

# Is It Time to Pay More Attention to Disc Position?

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*Most surgical and nonsurgical treatments of painful temporomandibular joint internal derangements are primarily directed toward relief of pain and dysfunction; correction of disc displacement is increasingly of lesser or no concern. However, internal derangements are variably progressive and, in some patients, cause condylar deformity with secondary deficiency of the mandible. If data support the hypothesis that condylar deformity and growth retardation can result from a displaced disc, and, conversely, that a normally positioned disc permits normal growth and maintains condylar mass, a goal of any treatment for reducing disc displacement should include reestablishment of a normal disc/condyle relationship. Functional appliance therapy for the deficient mandible may be most effective in those patients that present with a normal disc/condyle relationship; if a reducing disc is present, such therapy may be most effective only when the appliance advances the condyle to a position beneath the disc.*

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Some treatments for a painful temporomandibular joint (TMJ) with a displaced disc provide relief of pain while allowing the disc to remain displaced.<sup>1-9</sup> Therefore, restoration of a normal disc position is not always a necessary component of pain resolution, although it may increase the likelihood of pain relief.<sup>1,10,11</sup> Also, disc imaging studies of the TMJ show that it is common to have displaced discs without significant symptoms.<sup>12-15</sup> It is tempting to conclude that disc position is an unimportant consideration in selecting a mode of therapy, but this ignores the possibility that normal disc position may serve other key functions. The present report investigates the possibility that there are at least two other functions of a normal disc/condyle relationship:

1. Hypothesis 1: A normal disc/condyle relationship protects the condyle from degenerative joint disease. In addition to the issue of pain and its relationship to internal derangement, accumulating evidence suggests that disc displacement sometimes causes degenerative joint disease (DJD) and skeletal deformity.
2. Hypothesis 2: A normal disc/condyle relationship is necessary to realize the full genetic potential for mandibular growth. When internal derangements occur in children and are associated with mandibular deficiency, at least part of the deficiency may be the result of diminished growth secondary to the disc displacement.

## Disc Displacement, Condylar Deformity, and Skeletal Deformity

There is now a well-documented relationship between displaced discs and facial skeletal deformity. The relationship between condylar deformity and skeletal deformity when there is no evidence of systemic arthritis, as far as the authors can ascertain, was first reported independently by Boering<sup>17</sup> and Ricketts<sup>18</sup> in 1966. Both observed that the condition was often progressive and resulted in variable shortening of ramus height and/or length of the body of the mandible (Fig 1). More recent studies have used imaging techniques to document the association of a displaced disc and skeletal deformity.<sup>19-27</sup> More specifically, disc displacement correlates highly with the skeletal deformities of mandibular deficiency and/or open bite (Figs 2a through 3b)<sup>19,21-24,26,27</sup> as well as the shorter side (vertically or horizontally) in mandibular asymmetry.<sup>14,23-25</sup> The relationship between condylar deformity and disc displacement has been further defined (Fig 4).<sup>14,28,29</sup> One hundred percent of the deformed condyles were associated with a displaced disc, and 91% of these were nonreducing. Conversely, all joints with normal disc position had normal condylar morphology. Thus, there is an association between a displaced disc, especially a nonreducing disc, and radiographically detectable change in condylar morphology (ie, DJD) as well as a variable degree of facial skeletal deformity. Since disc displacement always preceded DJD and typically was a late-stage event, it seems probable that the two events are causally related and that disc displacement initiated the condylar changes, rather than vice versa.

When internal derangement occurs in a growing child,<sup>20,30</sup> the skeletal deficiency may be the result of loss of growth<sup>14,17,31</sup> as well as subtraction from

previously obtained growth,<sup>14,17</sup> such as when there is progression to DJD followed by loss of condylar bone. If there is both loss of growth and subtraction from previous growth, the mandibular skeletal deficiency is more severe than for either event alone. Furthermore, the earlier disc displacement occurs, the greater the effect, since growth would be impaired for a longer time.

