

# Range and pattern of mandibular opening in patients with anterior displacement of temporomandibular disc without reduction

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## Abstract

**Introduction.** Impairment of mandible mobility model is one of the criteria for clinical diagnosis of temporomandibular joint (TMJ) disc displacement.

**Objectives.** Analysis of the range and pattern of the mandibular opening in patients with anterior disc displacement without reduction.

**Materials and method.** According to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) the range and pattern of mandibular opening were analyzed in 49 patients (45 women and 4 men) with uni- and bilateral anterior disc displacement without reduction on MR imagines.

**Results.** The average range of opening in patients with unilateral lack of disc reduction was 33.74 mm, and 28.93 mm in patients with bilateral lack of reduction. The difference between the average range of opening in both groups was statistically significant ( $p < 0.05$ ). Uncorrected mandibular deviation was the most frequent opening pattern in patients with unilateral lack of reduction (19 out of 35 cases). In 11 out of 14 cases with bilateral lack of reduction the straight opening pattern was found.

**Conclusions.** TMJ disc displacement with bilateral lack of reduction during opening can cause greater opening limitation than unilateral lack of reduction. Anterior disc displacement without reduction in the MR images can clinically present with limitation of mandibular opening as well as correct range of this movement, which can cause difficulties in the clinical diagnosis of these problems.

## Key words

temporomandibular joint disorders; temporomandibular joint disc; magnetic resonance imaging

## INTRODUCTION AND OBJECTIVE

Clinical analysis of mandibular mobility model is a basic examination to assess the condition of the masticatory system, including function of the condyle-disc complex of the temporomandibular joint (TMJ). Analysis of free mandibular movements includes measurement of the range of movements, including range of mandibular opening as well as the assessment of the pattern of this movement. The range of the mandibular opening measured between the incisal edges of the upper and lower medial incisors according to different authors should be from 40 to 60 mm, and have a straight pattern without lateral deviations [1, 2].

Limited range of mandibular opening below 35 mm and hard end-feel are one of the main criteria for identifying the anterior disc displacement without reduction [3].

Nevertheless, in many cases, precise diagnosis of intra-articular disorders can not be made solely on the basis of a clinical examination, because clinical methods for diagnosis of TMJ disorders, including the assessment of the disc position have certain documented limitations. Only the use of magnetic resonance (MR) images which is recognized as the gold standard in the diagnosis of intra-articular disorders

allows for precise visualization and evaluation of the TMJ disc function in any position of the mandible without exposing the patient to the radiation [4].

According to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC / TMD), clinical symptoms of anterior disc displacement in cases of unilateral lack of disc reduction with limitation of the mandible opening are accompanied by uncorrected mandibular deviation towards the joint in which the reduction does not occur [3, 5].

The literature rarely describes cases of disc displacement with bilateral lack of reduction [6]. We were not able to identify reports comparing of the range and pattern of mandibular opening in both types of these displacements.

The aim of this study was to analyse the range and pattern of the mandibular opening in patients with anterior disc displacement without reduction on one or both sides in the sagittal plane on MR imagines. A research hypothesis was formulated that the range of mandibular opening is decreased in people with bilateral lack of disc reduction compared to people with unilateral lack of reduction.

## MATERIALS AND METHODS

MR images of TMJs were retrospectively analysed in patients seeking treatment for TMD, in whom TMJ disc displacement was suspected on the basis of the interview and clinical examination. MRI investigations of the TMJs were carried

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out in intercuspal position (IP) and open-mouth position (OMP), using silicon bite indices. All patients underwent bilateral MRI examinations of TMJs with a TMJ surface-coil. MRI images were done with the aid of a 1.5-T MRI unit (Eclipse 1.5T; Picker). PD, T1, T2\*-weighted fast spin-echo. MRI was performed in the oblique sagittal and the coronal projection.

Two experienced observers separately evaluated MR images. The observers were evaluated beforehand during a calibration session, at which interobserver reliability assessment revealed acceptable agreement ( $\kappa = 0.78$ ). In cases of disagreement, the final assessment was made by consensus. The Bioethics Committee of the Medical University of Lublin, Poland approved this study (no. KE-0254/11/2015).

The MR images of 49 patients (45 women and 4 men) with uni- and bilateral anterior disc displacement without reduction were qualified for the presented study [7].

