

# Case Report of a Posterior Disc Displacement Without and With Reduction

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*This article presents the case of a patient with an acute posterior disc displacement without reduction (PDDWR), whose temporomandibular joint (TMJ) showed, after physiotherapeutic manipulation, the characteristics of a posterior disc displacement with reduction (PDDR). Opto-electronic condylar movement recordings in both the PDDR state and the PDDWR state, and magnetic resonance imaging (MRI) scans of the TMJ in the PDDR state were carried out to document the case. The first 2 physiotherapeutic manipulations were initially successful in reducing the disc, but a few days later the joint showed a relapse to the PDDWR state. From the third manipulation on, now 12 months ago, the patient has been free of symptoms of the PDDWR state. Condylar movement traces of the joint in the PDDWR state indicated that the condyle was prevented from entering the fossa completely. The downward condylar movement deflections during the early phase of closing, recorded after the second manipulation, showed the reduction of the posteriorly displaced disc during closing. The movement recordings also showed that the PDDR could be eliminated by submaximal opening and closing movements. The MRI scans, taken after the third, successful manipulation, showed the disc to be in a normal position with respect to the condyle when the mouth was closed, and to be posteriorly displaced when the mouth was maximally opened. The case shows that manipulation techniques may successfully reverse an acute PDDWR into a PDDR. The technique of MRIs and condylar movement recordings show promise in further unraveling the morphological and clinical features of posterior disc displacements.*

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**D**isc displacements within the temporomandibular joint (TMJ) are examples of frequently occurring internal derangements. Anterior disc displacement with reduction is probably the one that is described most often. It is characterized by an anterior displacement of the articular disc in the closed jaw position that improves its structural relationship with the condyle during mouth opening.<sup>1</sup> Clicking sounds are the main symptom of anterior disc displacements with reduction. This condition is painless most of the time and only rarely does it hamper joint function. However, occasionally, the disc does not reduce on opening. It then stays permanently displaced with respect to the condyle, and the patient has difficulty in fully opening the mouth (closed lock).

A few studies also have reported a posterior disc displacement (PDD).<sup>2-8</sup> This condition, which is not well known, is described as a painful, sudden inability to close into maximum intercuspation, ie, into intercuspal position, as if an elastic material is present in the joint.<sup>3</sup> This latter description suggests that in the closed mouth position the disc is displaced posteriorly to the condyle. The absence of clicking sounds<sup>3</sup> indicates that there is no disc reduction on movement. This description fits the clinical condition of a disc that is permanently displaced: a PDD without reduction (PDDWR). Differential diagnosis, amongst others, of joint effusion may be considered for this condition. Unfortunately, descriptions of a PDD with reduction (PDDR) are very rare. Its main clinical symptom would be clicking on closing, not on opening.<sup>9,10</sup>

The aim of this study was to present the case of a patient with an acute PDDWR, whose joint showed, after physiotherapeutic manipulation, the characteristics of a PDDR. The case was documented with magnetic resonance imaging (MRI) and with condylar movement recordings.

## Case Report

### Clinical History

Two weeks before his visit to the clinic for Craniomandibular Disorders of the Department of Oral Function at the Academic Centre for Dentistry Amsterdam (ACTA), the 28-year-old subject experienced a sudden pain in the left TMJ during dinner. From then on, he had problems with chewing because of pain in the region of the left TMJ, and he was unable to occlude his posterior teeth because he felt an obstruction in the left TMJ. The patient had no history of TMJ pain, dysfunction, or trauma before this incident, nor was he aware of any traumatic event on either opening or closing during the aforementioned dinner.

Physical examination showed the subject to be an otherwise healthy young man. His maximum active mouth opening was 59 mm, which included an overbite of 2 mm. Lateral excursions were symmetrical and had a magnitude of 10 mm; the protrusive excursion was 8 mm. The left TMJ was painful upon preauricular and intra-auricular palpation. The patient occluded in an anterior position, resulting in a posterior open bite of approximately 1 mm at the level of the left first molar; the expected closed-mouth deviation of the mandible toward the unaffected side was not observed. The joint play test, during which manual disto-cranial

