Recognition, prevalence, and risk factors of internal derangements of the temporomandibular joint
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Chapter 2

Types of internal derangements
**Introduction**

The craniomandibular articulation comprises two distinct temporomandibular joints connecting the base of the skull with the mandible. The temporomandibular joint (TMJ) is made up of two incongruent parts: the mandibular condyle and the glenoid fossa of the temporomandibular bone; further named the condyle and the fossa (see fig. 1). The articular disc, formed of dense fibrous tissue, is positioned between the mandibular condyle and the articular fossa and eminence. The disc divides the joint cavity in two compartments; an upper and a lower compartment. The central part of the disc is considerably thinner than the posterior and anterior parts. The disc compensates for the incongruity of the bony parts, as it fits like a cap over the condyle, thereby distributing compression forces over a broader articular surface (Brown, 1975; Hesse and Hansson, 1988). Generally, two types of movements are distinguished: a rotation in which the condyle rotates against the lower surface of the disc in the lower joint compartment, and a translation which occurs between the disc and the fossa, i.e., the upper joint compartment (Posselt, 1952; Brown, 1975). The fibrous capsule of the TMJ is attached to the temporal bone along the limits of the fossa and the condyle. It consists of a loose arrangement of connective tissue, that is reinforced laterally by the temporomandibular ligament.

![Fig. 1. The temporomandibular joint](image)
An internal derangement of the TMJ is anatomically described as a deviation in position or form of the tissues within the capsule of the joint (The glossary of prosthodontic Terms, 1999). Functionally, this deviation is manifest by interferences with smooth TMJ movements (McNeill, 1993). The aim of this chapter is to give a brief overview of the most frequently occurring internal derangements that are associated with a clicking sound during movement.

**Anterior disc displacement with reduction**

Anterior disc displacement with reduction (ADD) 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, usually resulting in a click (Farrar and McCarty, 1982). The opening click occurs when the condyle shifts underneath the posterior band of the disc; the closing click is the result of the dislocation of the disc from the condyle (see Fig. 2). The closing click is of less magnitude than the opening click (Okeson, 1996).

![Fig. 2. Mechanism of anterior disc displacement with reduction, * indicates a clicking sound.](image-url)
The causes of disc displacement with reduction are not agreed upon. Several theories have been postulated, such as osteoarthrotic changes in the joint (Dijkgraaf et al., 1995) and steepness of the articular eminence (Atkinson et al., 1983; Panmekiate et al., 1991; Ren et al., 1995). Recently, it was found that interactions of intra-articular proportions and condyle position were positively related with anterior disc displacement (Pullinger et al., 2002).

Although most anterior disc displacements with reduction are considered to be harmless and cause no or only little discomfort to the patients (Okeson, 1996), it is believed that these displaced discs may occasionally develop into a more serious clinical condition, viz. anterior disc displacement without reduction (Lundh et al., 1987). Clinically, this condition is characterized by a painful limitation of the mouth opening. Unfortunately, it is unknown which anterior disc displacements show this development, and under which conditions.

The current opinion is that treatment is not indicated for anterior disc displacement with reduction (Okeson, 1996). In the past, however, an anterior disc displacement with reduction was considered a risk factor for TMJ pathology and should be treated (Brown, 1980; Farrar and McCarty, 1982; Lundh et al., 1985). Oral appliances (acrylic flat or reposition splints) as well as physical therapy, occlusal adjustments and even surgical procedures have been conducted to treat anterior disc displacements, mostly with poor result (Okeson, 1996). Disc displacement without reduction, on the other hand, may require treatment, especially in the acute phase (Okeson, 1996).

**Posterior disc displacement with reduction**

In a few publications, cases of a posterior disc displacement (PDD) have been reported (Obwegeser and Aarnes, 1973; Blankestijn and Boering, 1985; Gallagher, 1986; Engelke, 1990; Westesson et al., 1998; Chossegros et al., 2001; Nitzan, 2002). It is described as a painful, suddenly occurring inability to bring the upper and lower dentition together in maximal occlusion (open lock), as if an elastic material is present in the joint (Blankestijn and Boering, 1985). This latter aspect suggests that in the closed mouth position, the disc is posteriorly displaced with respect to the condyle. No clicking sounds were reported, which indicates that there was no disc reduction on movement. This description fits the condition of a disc which is permanently displaced: a posterior disc displacement without reduction (PDDWR). Descriptions of a posterior disc displacement with reduction (PDDR) are very rare (Wise et al., 1993; Yoda et al., 2002). The disc is described to be in a normal position with respect to the condyle when the mouth is closed, but it gets posteri-
orly displaced in the final part of mouth opening and it restores its relationship with the condyle during mouth closing (see fig. 3). This view is however not undisputed, see the PDD-mechanism suggested by Chossegros et al. (2001).

Although the etiology of the posterior disc displacement is unknown, it has been suggested that in patients with a habitual luxation of the TMJ, the luxations exert extreme forces on the medial and lateral parts of the disc, forcing the disc in a posterior direction on maximal opening (Lückerath et al., 1989).

![Diagram](image)

*Fig. 3. Mechanism of posterior disc displacement with reduction, * indicates a clicking sound.*

**Hypermobility**

As a clinical condition, hypermobility in the TM joint can only be noted when it interferes with smooth mandibular movements. Jerky mandibular movements and clicking sounds are noted when the condyle snaps over the apex of the eminence during opening (McNeill, 1993). It usually occurs during a yawn or a wide bite when the mouth is completely opened and the condyle moves beyond the articular eminence (see Fig. 4).
prevalence and etiology of hypermobility is still unknown. Anatomical reasons, such as loose ligaments, are thought to be etiological factors. Whether general joint hypermobility is associated with hypermobility in the TM joint is still unclear (Dijkstra et al., 2002)

Hypermobility may persist in a subject for decades without complaints, but it is known that in some cases, masticatory muscle pain (muscle splinting, secondary myogenous CMD pain) may accompany the subluxation (Okeson, 1996). Most hypermobility-clicks are, however, painless, and subjects are often unaware of their presence. Treatment of hypermobility is only required when the hypermobility causes problems with closing, such as a “open lock”, a situation in which the mouth is maximally opened and cannot be closed. In these cases, patients are learned to avoid maximal mouth opening. In recurrent cases, a “mono-block” splint or surgical intervention is indicated.

Fig. 4. Mechanism of hypermobility, * indicates a clicking sound.
Other internal derangements associated with clicking

**Deviation in form**

From autopsy material, it is known that irregularities or aberrations in the form of intra-capsular soft and hard articular tissues can occur (McNeill, 1993). These irregularities are described as deviations in form (DIF) and are supposed to cause clicking on opening and on closing (McNeill, 1993). However, whether a DIF is a clinical problem is a matter of discussion; it is, for example, not mentioned anymore as internal derangement in the later editions of the Guidelines of the American Academy of Orofacial Pain (Okeson, 1996).

**Ligamentous clicking**

According to the mechanism of "ligamentous clicking" as described only by Freesmeyer (1993), a joint sound occurs when the condyle snaps the ligamentous structure of a tight articular capsule (the structure that surrounds the articular condyle and that encloses the joint fluid). The origin of the clicking sounds is then similar to the way a guitar string produces its sound.