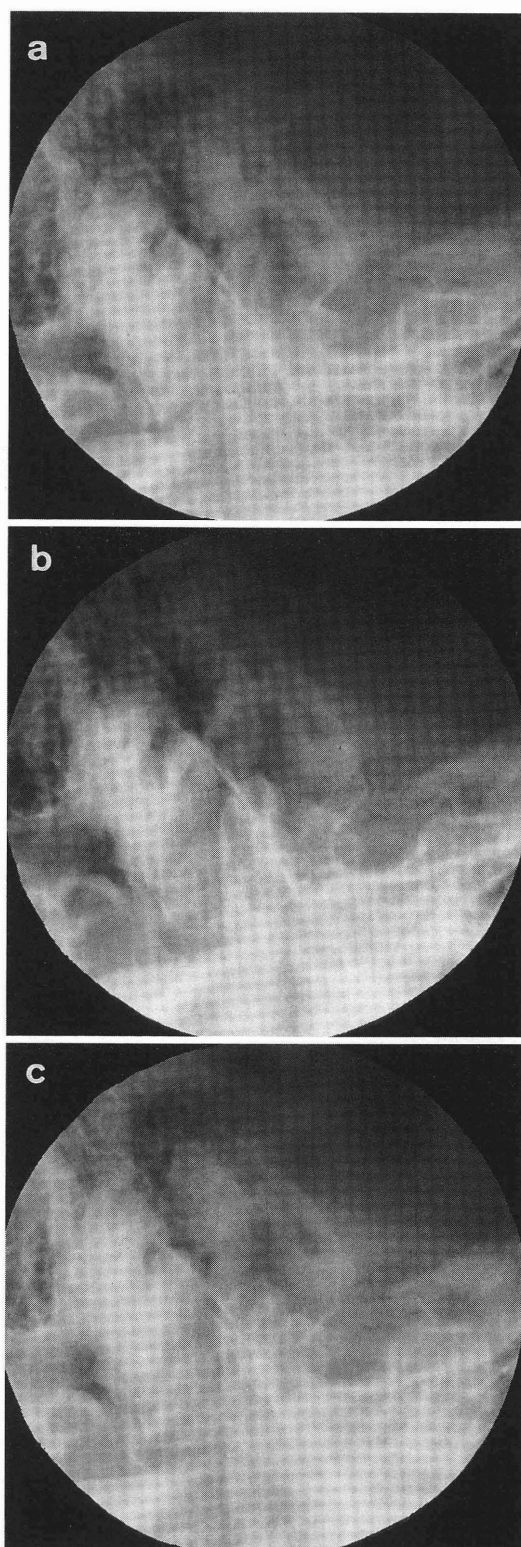


Figure 1 : Lateral oblique transcranial projection of right TMJ (case 1). Pre-(a) and post-operative (b: post-op. 1 day, c: post-op. 6 months) images. Note the antero-inferior repositioning of the mandibular head (b), which remained during a follow-up (c).