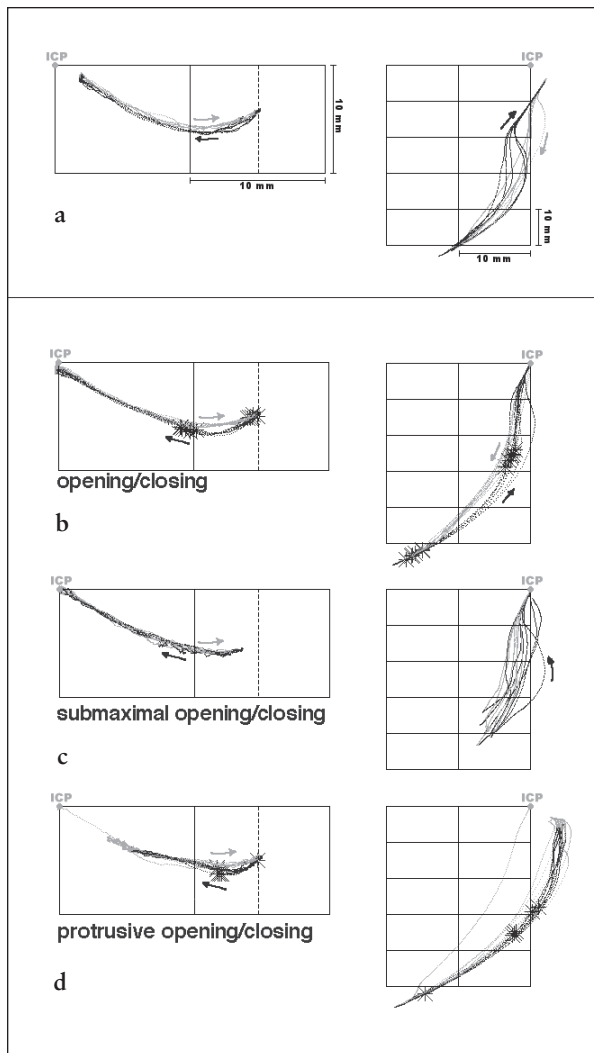
compression of the condyle into the fossa was exerted, was very painful on the left side. Based on these clinical findings and the oral history, a PDDWR was suspected.

A physical therapist was enlisted and was able to reduce the disc by manipulating the mandible in a caudal and dorsal direction with a firm but controlled force, a technique resembling the one that is commonly used in a downward and forward direction for the reduction of an anterior disc displacement without reduction. At the time of reduction, the patient and the physical therapist felt a sudden "pop" in the left TMJ. Subsequently, the patient was able to occlude again in intercuspal position. He was instructed not to open his mouth maximally to prevent another posterior displacement of the disc. However, 3 days later, the patient returned to the clinic with the same complaints. Again it was possible to reduce the disc with the aid of the manipulative techniques. Ten days after the initial visit, a third and final manipulative attempt had to be performed. From this time forward, the patient was free of symptoms of a PDDWR state, while, 12 months later, the PDDR symptoms (ie, soft opening clicks and louder closing clicks) have persisted. Only after the MRI taken at maximum opening did the subject temporarily experience his original symptoms. However, these lasted only about a day and disappeared without therapeutic intervention. An overview of the time course of this case is given in Table 1.

### Condylar Movement Recordings

Mandibular movements were recorded by means of the OKAS-3D system, which is an opto-electronic device capable of accurately recording mandibular motion with 6 degrees of freedom at a frequency of 300 samples per second.<sup>11</sup> With the use of rigid body mathematics, the movement traces of the kinematic center of the TMJ condyles<sup>12,13</sup> and those of the lower incisal point were reconstructed relative to the skull. Small condenser-type microphones were placed over the palpated lateral pole of the TMJs for the simultaneous recording of joint sounds. A specialized software procedure graphically visualized the recorded movement traces. The occurrence of a joint sound was depicted on these traces with an asterisk.

Two movement recordings were made, 1 before and 1 after the third manipulation of the PDDWR (Table 1). The traces from the second recording were used for reference, ie, the traces of the first recording were superimposed over those of the second recording. This was possible because the



**Fig 1a** Superimposed sagittal movement traces made before the third manipulation. The traces show the simultaneous recording of (*left*) the kinematic center and (*right*) the incisal point. The start and end points of the movement traces were anterior to their “original” intercuspal position, which was determined after the third manipulation. Hence, the figure shows that it was impossible for the left condyle to completely enter the fossa.

**Figs 1b to 1d** Results of the opto-electronic movement recordings after the third manipulation. Observed clicks are indicated with asterisks (\*). (*b*) The closing traces now show a downward deflection with respect to the opening traces until the time of clicking. Further, the sagittal movement traces of the incisal point and those of the left condyle were longer than before the manipulation, as they started and ended in the intercuspal position. (*c*) Recordings of submaximal opening and closing show that the clicks and the downward deflection in the closing traces were eliminated. (*d*) Opening and closing from and into a protruded position again showed the clicks and the downward deflection in the closing traces, indicating that the PDD was present.

