Masticatory muscle pain: Causes, consequences, and diagnosis

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Publication date
2013

Chapter 1

General Introduction

Musculoskeletal pain in the orofacial region is described under the umbrella term “temporomandibular disorders” (TMD) (McNeil, 1993). Apart from pain arising from the temporomandibular joints (TMJs) and/or the masticatory muscles, TMD also includes internal derangements and degenerative diseases of the TMJs (McNeil, 1993). TMD pain is the most common orofacial pain condition of non-dental origin (de Leeuw, 2008). In the general population, the prevalence of TMD pain is around 10% (LeResche, 1997). Its prevalence is highest in populations aged between 20 and 40 years of age (Drangsholt and LeResche, 1999). Like for other musculoskeletal disorders, TMD pain is more common in women than in men, with a female : male ratio of 2:1 in the general population (Bush et al., 1993). In the population of patients referred to specialized orofacial pain clinics, though, the female : male ratio is considerably higher (up to 9:1) (Bush et al., 1993).

Nowadays, the etiology of TMD-pain is considered multifactorial (Greene, 2001). In this respect, the biopsychosocial model (Engel, 1977;Adler, 2009) is commonly accepted as a framework to describe relevant etiological factors for musculoskeletal pain, including TMD pain. Tissue overloading, like macro- or micro-trauma, are included under the “bio-“ component of the model, and are suggested to play an important role in initiating and/or perpetuating musculoskeletal pain (de Leeuw, 2008; Greene, 2001). For the masticatory system, parafunctional activities like tooth grinding and clenching are considered to lead to overloading of the muscle and joint structures. In a systematic review, self-reported parafunctional activities were found to be associated with TMD pain (Manfredini and Lobbezoo, 2010). In a recent report, this association was confirmed (Michelotti et al., 2010). Interestingly, however, when grinding activities were more objectively rated with polysomnographic recordings, the association between parafunctions and TMD pain was no longer found (Raphael et al., 2012). So, the relation between parafunctions and pain is still unclear.

Experimentally induced parafunctions have been studied in order to test whether such activities can indeed initiate pain resembling TMD pain; for a review, see (Svensson et al., 2008). To that end, different kinds of provocation exercises have been developed. In one study, sustained isometric voluntary protrusive jaw-muscle contractions at different clenching levels were not sufficient to provoke pain (Clark et al., 1991). These activities were thought to mimic the clenching component of bruxism. This led to the conclusion that contrary to clinical beliefs, significant jaw pain and tenderness are difficult to induce in healthy participants (Clark et al., 1991). Others tried to mimic long-term awake clenching activity, with results varying from no provocation of pain (Svensson and Arendt-Nielsen, 1996) to provocation of the full spectrum of myofascial TMD-pain complaints (Glaros et al., 1998a; Glaros et al., 1998b; Glaros et al., 2000; Glaros and Burton, 2004). The provoked signs and symptoms of TMD pain, however, were short-lasting and present in a small proportion of the participants only. Other, more dynamic protocols, mimicking tooth grinding movements, provoked significantly elevated pain levels (Arima et al., 1999).

Again, the provoked pain was short lasting and diminished during the days following the provocation part (Arima et al., 1999). To investigate the effect of parafunctional activities on the masticatory system , the study described in **Chapter 2** assesses the effects of experimentally induced jaw-muscle pain by means of intense chewing exercises on the orofacial sensory-motor system. Pain levels (visual analogue scale-VAS scores) and pressure-pain thresholds were measured as sensory components of the masticatory function, while the amplitude of the jaw-stretch reflex was used as motor component of the masticatory function. The results showed that pain levels increased and pressure-pain thresholds diminished after the chewing exercises. However, the motor component of the masticatory function, as quantified by the jaw-stretch reflex amplitude, did not show any change. In a critical reflection on this negative finding, the possibility was considered that the methodology used for the recording of the jaw-stretch reflex was insufficient. More specifically, it was considered whether the amplitude of the jaw-jerk reflex was influenced by spatial differences in day-to-day placement of the electrodes. Therefore, in **Chapter 3,** we studied the spatial dependency of the jaw-stretch reflex recording of the masseter muscle.

As for earlier experimental studies, the symptoms of fatigue and pain provoked by the intense chewing exercise were short lasting, and did not resemble the type of complaints TMD-pain patients present with. Therefore, in **Chapter 4**, a new protocol was developed to induce longer lasting muscle fatigue and pain. This protocol was based on a combination of concentric and eccentric load of the masticatory muscles. Concentric exercises are responsible for short lasting pain of ischemic origin, because they resemble more the usual muscle load during everyday activities. Eccentric muscle contractions, on the other hand, are responsible for delayed and longer lasting pain complaints due to their unaccustomed nature. This type of pain is usually called delayed onset muscle soreness (DOMS) (Proske and Morgan, 2001). In **Chapter 5**, it is investigated whether signs and symptoms of TMD (like subjective feelings of fatigue and pain, limited range of motion, decreased pressure pain thresholds, and muscle tenderness to palpation) can be provoked in healthy individuals with the use of this protocol. It is also examined whether the provoked signs and symptoms mimic those presented by TMD patients.

In clinical practise, for the recognition of pain from the masticatory structures, several diagnostic tests can be used (Lobbezoo-Scholte et al., 1994; Visscher et al., 2000). The most widely used classification system for TMD is the Research Diagnostic Criteria for temporomandibular disorders (RDC/TMD) (Dworkin and LeResche, 1992). It includes two axes: Axis I assesses the physical complaints, while Axis II investigates the psychosocial background of the patient. The clinical examination for an Axis I diagnosis largely depends on standardized palpation of the masticatory muscles. The validity of the RDC/TMD for the recognition of TMD pain is, however, insufficient (Truelove et al., 2010; Visscher et al., 2009). To improve the recognition of TMD-pain, alternative diagnostic tests like dynamic/static tests have been proposed (Naeije and Hansson, 1986; Visscher et al., 2009). These tests are based on the principle that when a patient's pain complaints arise from the musculoskeletal structures, these complaints should be provoked by functional (dynamic and static) loading of the system (Naeije and Hansson, 1986; Visscher et al., 2009). In addition, the concept of "familiar pain" could improve the validity of clinical tests for TMD-pain (Schiffman et al., 2010; Visscher et al., 2009). When familiar pain is used as the outcome measure of a clinical test, only a response of pain that resembles the patient's current complaints is considered positive. Finally, the validity of clinical test could be confounded by the presence of comorbid factors, like widespread pain or depression. Even though the negative influence of comorbidity on the prognosis of TMD-pain treatment is well-known (Hoffmann et al., 2011), its influence on the validity of clinical tests for musculoskeletal pain has not been studied before. Therefore, in **Chapter 6**, the influence of comorbidity on diagnostic tests for TMD is studied, together with the role of the addition of the familiar pain concept in in the diagnostic accuracy of both palpation and dynamic/static tests.

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