The age of participants ranged from 14 to 55 years. Patients with a history of facial trauma, systemic inflammatory arthritis, TMJ tumour or TMJ surgery were excluded from the study.

Afterward the range and pattern of the mandibular opening of selected patients were also analysed. The range of mandibular was measured in millimeters on the day of the MR examination using a ruler with a millimeter scale as the distance between the incisal edges of the upper and lower medial incisors corrected by the vertical incisal overlap. The deviation pattern was classified according to RDC/TMD as:

- straight
- corrected deviation
- uncorrected deviation.

The obtained data were analysed using IBM SPSS Statistics Version 22 software. The inter-observer reliability of measurements was assessed using kappa statistic (Cohen's kappa,  $\kappa$ ). Student's t-test was used for uncorrelated data to test the significance of differences between means. The level of significance was set at  $p < 0.05$ .

## RESULTS

The analysis of MR images of 49 patients revealed anterior disc displacement without reduction on one side in 35 cases and on both sides in 14 cases (Table 1, Figure 1 and 2).

**Table 1.** Temporomandibular disc displacement and range of mandibular opening

Anterior disc displacement	n	Range of mandibular opening (mm)					
		$x_{\min}$	$x_{\max}$	$\bar{x}$	SD	t	p
Without reduction on one side	35	21	46	33.74	7.71	2,072	< 0.05
Without reduction on both sides	14	18	36	28.93	6.29		

The average range of opening in patients with unilateral lack of disc reduction was 33.74 mm (minimum 21 mm, maximum 46 mm), and 28.93 mm (minimum 18 mm, maximum 36 mm) in patients with bilateral lack of reduction. The difference between the average range of opening in both groups was statistically significant (Table 1,  $p < 0.05$ ).

Uncorrected mandibular deviation was the most frequent opening pattern in patients with unilateral lack of reduction

**Table 2.** Temporomandibular disc displacement and pattern of mandibular opening

Anterior disc displacement	n	Pattern of opening		
		straight	corrected deviation	uncorrected deviation
Without reduction on one side	35	5	11	19
Without reduction on both sides	14	11	2	1

(19 out of 35 cases). In 11 out of 14 cases with bilateral lack of reduction the straight opening pattern was found (Table 2).

