Temporomandibular Disorders: Disc Displacements

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Disc displacements (DD) of the temporomandibular joint were incorrectly referred to as "internal derangements" in earlier publications. "Internal derangements" is essentially an orthopedic term for disorders believed to cause mechanical impediments to joint function, a fault that subsequently disturbs the normally smooth action of a joint. They are characterized by reducing or non-reducing disc displacements or other abnormalities in disc tissue position or morphology, which may lead to temporomandibular joint clicking and/or crepitus, and in some cases, pain and limitation in joint or jaw movement. Their diverse treatment has included intraoral splints (anterior positioning splints with stepping back and flat-plane splints, for example), medications (eg, anti-inflammatory medication), physiotherapy, and surgery,[1,2] which have yielded varying degrees of success.[3] However, there is also evidence that some patients with DD may recover spontaneously.[2,4] This underscores the need for a clear identification of the range of conditions, which demand different management strategies.

The intent of this paper is to highlight currently available methods used for assessment and treatment of DD in temporomandibular disorders (TMD).

Etiology of Disc Displacements

Currently, the etiology of DD is unclear, since numerous investigations have failed to implicate specific occlusal, orthodontic, or parafunctional factors, which are equally distributed in both patient and non-patient populations.[5] However, there has been some suggestion that trauma related to direct jaw injury, or secondary to cervical hyperextension-flexion injuries, may play a causal role.[6,7] On the other hand, there seems to be even more evidence that trauma, at least that associated with hyperextension-flexion injury (ie, whiplash), does not increase the incidence of DD.[8,9] Indeed, the data do not demonstrate a difference in the prevalence of DD in TMD patients following whiplash, as compared to those with non-traumatic (ie, idiopathic) TMD.[8–10] One might also be tempted to infer that previously non-symptomatic disc displacements stand a greater chance of becoming symptomatic following a whiplash injury. However, evidence shows that this is probably not the case, since there must be significant

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Table 1 Overall Agreement of Diagnostic Modalities*

	Experimental group		Control group
Diagnostic method	Arthrography	MRI	MRI
Clinical examination	17/20 (85%)	20/40 (50%)	29/32 (91%)
Sagittal recording device	15/18 (83%)	19/37 (51%)	29/32 (91%)
Magnetic resonance imaging	10/15 (67%)		

*$P = 1.0$ (Fisher's exact 2-tail test).

numbers of individuals who have non-symptomatic DD, as judged by pre-accident imaging or joint movement.[11,12] Yet, more do not go on to develop symptomatic displacement after an accident.[8,9]

Suffice it to say then, that apart from the data suggesting that individuals with generalized joint laxity may have a greater incidence of DD than non-patient controls,[13] the underlying causes are still not clear. In addition, given the prevalence of asymptomatic DD in the non-patient population, one could also suggest that these are more or less a variation of normal.

Diagnosis of DD

There is currently a wide variety of methods and devices that are used for diagnosis of DD. These include radiographic measures, such as tomography and arthrography,[14] as well as methods relying on assessment of jaw movements with jaw-tracking devices.[15,16] In addition, some methods rely on the use of acoustic measurements (sonography) to identify sounds of a joint with suspected DD that might not otherwise be detected.[17] More recently, magnetic resonance imaging (MRI) has also been used to locate disc position.[18]

Current evidence indicates that sonography appears to be quite sensitive with respect to identification of joint noises, although it may not necessarily discriminate between patient and non-patient populations,[17] with a resultant higher tendency for false-positive findings. In fact, the implication that joint sounds cannot be detected without the aid of a highly sensitive amplification device is unjustified; hence, further discussion seems unnecessary. On the other hand, arthrography appears to be a highly diagnostic procedure and can be used to identify various presentations of DD.[14,18] It is, regrettably, an invasive procedure, and this has prompted great interest regarding the use of MRI for assessing DD.[14] However, MRI remains an expensive imaging technique and, as will be suggested below, may be open to interpretation error.

Previous findings have demonstrated that when MRI was compared to arthrography for identification of DD disorders, there was a fairly low level of agreement.[14] As demonstrated in Table 1, at best only 67% agreement was reached between diagnostic identification of DD disorders obtained with MRI as compared to arthrography. The findings were subclassified into DD with reduction, DD without reduction, and normal disc position. Had the DD been grouped or concatenated into 1 category (ie, displacement), the accuracy would have improved, as differences were usually related to whether or not reduction was identified. Inasmuch as it may be impossible to correlate severity of symptoms to the level of displacement or intra-articular condition of the disc,[19] such differences may not be clinically important; disagreement was present nonetheless. Alternatively, it appeared that digital palpation of the joints was more accurate, in that the percentage of agreement between this type of examination and arthrography was much higher (85%). It was also found that recording of joint movement with a sagittal recording device was also quite accurate in relation to arthrography and predicted arthrographic findings at a level of 83%.