**Table 1** Overview of the Time Course of the Case

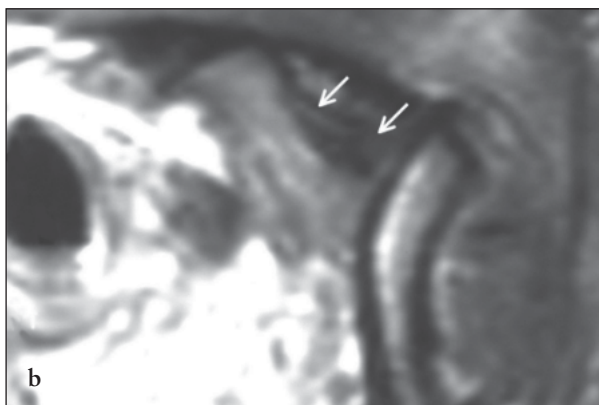
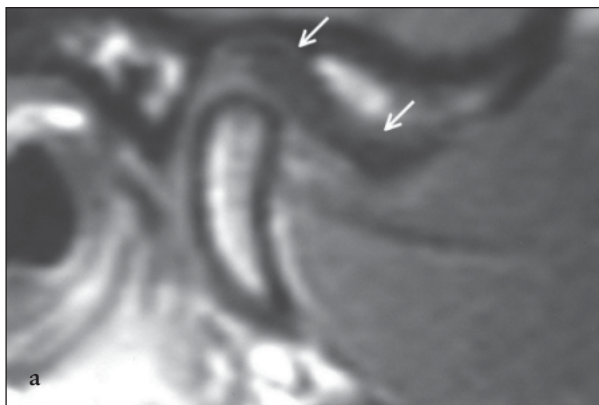
| Day | Event   |
|-----|---|
| 0   | Onset of sudden pain  |
| 14  | Intake, physical examination, first manipulative attempt (relapse within a day) |
| 17  | Second manipulative attempt (relapse within a day)                              |
| 21  | Opto-electronic movement recording  |
| 24  | Third manipulative attempt (successful), opto-electronic movement recording     |
| 54  | MRI   |

individually fitted clutches used to attach the lightweight frames of the photocells rigidly to the patient’s dentition<sup>11–13</sup> could be identically repositioned for the second recording.

Figure 1 shows the results of the movement recordings made before and after the third manipulation. Prior to the manipulation, the start and end points of the movement traces of the left kinematic point and that of the incisal point were anterior to the “original” intercuspal position, which was determined after the third manipulation. Apparently, it was impossible for the left TMJ condyle to completely enter the fossa (Fig 1a). After the manipulation, soft clicks at the end of opening and louder clicks during closing were recorded. The sagittal movement traces of the incisal point and those of the left kinematic point were longer than before the manipulation, as they started and ended in the intercuspal position. Furthermore, in the first part of closing, the sagittal traces of the kinematic point showed a characteristic downward deflection with respect to the opening traces (Fig 1b), that was not noted before the manipulation. Submaximal opening and closing from and into intercuspal position eliminated these downward closing deflections (Fig 1c), while opening and closing from and into a protrusive position (Fig 1d) did not. The transverse movement traces were straight lines, without lateral deviations at the time of clicking.

## MRI

T<sub>1</sub>-weighted MRI scans were performed 1 month after the last manipulation (Table 1), using a 1.5 T MRI system (Gyrosan NT Intera; Philips Medical Systems) with a surface coil used as receiver. The patient’s head was placed in a headrest in the MRI scanner. Nine sagittal and 9 coronal 3-mm interleaved images were taken (repetition time, 530 ms; echo time, 18 ms) with the teeth in intercuspal



**Figs 2a and 2b** MRIs showing that the disc (*arrows*) was in a normal position when the teeth came into intercuspal position (*a*) but was posterior of the condyle when the mouth was opened maximally (*b*).

position. Thereafter, a new series of nine 3-mm interleaved sagittal images were taken with the mouth maximally opened, using a resin bite block to secure the jaw position. For all images, the data matrix was  $205 \times 256$ , and the imaging time was 4 minutes and 21 seconds.

Figure 2 shows the images of the left TMJ with the PDDR. The articular disc appears in a normal position in the image taken in intercuspal position (Fig 2a), but it appears posterior to the condyle in the image taken at maximum opening (Fig 2b).

## Discussion

The occurrence of PDDWR has only been reported in a few publications,<sup>2-8</sup> which indicates that this subtype of TMJ internal derangement is relatively rare. However, since patients with this condition have pain and severe problems with chewing,<sup>3</sup> a better understanding of the mechanisms of PDDWR is needed. Although only the findings of

1 patient are described in this case report, they give a good insight into the possible mechanisms of PDD with and without reduction. Unfortunately, due to the long waiting list for MRIs, it was possible to take only MRI scans of the joint in the PDDR state; the condylar movements were however recorded with the joint in both the PDDRW and the PDDR states.