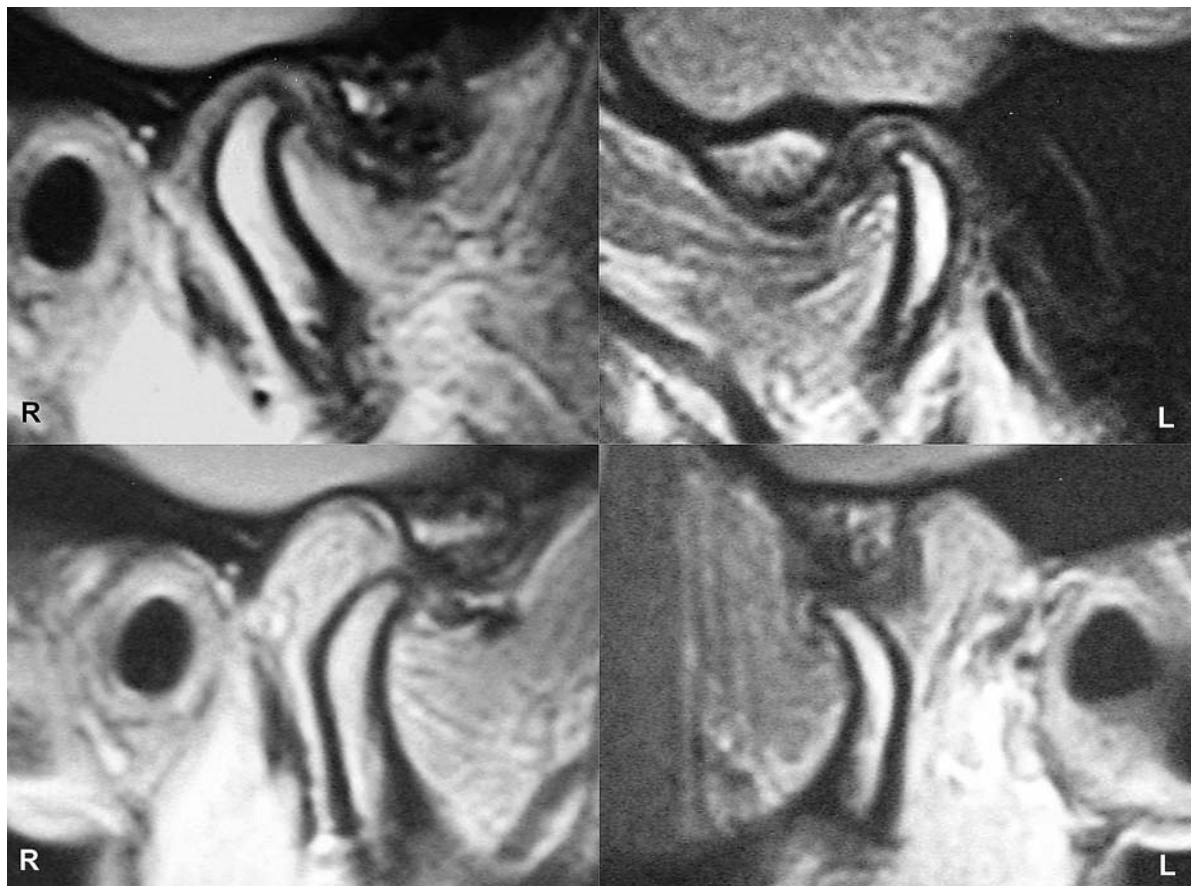
## DISCUSSION

Analysis of free mandibular movements, among them the measurement of the range of mandibular opening is the basic clinical examination in diagnosing of TMJ disc displacement. The clinical differentiation of disc displacement with and without reduction is based mainly on the occurrence or absence of reciprocal clicking and the accompanying specific disturbances of the mandibular mobility [4]. Definitely, the use of MR imaging, that allows the visualization of the articular disc, greatly expands the diagnostic possibilities of these disorders.

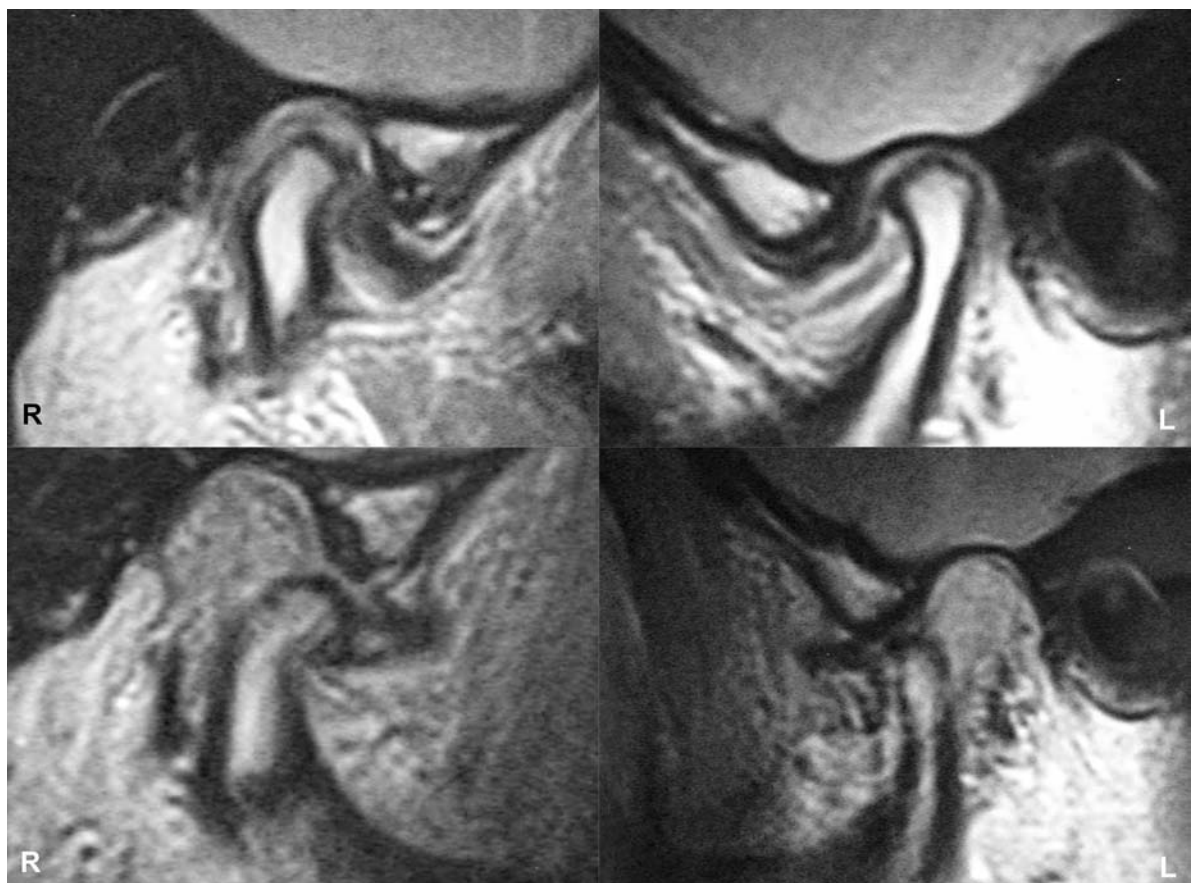
Literature data show that the agreement between clinical and MRI diagnosis of TMJ disc displacement varies from 59 to 90% and seems to result from the methodology and diagnostic criteria adopted in various studies [4, 8–10]. The greatest non-compliance concerns the disc displacement without reduction in cases without restriction of the mandibular opening according to RDC/TMD. The conducted research confirmed that anterior disc displacement without reduction in the MR images can clinically present the limitation of the mandibular opening as well as the correct range of this movement, which causes difficulties in clinical diagnostics of these displacements (Table 1). In presented study the range of mandibular opening was 18 to 46 mm, which also shows that there is a probability of making a false diagnosis of the type of disc displacement based on the limitation of the range of the opening.

