Temporomandibular joint internal derangements: Diagnosis, mechanisms and risk factors, and prognosis

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Chapter 7

General Discussion

In clinical research, internal derangements (IDs) of the temporomandibular joint (TMJ) have usually been studied without differentiating between their most prevalent types (viz., anterior disc displacement with reduction (ADDR) and symptomatic TMJ hypermobility), which share common clinical signs (i.e., clicking joint sounds on movement) (Huddleston Slater, 2003). This has shed doubt on the applicability of some previous conclusions related to either of those ID types, for example, regarding a fluctuating natural course of ADDRs studied by exploring joint clicking (Könönen *et al.*, 1996; Magnusson *et al.*, 2000). In order to gain knowledge on ADDR and symptomatic TMJ hypermobility, an accurate diagnostic classification is needed.

In this thesis, for the first time, the current Research Diagnostic Criteria for temporomandibular disorders (RDC/TMD, Dworkin and Le Resche, 1992) regarding ADDR were thoroughly evaluated. The RDC for ADDR were found to run the risk of false positive or negative results. This applies especially to the 5-mm criterion, according to which in ADDR the opening clicks occur at a greater mouth opening than the closing clicks, and the detection of clicks on horizontal movements in case of non-reciprocal clicking (i.e., clicking on either mouth opening or closing, but not on both). Modified criteria were noted (**Chapter 2**) that have been found earlier to have an excellent reliability (Huddleston Slater *et al.,* 2004). However, their specificity, sensitivity, and positive and negative predictive value remain to be determined. Furthermore, the RDC/TMD classification regarding ADDR should be extended, as in the thesis, the existence was shown of subtypes of ADDRs with and without intermittent locking. These behave differently in time (**Chapter 6**), and on TMJ loading (**Chapter 5**). Because currently no clinical test exists to distinguish between these ADDR subtypes, classifying into either of those relies on anamnestic report about episodes of locking.

The observation in **Chapter 6,** that a recently developed, permanent anterior disc displacement without reduction (ADDWoR) is only rarely accompanied by a limited mouth opening (i.e., closed locking), indicates that ADDWoR diagnosis should preferably be based on magnetic resonance imaging (MRI). However, because MRI is often difficult to interpret (Palla, 2009), and has low availability and high costs, clinical diagnostics remains important if an ADDWoR should be identified (e.g., for research purposes, especially in large samples, or in patient care, in case of arthrogenous complaints without a clear cause). Currently, clinical ADDWoR recognition depends on item 14 of the RDC/TMD questionnaire (viz., a history of locking, or catching, inducing a mouth opening limitation that is severe enough to interfere with the ability to eat) (Dworkin and Le Resche, 1992). However, this question may lead to false negative results, because the loss of a late disc

reduction, which induces a relatively small movement limitation, may not interfere with the ability to eat. This thesis suggests that ADDWoR diagnostics may be improved by replacing the abovementioned item by a question about (periods of) sudden inability to open the mouth completely in the past, during which joint clicking had disappeared (**Chapter 4**). The latter question is more suitable to detect an ADDWoR, because locking in the past due to a displaced disc must be preceded by clicking, which is not true for other causes for a movement limitation in the past (e.g., a myogenous problem).

This thesis, furthermore, indicates that hypermobility of the TMJ should be included into the RDC/TMD classification in order to establish standardized terminology, definition and diagnostic criteria for this type of ID. The findings of **Chapter 3** that not only symptomatically hypermobile subjects translate their condyles beyond the eminence on mouth opening, but also nearly half of symptom-free subjects, indicate that such a condylar translation by itself is physiologic. This is corroborated by the finding of condylar translation beyond the eminence in a large population portion (70%) (Nevakari, 1960). These findings pose a question to the meaningfulness of the term "hypermobility" of the TMJ. We suggest that the following new, qualitative term is used instead- *condyle-eminence interference* (CEI). CEI is not defined on the basis of a condylar translatory capacity beyond the eminence (The glossary of prosthodontic terms, 2005), but as the snapping of the condyle along the eminence crest on open-close movements, creating functional symptoms, such as clicking joint sounds and jerky jaw deviations. This definition indicates that CEI can only be diagnosed clinically, and not on TMJ imaging (Katzberg *et al.*, 1982; Shorey and Campbell, 2000). An exception can be made in case of open locking accompanied by a history of trauma, where radiography is needed for differential diagnostics with mandibular fractures (De Leeuw, 2008). Furthermore, while linear measurements of the mouth opening and measurements of the angle of mouth opening (Dijkstra *et al.,* 1995) can be used to assess mandibular mobility, these can't serve as diagnostics for CEI, because it is not the extent of mobility, but the functional interferences on condylar movement that give rise to this type of ID. Furthermore, next to a non-problematic, basic subtype of CEI, CEI with occasional open locking (sudden, temporary and recurrent inability to close the mouth as the condyle stays trapped beyond the eminence; termed previously also TMJ dislocation, luxation or subluxation) (Shorey and Campbell, 2000; De Leeuw, 2008) can be distinguished. It is probably an unfavorable line of action of the masticatory muscles, which gives rise to interferences on condylar movement along the eminence (**Chapter 3**), or even induces open locking in CEI. Computer modelled jaw motion (Koolstra and Van Eijden, 1997; Korioth and Versluis,

1997) can be helpful in identifying whether there are certain jaw muscle activation patterns with disadvantageous effects upon condylar movement around the eminence.