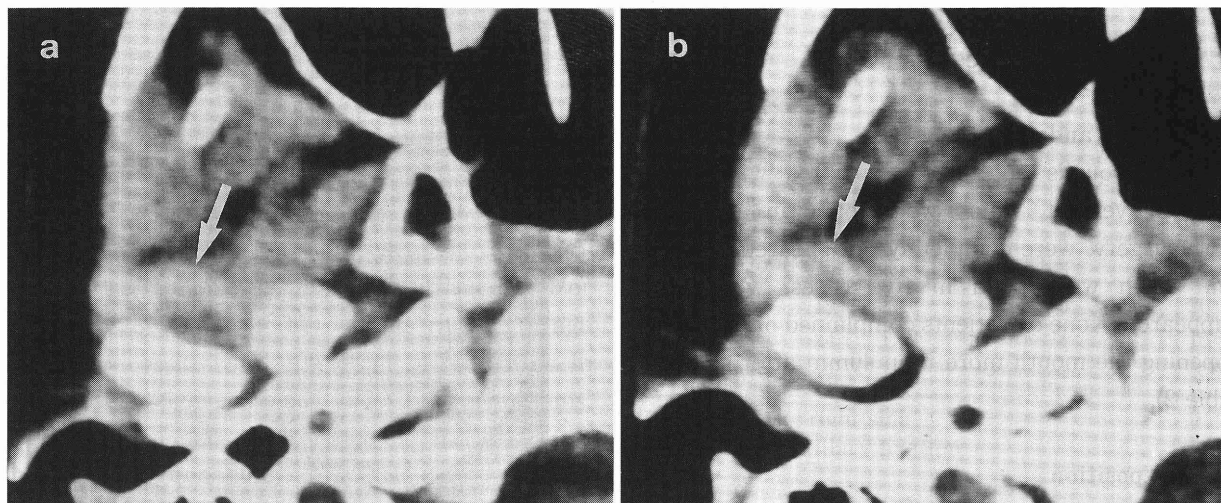


Figure 2: TMJ X-ray computed tomography in axial section (case 1). Pre-(a) and post-operative (b; post-op. 6 months) images. After IVRO, anteriorly displaced disc (arrow) of right TMJ was unchanged in closed mouth position.