Lack of disc reduction during opening may limit the range of this movement by mechanically blocking or even completely preventing translational movement in the affected joint [11]. In our study the smallest (only 18 mm) range of mandibular opening was found in the group of patients with bilateral lack of disc reduction (Table 1). This range indicates that during opening only rotational movement occurs in the lower TMJ compartment. Additionally, in most cases with bilateral lack of reduction a significant limitation of the opening was accompanied by a straight opening pattern. Such a model of mandibular mobility without deviation probably results from the same type of disc displacement in both joints.

However, it is worth noting that the majority of patients with unilateral absence of reduction presented uncorrected mandibular deviation during opening and a statistically significantly larger mean range of this movement (Table 1). In these cases, greater opening range can be explained also by the possibility of compensating movement in the second joint in which the full disc reduction takes place, which is not possible in the patients with bilateral lack of reduction.



**Figure 1.** Bilateral anterior disc displacement in the sagittal plane without reduction in the right temporomandibular joint (above).



**Figure 2.** Bilateral anterior disc displacement in the sagittal plane without reduction in both temporomandibular joints (below).

In the conducted studies, cases with a range of opening up to 46 mm occurred in the group of patients with unilateral lack of reduction, which is consistent with longitudinal studies describing the natural development of intra-articular disorders in cases with disc displacement without reduction. In patients who have not taken treatment the range of opening may progressively increase or even return to norm [12–15].

The presence of a proper range of opening in cases with chronic disc displacement without reduction may probably result from the following remodeling and adaptation of TMJ tissues, including changes in the shape of the articular disc, its elongation and loss of biconcave shape, as well as the elongation of the posterior attachment. These changes allow increasing the range of mandibular motion, and even in some patients, returning to the normal range of movements [6, 16–20].

The increase of the range of mandibular opening can be accompanied by changes in the opening pattern, such as appearance of corrected deviation or even straight path, which was observed in the examined patients (Table 2).

The presented research confirms that the clinical analysis of mandibular movements including the opening range and pattern can not be solely the basis for identifying the TMJ disc displacement without reduction and indicate the necessity (advisability) of conducting further research on the clinical symptoms of intra-articular disturbances in order to improve the diagnosis of these disorders.

## CONCLUSIONS

TMJ disc displacement with bilateral lack of reduction during opening can cause greater opening limitation than unilateral lack of reduction. Anterior disc displacement without reduction in the MR images can clinically present with the limitation of the mandibular opening as well as with correct range of this movement, which can cause difficulties in the clinical diagnosis of these problems.

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