While many risk factors have been proposed for the presence of an ADDR (Seligman and Pullinger, 2004; Stegenga and De Bont, 2006; Huddleston Slater *et al.,* 2007), literature indicating possible factors of influence upon disc reduction is scarce (Lundh *et al.*, 1987). The finding of **Chapter 4** that the prevalence of ADDR is correlated to increasing age in adolescence confirms earlier results (Huddleston Slater *et al.,* 2007). This finding strongly supports the concept that it is probably the intra-articular developmental changes in the growth period that may cause space insufficiency within the TMJ, and consequently disc displacement (Huddleston Slater *et al.,* 2002, 2007). In **Chapter 4**, none of the parafunctional activities were related to the presence of an ADDR, but diurnal clenching was associated to reported intermittent locking. This indicates that TMJ loading contributes to the loss of disc reduction, while having no significant role in the onset of ADDR. The structure and function of the articular disc is such that, when it is properly interposed, its intermediate zone can sustain heavy loading (see review by Tanaka and Van Eijden, 2003). If intra-articular changes during bodily growth have led to an ADDR, loading upon the posterior aspect of the disc and/or upon the bilaminar zone- both structures with no load bearing function (Hirose *et al.,* 2006), may influence the disc reduction. The effect of loading upon the reducing capacity is further demonstrated experimentally in **Chapter 5**. In that study, subjects with ADDR reporting intermittent locking were found prone to temporarily lose their reducing capacity after an intensive chewing exercise. In the same study, disc reduction in ADDR subjects without reports of intermittent locking was not influenced by the chewing task, indicating that it is not only loading that plays a role in intermittent locking, but also differences in loadability. In order to gain more insight into the mechanisms and risk factors for the loss of reducing capacity, differences between ADDRs with and without intermittent locking must be studied further in respect to intra-articular anatomical relations (e.g., morphology of the articulating surfaces, sideways component of disc displacement), and soft tissue characteristics (e.g., collagen type composition, tissue elasticity).

Farrar and McCarthy (1982), and Wilkes (1989) have postulated that ADDRs have a progressive natural course, during which ADDRs with early moments of reduction develop towards ADDRs with late reductions, and eventually without reduction (ADDWoR), followed by intra-articular degenerative changes. Other studies have reported that ADDR signs can disappear in time, usually without locking (Lundh *et al.*, 1987; Sato *et al.*, 2003), but in these studies it was not determined which functional and/or morphological

alterations within the TMJ were responsible for this loss of signs. The results in **Chapter 6** have shown that an ADDR is usually a stable condition over time. Only in subjects reporting intermittent locking ADDR has a tendency to gradually progress to later stages of disc reduction, or to lose its reducing capacity altogether. The MRIs, made at the disappearance of ADDR signs, showed that the disc displacement was still present in all involved subjects, but that it had lost its capacity to reduce (ADDWoR). Restoration of a normal condyle-disc relation as an explanation for the loss of clicking was never observed.

Because ADDR is usually non-problematic, its management comprises currently mainly of counselling (De Leeuw, 2008), which consists, so far, of reassurance and explanation about the mechanism of the condition. This thesis indicates that in case of ADDR with intermittent locking, patients need also to be informed about the risk of a temporary aggravation of their disc derangement as it progresses to an ADDWoR (**Chapter 6**). This progression may be facilitated by oral parafunctions (**Chapters 4** and **5**). These patients can be reassured about the short-term prognosis of a future ADDWoR that is usually asymptomatic (**Chapter 6**). However, the long-term prognosis of the latter, in respect to possible TMJ degenerative changes (Wilkes, 1989), or in respect to a possible impaired mandibular growth in young subjects (Gidarakou *et al.,* 2004; Bryndahl *et al.,* 2006), remains uncertain.

In conclusion, in this thesis a revised diagnostic classification for TMJ internal derangements is proposed. The latter is presented in table 1. Furthermore, in the thesis, possible risk factors for ADDRs and intermittent locking are determined. Moreover, it is recognized that joints with ADDRs with symptoms of intermittent locking differ in their loadability and natural course compared to ADDR joints without such symptoms. It is suggested that ADDRs with intermittent locking should be regarded as a separate and clinically relevant entity within the group of TMJ disc derangements.

Table 1. Proposal for a new classification for Axis I, group 2 conditions of the Research Diagnostic Criteria for temporomandibular disorders (RDC/TMD) regarding the most prevalent temporomandibular joint (TMJ) internal derangements.

Group 2: TMJ internal derangements
2.1 Anterior disc displacement (ADD)
2.1.1 ADD with reduction (ADDR)
2.1.1.a ADDR without intermittent locking • clicking on opening and (loaded) closing; and • elimination of clicking on opening and closing movements from a protruded jaw position.
2.1.1.b ADDR with intermittent locking • see 2.1.1.a; and • history of transient periods of sudden inability to open the mouth completely, during which joint clicking had disappeared.
2.1.2 ADD without reduction (ADDWoR)
2.1.2.a ADDWoR without limited mouth opening • history of joint clicking; and • history of (periods of) sudden inability to open the mouth completely, during which joint clicking had disappeared; and • no reciprocal joint clicking; and • unlimited and symmetric active maximal mouth opening and laterotrusive movements.
2.1.2.b ADDWoR with limited mouth opening • history of joint clicking; and • history of sudden and persisting inability to open the mouth completely, during which joint clicking had disappeared; and • no reciprocal joint clicking; and • limited and asymmetric active maximal mouth opening and laterotrusive movements, with an ipsilateral deviation on active maximal mouth opening, and a contralateral movement that is smaller than the ipsilateral movement; and • passive stretch of the active maximal mouth opening is ≤ 2mm.
2.2 Condyle- eminence interference (CEI)
2.2.1 CEI without open locking • clicking in the late part of opening and early part of (loaded) closing, in combination with jerky jaw movements; and • no elimination of clicking on opening and closing movements from a protruded jaw position.
2.2.2 CEI with open locking • see 2.2.1; and • history of (periods of) sudden inability to close the mouth without a specific manipulative manoeuvre.

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