Thus it would appear that with respect to identification of DD disorders, or more accurately DD (leaving out "disorders" as this suggests that there is a disease, which may not be the case, as will be discussed below), there are a number of useful methods available to the clinician. Given the relative ease associated with digital examination, it seems appropriate that unless compelling reasons are present (eg, surgery is planned), patients with suspected disc displacements do not necessarily have to be subjected to sophisticated imaging, invasive procedures, or jaw-tracking assessments.

Indications for Treatment of Disc Displacement Conditions

Given the identification of a disc displacement by one of the above-noted means, it must then be decided whether treatment is indicated, and if so, what type of treatment might be necessary. Many of these issues will be discussed elsewhere in these proceedings, so only a few concepts will be alluded to here. Prior to making a decision to treat, it is essential to understand that in many cases, disc displacement and associated problems (should there actually be any) may in fact resolve on their own. This was well-demonstrated in a recent study[2] wherein it was shown that approximately 60% of patients' symptoms resolved on their own, without any treatment at all. This was notably found in patients who had non-reducing DD, a condition that could be considered more significant than reducing DD (although not necessarily). Similar findings have been reported by other authors.[4] While this information is important, it does not, however, necessarily indicate which patients will actually improve spontaneously. Indeed, there are no predictors of spontaneous recovery (physical or otherwise), and this means that the clinician is faced with the apparent dilemma of trying to determine who will or will not recover spontaneously and who will or will not require intervention. This is not necessarily the case though, since, given these and others' findings, it would not be imprudent to simply wait for a period of 6 months prior to intervention or following the onset of symptoms. If there is or has been no resolution, and the patient's symptoms warrant intervention, this can then be done.

In relation to the above, it is noteworthy that, spontaneous resolution notwithstanding, the mere identification of DD without symptoms that disturb the patient does not necessarily constitute a diagnosis of dysfunction or disease. There is now evidence suggesting that physical "abnormalities" in disc morphology or position are not necessarily associated with clinical or historic presentation of a TMD.[19] In this regard, there are data confirming that there is a fairly high prevalence of DD in individuals who do not have other signs or symptoms of a TMD.[11,12,14] Indeed, there is now evidence indicating that physical abnormalities in vertebral discs that were commonly thought to cause back pain are found in a high percentage of non-patients.[20] Such a finding challenges the traditional belief that bulging or herniated vertebral discs play a causal role in back pain. Similarly, dentists must apply the same logic to DD in the temporomandibular joint, given the prevalence of DD in non-patient populations. Thus, the identification of a disc displacement, even in a patient, may be more coincidental than causal. Interestingly, when DDs are actually thought to be indicative of or related to disease and are treated, for example, with surgical repositioning, concomitant improvement in disc position may not be realized, and yet patients may still report improvement.[1,21–23] It is therefore crucial to recognize that when DD has been identified in patients (by MRI, arthrography, or digital examination), treatment may not be indicated, because improvement could occur on its own. It is also possible that, in these patients, the DD itself is not actually related to their symptoms.

To reiterate, the severity or degree of DD has not been correlated with severity of symptoms; this further underscores the notion that DD should, where possible, be managed with caution. Therefore, it is suggested here that so-called internal derangements or DDs should only be treated after an appropriate waiting period of approximately 6 months. If the DD is painful, appropriate action might include the use of anti-inflammatory medications, other analgesics, or non-invasive and reversible treatment modalities. If the condition persists and is characterized by painful clicking, painful closed lock, or various levels of arthralgia associated with DD, other intervention may be indicated and could include any or all of the modalities noted above (see other management-related papers in these proceedings).

Disc Displacement Disorders and Pain-Free Range of Motion

We carried out preliminary initial investigations[24,25] to determine whether treatment by arthroscopic surgery of intra-articular or DD disorders would lead to improvement in pain and joint mechanics (eg, jaw movement or jaw opening, pain, and clicking). We prescribed arthroscopic surgery for our patients with symptomatic DD. These patients had received prior non-invasive therapy but still suffered from varying degrees of persistent joint pain and clicking or closed lock (or limitation in opening). It has been shown previously that the pain and hypomobility associated with symptomatic DD can be treated with arthroscopic surgery.[1,21,22,26,27] In this case, the goals were to determine what the outcome of treatment would be on the basis of both objective (examiner-based) and subjective (patient-based) outcome measures. Some of the objective measures included

auscultation of joint noises by the examiner with a stethoscope. In addition, digital palpation was used to assess joint tenderness (on a scale of 0 to 3). Maximal interincisal opening was also measured with a ruler.