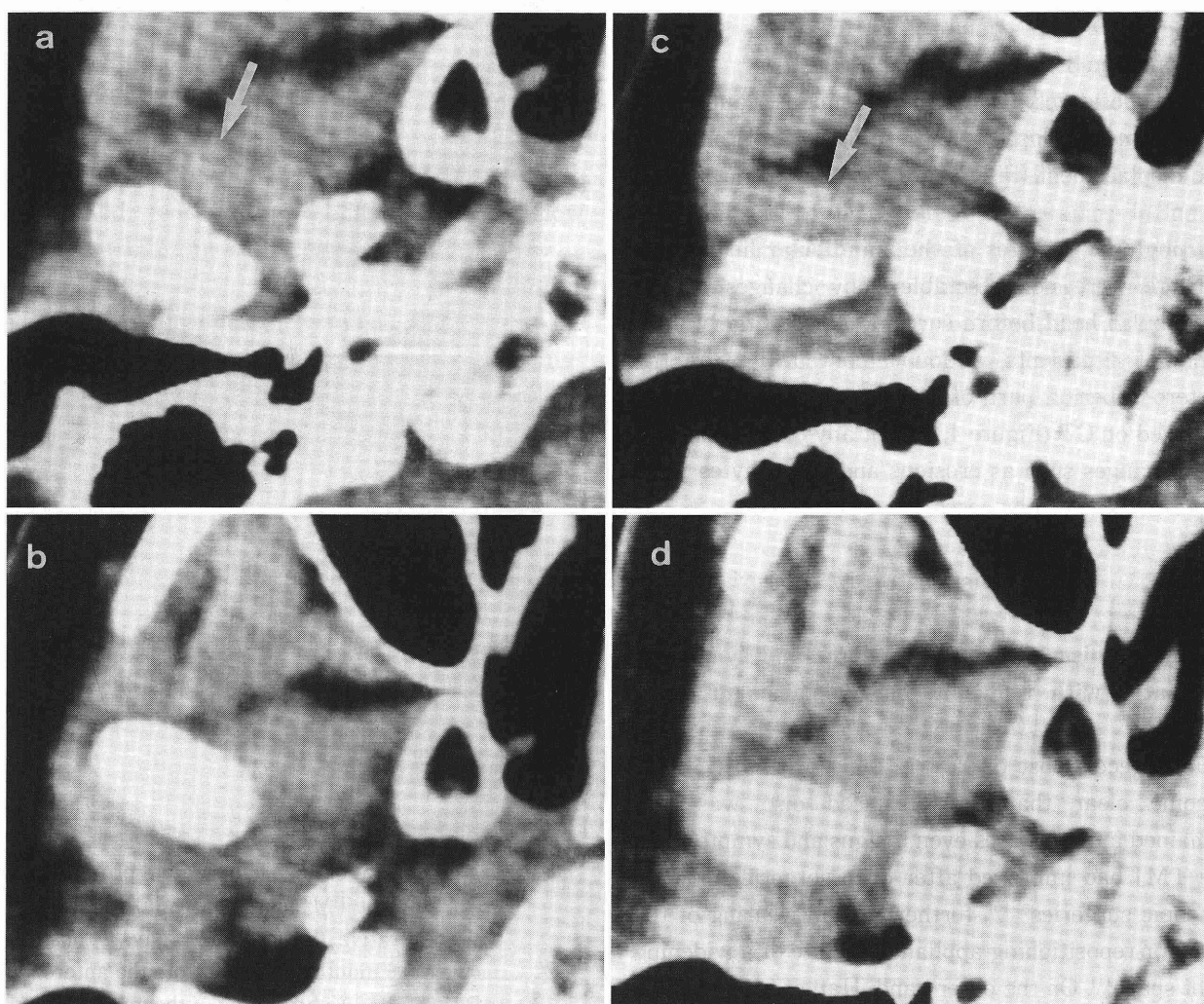


Figure 3: TMJ X-ray computed tomography in axial section (case 2). Pre-(a, b) and post-operative (c, d; post-op. 6 months) images. After IVRO, anteriorly displaced disc (arrow) of right TMJ was unchanged in closed mouth position. In opened mouth position, the disc is reduced (b, d).



Figure 4 : TMJ X-ray computed tomography in axial section (case 2). Pre-(a) and post-operative (b ; post-op. 6 months) images. After IVRO, a double contour line (arrowheads) in the postero-superior part of mandibular heads was observed.

