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

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# **Chapter 1**

## ***Introduction and aims of the study***

Craniomandibular disorders (CMD) is a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both. The term is synonymous with temporomandibular disorders (TMD). Its most frequent presenting symptom is pain, usually localized in the muscles of mastication, the preauricular area, or the TMJ. The pain is usually mild, fluctuates over time, and is aggravated by chewing or other jaw functions. In addition to complaints of pain, patients with CMD may have problems with functioning, such as limited or asymmetric mandibular movements and TMJ sounds that are usually described as clicking, popping, grating, or crepitus (McNeill, 1993). These problems with functioning will be the focus of this thesis.

Problems with TMJ functioning were already recognized in the 30th century BC when the ancient Egyptians described a technique for the reduction of a mandibular dislocation. Later, in the fifth century B.C., Hippocrates also described such a technique (reviewed by Schwartz, 1966). During the following centuries, interest for TMJ problems remained, mainly from an anatomical point of view (reviewed by Schwartz, 1966). It was only a few decades ago that advances in imaging techniques, such as tomography, arthrography, computed tomography (CT) and, later, magnetic resonance imaging (MRI) resulted in an improved visualization of the TMJ structures in living humans and therefore, in a better understanding of functional TMJ disorders. Farrar and McCarty (Farrar, 1971; McCarty 1980) emphasized the role of disc interferences within this group of functional problems and used the term "internal derangements". Later on, an internal derangement was described as a localized mechanical interference of smooth TMJ movement, such as anterior disc displacement with reduction (ADD) and hypermobility (McNeill, 1993). Symptoms of internal derangements, such as clicking, were supposed to be related to a possible future impairment of condylar motion (Farrar and McCarty, 1982). Increased knowledge led to the realization that these symptoms were subsidiary to CMD pain complaints and nowadays, CMD is mainly seen as a (chronic) musculoskeletal pain disorder (Merskey and Bogduk, 1994; Okeson, 1996).

Although in the last decades, knowledge about the CMD pain complaints has increased dramatically, only little is known about the clinical implications of internal derangements. So far, studies to internal derangements have mainly been concentrated on the "TMJ clicking" often associated with it, and not on the underlying causes. This is nicely illustrated by the fact that in the past, only the prevalence of clicking as such has been studied (Hanson and Nilner, 1975; Glass *et al.*, 1993; De Kanter *et al.*, 1993) and not

the prevalence of types of internal derangements (for a brief overview of internal derangements that are associated with clicking, see **chapter 2**). Although most internal derangements are considered to be harmless and cause no or only little discomfort to the patients, it is believed that anterior or posterior disc displacement with reduction may occasionally develop into a more serious clinical condition: a closed lock or open lock (Blankestijn and Boering, 1985; Okeson, 1996). Unfortunately, it is unknown which disc displacements show this development, and under which conditions. To gain more insight into the possible long term clinical implications of internal derangements, research should focus on their prevalence rates and risk factors rather than on those of symptoms such as clicking. Large population samples are then needed and one is, for practical reasons, limited to clinical examination techniques.

Unfortunately, for the recognition of internal derangements associated with clicking, no clinical criteria exist. Only for the recognition of an ADD, criteria have been described in the Research Diagnostic Criteria (RDC) for Temporomandibular Disorders (Dworkin and LeResche, 1992). These criteria are, however, unvalidated. The RDC suggest that the amount of mouth opening at the time of the opening and closing click is important in the recognition of an ADD. It is, however, a clinical experience that the closing click is often of less magnitude than the opening click (McNeill, 1993), and this may hinder the recognition of an ADD. In **chapter 3** of this thesis, it is studied why the closing click is softer than the opening click. In **chapter 4**, the validity of the amount of mouth opening at the time of the opening and closing click for the recognition of an ADD is studied. With the aid of the results from latter studies, in **chapter 5**, sets of diagnostic criteria for the clinical recognition of three types of internal derangements are developed and tested for their concurrent validity, using two instrumental techniques (MRI and opto-electronic movement recordings). In **chapter 6**, the reproducibility of these sets of clinical criteria is tested.

A possible risk factor for the development of an internal derangement may be increasing age during childhood and adolescence (Egermark-Eriksson *et al.*, 1981; Dibbets and van der Weele, 1992; Thilander *et al.*, 2002). Unfortunately, an unequivocal interpretation of these latter studies is hampered by a lack of classification of the internal derangements, the large age increments used (Egermark-Eriksson *et al.*, 1981), and the non-representative (orthodontic) samples studied (Dibbets and van der Weele, 1992). With the aid of the newly developed sets of clinical criteria, in **chapter 7**, the prevalence and risk factors of types of internal derangements in children and adults were studied.

## **Aims and outline of the thesis**

The aim of this thesis was threefold. The first aim was to propose sets of clinical criteria for the recognition of types of internal derangements, and to test their reliability and validity. The second aim was to study the prevalence of types of internal derangements in children and adults. The third aim was to study risk factors for different types of internal derangements.

**Chapter 2** provides a brief overview of types of internal derangements that are associated with TMJ clicking. In **chapter 3**, the influence of loading of the mandible during closing on the intra-articular distance within the TMJ is studied. The concept of mandibular loading to provoke the closing click is introduced. In **chapter 4**, the validity of the interincisal distance (amount of mouth opening) for the recognition of an anterior disc displacement with reduction is tested. In **chapter 5**, sets of clinical criteria to recognize types of internal derangements are proposed and tested for their validity. In **chapter 6**, the reliability of the clinical assessment of internal derangements is tested for different techniques (palpation, auscultation, and the combined use of both techniques). In **chapter 7**, the prevalence of internal derangements in children and adults and risk factors that are associated with the development of the internal derangements are studied. In **chapter 8**, a case report of a posterior disc displacement without and with reduction is presented. In **chapter 9**, a general discussion and conclusions are presented. In **chapter 10**, a summary of this thesis is given.