Other objective measures were used, including assessment of muscle pain on palpation, quality of life measures, and psychologic profiles, but will not be described here. Subjective measures of treatment outcome included the assessment of pain in various craniofacial locations, including the head, jaw, and temporomandibular joints, with the use of a 100-mm visual analogue scale (VAS) for each location. In addition, patients were asked to quantify their perceived limitation in jaw opening (pre- and post-arthroscopic surgery), also with the use of a 100-mm VAS. The VAS measures were used to assess other subjective parameters, including severity of clicking and levels of annoyance of the clicking (both to the patient and to others, from the patient's perspective).

The patients who were prescribed arthroscopic surgery were first assessed presurgically and then at 1, 3, and 6 months postoperatively by the use of the objective and subjective measures noted above. One of the more intriguing findings was that most patients perceived statistically significant improvements (ie, reductions) in limitation of jaw opening (approximately 55%; $P < 0.0001$) on the basis of the VAS measures. Yet there were no objective changes in actual opening over time. The lack of change has also been reported by others.[28,29] There were also dramatic reductions in pain found in all sites (45 to 55% for condylar and jaw pain; $P < 0.02$) over time on the basis of the VAS, and yet there were also no objective alterations in objective measures for joint or muscle pain on examination. There were no changes in objective measurement of joint sounds, and this actually agreed with patients' perceptions of the severity of the joint sounds (ie, no change pre- and postoperatively). However, patients did perceive significant reductions in the extent to which the joint sounds bothered them ($P < 0.02$), despite the fact that the sounds were equally "severe."

On the basis of these findings, it was noted that the patients definitely perceived that their limitation in maximal opening had been reduced following surgery, which would mean, by definition, that they perceived they were in fact opening more widely; yet this was decidedly not the case. Given this, it was thought that a term that would take this apparent improvement into account, along with the actual clinical measurements, was needed. Moreover, it was also clear that as of yet, although most studies have focused on either pain or jaw opening or movement, there was no way to relate both pain and movement in a manner that might actually reflect more assiduously the clinical course in postsurgical patients. Hence, it was decided to develop a mathematical term that would reflect pain and movement in a manner that would be consistent with the clinical course and would in essence represent the functional capacity of a patient's jaw movements. This was termed Pain-Free Range of Motion (PROM). It represents the magnitude of mandibular movement *per unit pain*. The measured value for jaw opening in millimeters is used as the numerator, while the VAS measurement (in millimeters) for jaw pain is used as the denominator (≥ 1 mm, so that all VAS pain measurements less than 1 mm are automatically increased to a value of 1). With this term, it was then possible to reflect the relative improvements in the patients' jaw movement per unit pain over time. Over the 6-month postoperative period there was at least a 3-fold ($P < 0.05$) increase in PROM for patients following arthroscopic surgery, whereas there was no improvement in actual opening at all over time. The findings further suggest that since there was no improvement in actual jaw opening, and in light of previous data referred to above, there was probably no alteration in disc position or mechanics, despite improvements in symptoms.

With respect to the issues discussed above vis-à-vis the relative importance of disc position, it would therefore appear that the aforementioned data, as well as the previous literature, implicate a lesser role for disc position than previously thought. That is, individuals (including patients) may or may not have pain, regardless of disc position. Moreover, even when there is clicking, it would seem that this represents, more or less, a minor inconvenience to patients, as long as there is no pain.

Taken together, the weight of evidence suggests that DD resulting in clicking may be nothing more than an acoustic nuisance, suggesting that the need for treatment must be judged carefully, and in many cases treatment should not proceed. Similarly, pain may be associated with some DD that could necessitate intervention at some point (notwithstanding the fact that many may resolve spontaneously). However, the goals of treatment should perhaps not focus on repositioning the "displaced" discs but, rather, on treating the pain.

Conclusions

Current information suggests that while there are many ways to identify patients who have DD, the mere identification of this does not necessarily mean that they have a disorder. Moreover, although rather sophisticated methods have been developed for identification of DD, such as MRI, sagittal recording, and sonography, the simpler approaches, including clinical examination via digital palpation, may be all that is needed in most cases. As regards therapy, it is also apparent that even when a patient does have a symptomatic DD (painful clicking and/or severely restricted and/or painful opening), treatment goals need to be reexamined. In this regard, it may not be necessary to reposition "displaced" discs (surgically or otherwise). First, this may not even be possible; and second, even when attempted, such treatments do not necessarily lead to changes in joint mechanics, as gauged by improvements in range of joint and jaw movement or even reductions in clicking. However, most treatments, when successful, do at least lead to reductions in pain. Indeed, it would seem that pain reduction is much more important than treatment of clicking or even reduced range of motion. To reflect this, we have developed a novel treatment outcome measure, PROM. This measure, which does show improvement following (surgical) treatment of patients with DD, takes both range of jaw movement and pain into account and could be used in future investigations to study the efficacy of treatment for patients with DD and other TMD. In fact, we suggest that this outcome measure might reflect more assiduously the true clinical course for patients with DD following treatment.

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