The short time frame in which many internal derangements of the TMJ occur sometimes makes it difficult, even for experienced clinicians, to establish a clinical diagnosis for the joint problem under examination. Condylar movement recordings might then be used as a more objective recording of the clinical examination. Because internal derangements are anatomic problems, MRI has an obvious additional diagnostic value as well. Although misdiagnosis of disc displacement is a known problem of MRI,<sup>14-16</sup> some researchers have reported the presence of a PDD on MRI in the closed mouth position.<sup>3,6,7</sup> In these reports, the PDD was clinically described as a sudden, painful inability to close the teeth into the intercuspal position, as if an elastic material was present in the joint.<sup>3</sup> The results of the present case suggest that these authors described a PDDWR. The present case report is, to the authors' knowledge, the first one that describes the successful manipulation of an acute PDDWR into a PDDR.

The MRI and the condylar movement recordings of this patient suggest the following possible mechanism for the PDDR. The disc was in its normal position with respect to the condyle when the mouth was closed, became posteriorly displaced in the final part of mouth opening, and restored its relationship with the condyle during mouth closing. Soft clicking sounds on opening and louder sounds on closing were the main signs of the PDDR. However, opening clicks were not reported by Wise et al<sup>9</sup> or Yoda et al<sup>10</sup> in their descriptions. This may be because the soft opening clicks are often difficult to observe during the clinical examination. The opening clicks recorded in this patient indicated the posterior dislocation of the disc at the end of mouth opening. The closing clicks and the concomitant characteristic downward deflections in the kinematic point movement traces in the early part of closing illustrated the slipping of the condyle over the anterior band of the disc. This mechanism of PDDR is in line with suggestions made earlier,<sup>9,10</sup> but in contrast to the mechanism described by Chossegros et al.<sup>7</sup> The latter authors state that for both the "reducible" (PDDR) and the "nonreducible" PDD (PDDWR), the disc is displaced backward when the mouth is closed, and that for

the “reducible” form, the disc resumes its normal position over the condyle in the opened position.

The mechanism suggested in this report explains why the test used to diagnose an anterior disc displacement with reduction, ie, opening and closing from and into a protruded position, did not eliminate the PDDR. Indeed, this kind of opening and closing did not prevent the disc from getting posteriorly displaced, because the displacement did not occur in the final phase of closing, as is the case for anterior disc displacements, but in the final phase of opening. For this reason, the test used to diagnose a PDDR is submaximal opening and closing. Whether the sudden onset of the PDDWR in this patient was preceded by an unnoticed PDDR is unfortunately unknown.

The mechanism postulated describes a complete PDD. However, from the literature on anterior disc displacements, it is known that a disc can be partially or totally displaced.<sup>17</sup> It is possible that the described patient had a partial PDD. This may explain the small difference in the length between the movement traces obtained before and after successful manipulation, as well as the lack of deviation of the mandible to the unaffected side when the patient attempted to close before the manipulation, ie, with the PDDWR.

As part of an ongoing study on the prevalence and etiology of TMJ clicking, approximately 100 condylar movement recordings of clicking TMJs have been made at the Department of Oral Function of ACTA. The recordings of 3 patients showed the same PDDR movement characteristics described here. One patient reported to have, once in a while, clinical symptoms similar to the PDDWR symptoms presented here, which lasted several weeks and disappeared spontaneously. In another of these patients, the closing click was not only much louder than the opening click but was also painful. This patient had found out by herself that the painful closing click could be eliminated simply by avoiding maximal opening of the mouth. It is clear that more research is needed to gain better insight into the morphological and clinical features of PDDs with and without reduction. Such research may very well include condylar movement recordings using the kinematic center for reference, because this condylar point is relatively insensitive to irregularities in the mandibular movement trajectories.<sup>13</sup>

The physical therapist was able to reduce the disc by using manipulation in caudal and distal directions. Although the treatment was only used in this single case, it suggests that a PDDWR may be reversed to a PDDR if treated sufficiently early. The manipulation had to be repeated several times,

despite instructions to the patient not to open his mouth maximally. From the third manipulation on, which was performed 12 months ago, the patient has remained free of symptoms. He only experienced some transient complaints after the MRI scans taken at maximum opening. The fact that the condition did not relapse after the third manipulation may be related to the fact that, in general, the effects of most instructions to patients only become effective after a certain period of time.

In conclusion, manipulation techniques may successfully reverse an acute PDDWR into a PDDR. MRI and condylar movement recordings, as techniques to document these cases, look promising in further unraveling the morphological and clinical features of PDDs.

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