## Prevalence of Condylar and Skeletal Deformity

The number of clinically significant facial skeletal deformities secondary to disc displacement must be known to determine the extent to which there is a need to try to prevent it by treatment. Probably the best estimate for the rate at which these changes occur in symptomatic subjects can be obtained from Boering,<sup>17</sup> who treated 400 patients with painful TMJs and followed them for 4 to 12 years. All treatments were nonsurgical with minimal intervention. He found that 45% of the patients showed alteration in condylar morphology when first examined. After reexamination 2 to 5 years later, alterations were present in an additional 20% of the cases. Wilkes<sup>16</sup> also has reported radiographic progression of regressive changes of the condyle in over 70% of his patients with painful internal derangements who had refused operations and were evaluated 5 to 14 years later. Lundh et al<sup>12</sup> observed that 23% of 70 joints with reducing disc displacement progressed to nonreducing disc displacement during 3 years of nonsurgical treatment. Disc position, however, was determined clinically, and only 9% of the 70 joints experienced significant limitation of motion (locking). Less is known about the incidence and prevalence of DJD and skeletal deformities in persons with asymptomatic or minimally symptomatic internal derangements. Internal derangements are common even in asymptomatic persons. One recent study of 70 asymptomatic subjects showed 24% of the joints had internal derangements as documented by MRI.<sup>33</sup> Yet, only a small proportion of those with displaced discs develop DJD and skeletal deformity. Both the reason that significant skeletal changes occur in some of these people and not others and the mechanism of these changes are unclear.

An estimate of the prevalence of DJD and skeletal deformity can be made for whites and the population as a whole. Mandibular deficiency, the most prevalent facial deformity, is highly correlated with skeletal Class II malocclusion.<sup>34</sup> Ten percent of 12-

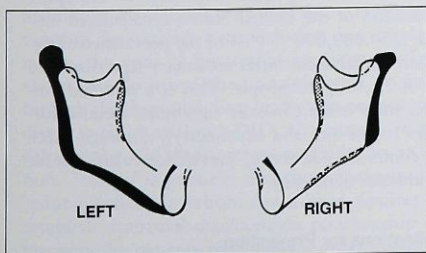
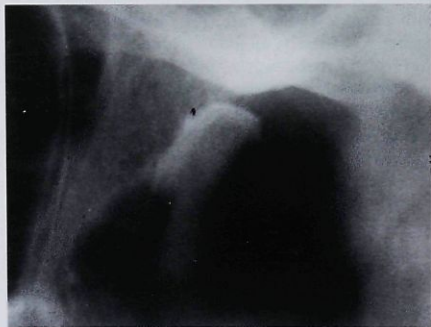


Fig 1 Tracing of right and left halves of mandible from cephalogram at ages 8 and 17 years. Adapted with permission from Ricketts.<sup>18</sup>



**Figs 2a and 2b** Mandibular deficiency, anterior open bite, asymmetry of the mandible, and DJD in a 37-year-old woman showing mandibular deficiency and deviation of the chin. Arthrograms confirm a nonreducing disc in both TM joints.



**Figs 3a and 3b** Transpharyngeal radiographs of the right and left condyles of patient in Figs 2a and 2b showing DJD.

to 17-year-old white youths were shown to have a Class II malocclusion with an overjet of at least 7 mm.<sup>35</sup> This 10% figure, moreover, probably underestimates the incidence, since mandibular deficiency may be present with a minimal overjet. Suppose that it were subsequently shown that 90% of mandibular deficiencies were in fact caused by a displaced disc, which on the basis of the high correlation of disc displacement in skeletal deformity,<sup>19,21-24,26,27,31</sup> seems quite reasonable. The prevalence of mandibular deficiency secondary to an internal derangement then could be calculated by multiplying the incidence of mandibular deficiency (10%) by the proportion of patients with a displaced disc (0.9) for an estimated incidence of 9%.

If one assumes the same incidence for the entire population of the United States, a calculated estimate ( $250,000,000 \times 9\%$ ) of the prevalence of significant facial deformities secondary to a displaced disc is 22,500,000 people. This is a minimal estimate, since other clinically significant facial deformities (open bite and asymmetry), although much less common, add to the prevalence calculated for mandibular deficiency.

#### Implications for Prevention

Enough facts about DJD and skeletal deformity are becoming clear to suggest some components of an interventional program. Since most of the persons

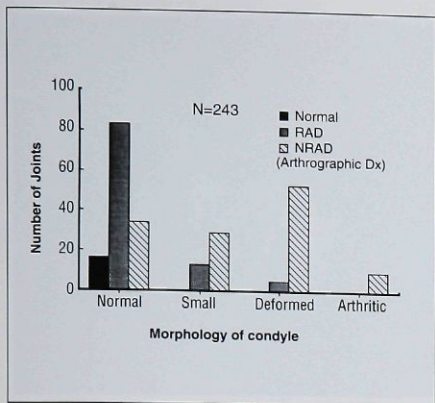


Fig 4 Relationship between condylar morphology and disc position.