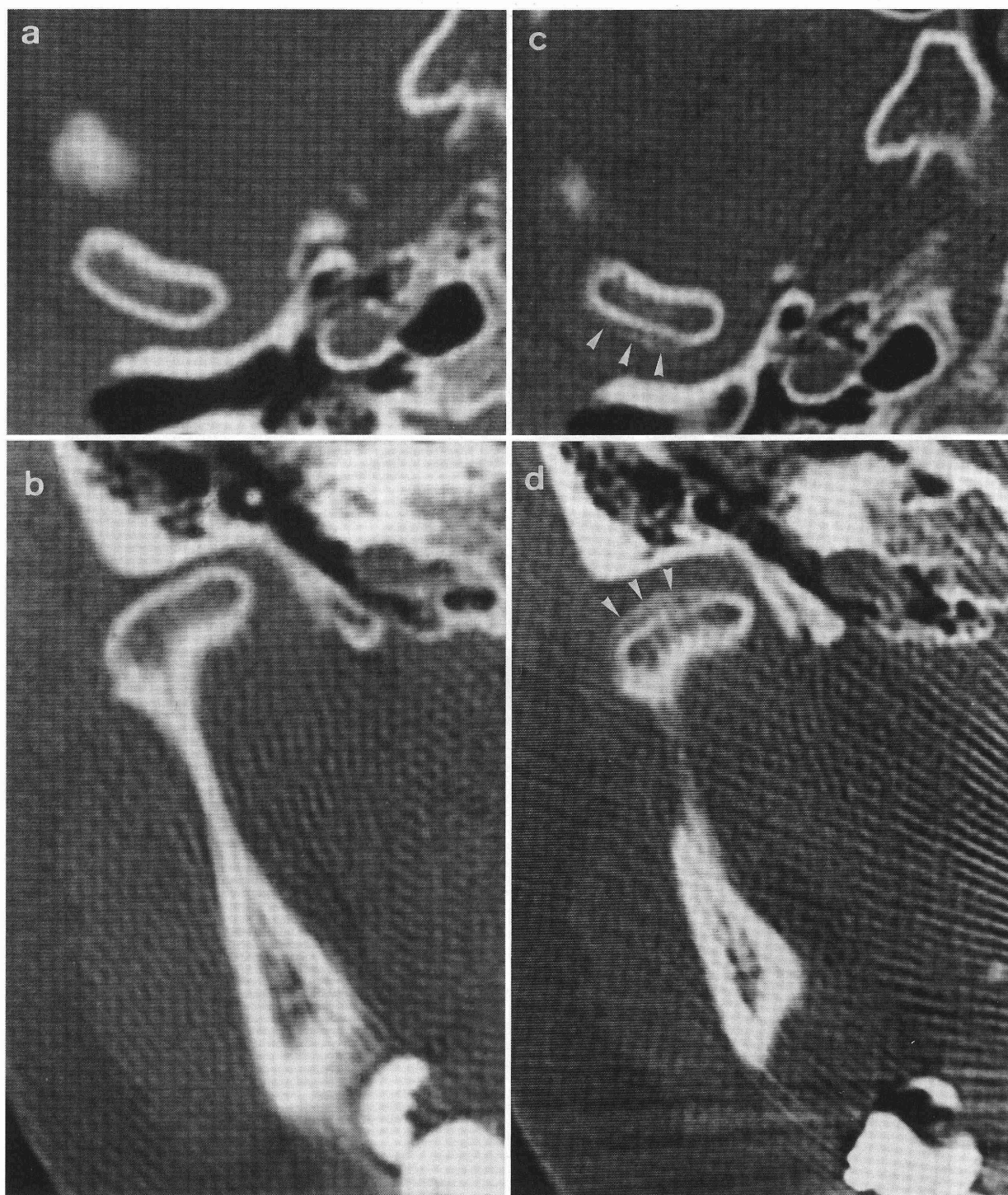


Figure 5 : TMJ X-ray computed tomography in axial and coronal (45 degree to RBL) section (case 3). Pre-(a, b) and post-operative (c, d ; post-op. 14 months) images. After IVRO, a double contour line (arrowheads) in the postero-superior part of right mandibular head was observed.

lished in none of the cases by surgery, whereas a widely spread joint space was obtained. In our opinion, it is difficult to recapture the disc to the mandibular head after morphologic changes of articular disc and/or mandibular head in patients with internal

derangement. Regardless of the disc position, however, the clinical signs and symptoms were completely disappeared post-operatively. Bell et al.¹²⁾ also reported that success of this procedure was predicted on producing a more functional articular disc-condylar

relationship in consequence of the antero-inferiorly repositioned condylar segment. Based on these findings, a critically contributing factor for improving clinical signs and symptoms seems to establish a widely spread joint space. Furthermore, the width of joint space was related to the detached muscles during operation. By detaching the masseter and medial pterygoid muscles from the condylar segment, the lateral pterygoid muscle pulls this segment antero-medially. If these muscles are not detached, however, the superior position of the condylar segment is remained. Hall et al.⁵⁾ states that if the inferior 50 percent of the medial pterygoid muscle is detached from the segment, there is the modest sag of the mandibular head in an antero-inferior direction. Based on these data including our results, it is important to detach the medial pterygoid muscle from the condylar segment to some extent in order to obtain an appropriately wide joint space resulting in improvement of clinical signs and symptoms.

Postoperative bony changes of the mandibular head

In five joints of four patients, a double contour line in the postero-superior part of the mandibular head was observed on CT (Figure 4, 5). Westesson et al.¹³⁾ have already reported that a double contour line in the posterior part of mandibular head was recognized after occlusal treatment in about half of the patients with temporomandibular disorders. They interpreted this bony change as a sign of adjustment to the new functional situations. Any other abnormal bony changes such as erosions and osteophytes were found in none of our cases. Furthermore, in cases in which a double contour line was observed post-operatively, there were no signs of recurrence during their follow-up. Therefore, it was suggested that a double contour line of the mandibular head was an adaptive change in response to new circumstances of the TMJ.

Conclusions

We undertook imaging analysis of morphologic and positional changes of the mandibular head and disc in nine joints (eight patients) with reducible disc displacement of the TMJ after IVRO.

After the operation, clinical signs and symptoms were improved in all cases. The mandibular head was spontaneously repositioned antero-inferiorly, and the

joint space was widely spread, though anteriorly displaced disc with reduction was unchanged in all cases. A double contour line of the mandibular head was recognized in five joints, that was thought to be a change of the mandibular head adapting to newly established circumstances of the TMJ.

In conclusion, it was suggested that this procedure was effective in alleviating signs and symptoms of patients with reducible disc displacement of the TMJ because the joint space was widely spread as a result of the repositioning of the mandibular head, without recapturing of an articular disc.

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