Fig 5 Transpharyngeal radiograph 12 months after condylotomy. Condyle surgically repositioned anteriorly and inferiorly to reestablish a normal disc/condyle relationship. The bone between the outer and inner radiopaque lines on the posterosuperior aspect of the condyle represents new bone growth.

with mandibular deficiencies seem to be either asymptomatic or minimally symptomatic, a large number of persons would need to be screened. The screening test would need to be performed at an early age and perhaps more than once, since 10% of white youths aged 12 to 17 years already have significant mandibular deficiency.<sup>35</sup> Lastly, both the screening test and interventional procedure(s) would need to be safe, effective, and cost-efficient.

#### Implications for Functional Appliance Therapy

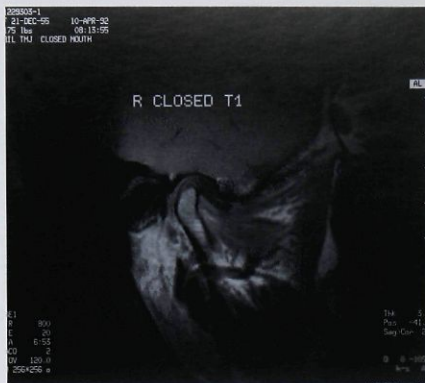
If growth is diminished by a displaced disc, then the failure of some patients to respond to functional appliance therapy could be explained by an inability to reestablish a normal disc/condyle relationship. In patients with reducing disc displacements, the goal of functional appliance therapy should be to move the condyle to a position beneath the displaced disc. In chronic nonreducing discs, with or without DJD, the extent of disc deformation and displacement preclude disc reduction. Thus, it is possible that those patients with reducing discs in whom functional appliances establish a normal disc/condyle relationship are precisely the patients who show a good mandibular growth response. This hypothesis is further supported by the finding that reestablishing a normal disc/condyle relationship in patients by surgi-

cally repositioning the condyle anteriorly and inferiorly to a position beneath the disc (condylotomy) typically results in a variable amount of growth of new condylar bone.<sup>36,37</sup> Growth seems greatest in young patients (Fig 5).

If the hypothesis is true that a normal disc/condyle relationship is a requirement for achieving the full genetic potential for growth, then disc imaging could identify patients who might benefit from functional appliance therapy (those having normal disc positions or reducing disc displacements) and patients who might benefit little if at all (those having nonreducing discs). Disc imaging would also be required to verify that forward positioning of the mandible with the functional appliance does reposition the condyle anteriorly and inferiorly sufficiently to reestablish a normal disc/condyle relationship, since the probability of reestablishing a normal disc/condyle relationship is poor when only clinical criteria are used.<sup>38,39</sup>

#### Implications for Treatment of the Painful Joint

If disc displacement does cause DJD and skeletal deformity, perhaps these changes can be prevented by reversing the internal derangement. The only data available comes from about 150 patients followed 1 to 8 years after modified condylotomy, a procedure that has been demonstrated to reestab-



**Figs 6a and 6b** MRI of right TMJ; closed mouth. (*Left*) disc displaced anteriorly and inferiorly (before condylotomy); (*right*) condyle has moved anteriorly and inferiorly, but the disc has also moved posteriorly and superiorly to reestablish a normal disc/condyle relationship (4 months after condylotomy).

lish a normal disc/condyle relationship in a high percentage of patients.<sup>37,40</sup> Only 2% of these patients developed DJD after this operation.<sup>37</sup> Boering<sup>17</sup> observed a ten-fold higher rate 2 to 5 years after only symptomatic treatment. Thus, these preliminary data suggest that reversal of the internal derangement might significantly reduce the subsequent occurrence of DJD.

The most common treatment for a painful joint with a reduced disc is nonsurgical. Restoration of the displaced disc to a load-bearing position does not appear to be a serious goal of nonsurgical treatment based on the paucity of reports with disc imaging after treatment.<sup>1,2,39</sup> Furthermore, the therapeutic position for repositioning splints is usually determined by clinical criteria, and studies show that predictable reestablishment of a normal disc/condyle relationship occurs only when disc imaging is used.<sup>33</sup> Arthroscopy is another treatment that rarely has as a goal reestablishment of a normal disc/condyle relationship, and disc imaging after arthroscopy confirms that continued disc displacement is the norm.<sup>3,4,8</sup> Even with surgical repositioning of the disc under direct vision, there is a relatively poor record of maintaining the disc in a normal position.<sup>7,9,11</sup> Modified condylotomy is the only surgical procedure that has been shown to reestablish a normal disc/condyle relationship frequently (72% to 95%) (Figs 6a and 6b).<sup>37,40</sup> This operation, however, is used by few surgeons. It is probably reasonable to say that most treatments do not reestablish a normal disc/condyle relation-

ship and thus do not prevent subsequent development of DJD and facial deformities.

## Conclusion

The immediate goals of treatment for a painful joint with a displaced disc are relief of pain and dysfunction, both of which might occur following a variety of treatments. It is also clear that reducing disc displacements are variably progressive and sometimes associated with subsequent development of DJD and facial skeletal deformity. A normal disc/condyle relationship seems to be a critical factor in protection against DJD and also for normal growth. Although the true prevalence of DJD or significant facial skeletal deformity caused by a displaced disc is not yet known, and neither are the factors that control rate and extent of progression, it is apparent that for mandibular deficiency alone, the problem is common enough and serious enough to suggest the need for a long-term goal of prevention. The authors also believe that it is now time to emphasize the value of a normal disc/condyle relationship for treatment of symptomatic patients and to suggest that the clinician consider the methods that are successful in restoring the disc to a load-bearing position when choosing a treatment. The best future treatments for this condition seem likely to be those that also reverse the internal derangement and prevent progression to DJD. Thus, long-term evaluation of disc-preserv-

ing treatments and functional appliance therapy should include determination of disc position to delineate its possible role in growth as well as prevention of DJD.

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## Resumen

Es tiempo de poner más atención a la posición del disco?

La mayoría de los tratamientos quirúrgicos y no quirúrgicos están dirigidos principalmente hacia el alivio del dolor y la disfunción; la corrección del desplazamiento del disco tiene cada vez menos importancia, o no la tiene. Sin embargo, los malfuncionamientos internos son variablemente progresivos y, en algunos pacientes, causan la deformación condilar con una deficiencia secundaria de la mandíbula. Si la información soporta la hipótesis de que la deformidad condilar y el retardo en el crecimiento pueden resultar de un disco desplazado; y a la inversa, que un disco posicionado normalmente permite el crecimiento normal y mantiene la masa condilar, entonces la meta de cualquier tratamiento para reducir el desplazamiento del disco debería incluir el restablecimiento de una relación cóndilo/disco normal. La terapia a base de aparatos funcionales para la mandíbula deficiente puede ser más efectiva en aquellos pacientes que tienen una relación cóndilo/disco normal; si se presenta un disco en proceso de reducción, tal terapia es más efectiva sólo cuando el aparato avanza el cóndilo hacia una posición inferior al disco.

## Zusammenfassung

Muss der Diskusposition mehr Beachtung geschenkt werden?

Die meisten chirurgischen und nicht-chirurgischen Therapien einer schmerzhaften Diskusverlagerung ("internal derangement") des Kiefergelenkes zielen in erster Linie auf eine Schmerzlinderung und Wiederherstellung der Funktion; Korrektur der Diskusposition ist immer weniger das Ziel. Diskusverlagerungen sind von unterschiedlicher Progredienz und verursachen bei manchen Patienten Deformitäten des Kondylus und sekundär einen zu kleinen Unterkiefer. Wenn Daten die Hypothese unterstützen, dass Deformitäten des Kondylus und Wachstumschmammung von einem verlagerten Diskus herrühren können, und umgekehrt, ein normal positionierter Diskus ein normales Wachstum erlaubt und die Dimension des Kondylus erhält, so sollte es das Ziel einer jeden Therapie von Diskusverlagerungen sein, auch die normale Kondylus/Diskus-Relation wiederherzustellen. Funktionelle Therapie für einen zu kleinen Unterkiefer kann erfolgreich sein bei Patienten mit normaler Kondylus/Diskus-Relation. Wenn aber eine Diskusverlagerung mit Reposition vorliegt, ist eine solche Therapie nur erfolgreich, wenn das funktionskieferorthopädische Gerät den Unterkiefer soweit protrudiert, dass sich eine normale Kondylus/Diskus-Relation einstellt.