Cervical spinal pain in chronic craniomandibular pain patients. Recognition, prevalence and risk indicators

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Chapter 5

The prevalence of cervical spinal pain in craniomandibular pain patients

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submitted
Abstract

The craniomandibular system and the cervical spine are often considered a functional entity, and it has been suggested that patients with a craniomandibular disorder (CMD) more often suffer from a cervical spine disorder (CSD) than persons without a CMD. However, in most studies, no controlled, blind design was used, and conclusions were based on differing signs and symptoms. Since pain, experienced during normal daily activities, is the most important reason to seek treatment for a CMD or CSD, in this study it played a prominent role in the recognition of a CMD or CSD. So, the aim of this study was to determine the prevalence of a cervical spinal pain in persons with or without craniomandibular pain, using a controlled, single blind design. The prevalence of cervical spinal pain was also determined in subgroups of craniomandibular pain patients. From 250 persons, a standardised oral history was taken, and a physical examination of the masticatory system and the neck was performed. To recognise the presence of the two disorders, three classification models were used: one based on symptoms only, a second on signs only, and a third one based on a combination of symptoms and signs. The CMD patients were also subdivided in three subgroups: patients with mainly myogenous pain, mainly arthrogenous pain, and both myogenous and arthrogenous pain. Craniomandibular pain patients more often showed cervical spinal pain than persons without craniomandibular pain, independent of the classification model used (p=0.000). No difference in the prevalence of cervical spinal pain was found between the three subgroups of craniomandibular pain patients (p=0.948).
**Introduction**

Craniomandibular disorders (CMD) and cervical spine disorders (CSD) are collective terms embracing a number of clinical problems of the musculoskeletal structures of the masticatory system and of the cervical spine. The most frequent symptom, that both disorders have in common, is pain originating from the musculoskeletal structures, which usually aggravates by chewing or other jaw function (Okeson, 1996), or by moving the head or adopting certain head positions (Grant and McKenzie, 1994). Studies on chronic musculoskeletal disorders, such as CMD and CSD, are hampered by the fact that there usually are no specific tissue changes that can objectively diagnose the presence or absence of the disorder. Their recognition mainly relies upon the presence of isolated signs or symptoms of the disorders (Lobbezoo-Scholte et al., 1995; De Wijer et al., 1996). However, isolated signs and symptoms of CMD and CSD are quite common in the general population. For example, the prevalence of pain on palpation of intraoral muscle sites in a group of community controls varied from 8% - 45% (Dworkin et al., 1990a) and more than half of a group of participants without neck complaints reported tenderness on palpation of the neck-shoulder muscles (Kirveskari et al., 1988). These examples confirm the need for the inclusion of a non-patient group in studies on CMD and CSD.

The craniomandibular system and the cervical spine are often considered a functional entity, and it has been suggested that patients with a craniomandibular disorder (CMD) more often suffer from a cervical spine disorder (CSD) than persons without a CMD. Previous studies to the coexistence between CMD and CSD, that included a non-patient group, indicated that CMD patients more often show signs and/or symptoms of CSD than non-CMD patients (Clark et al., 1987; Cacchiotti et al., 1991; De Laat et al., 1998; Ciancaglini et al., 1999). However, the results of these studies are difficult to interpret. Different signs and/or symptoms are used to describe the prevalence of a CMD or CSD. Moreover, different examination techniques, such as questionnaires (Clark et al., 1987; Cacchiotti et al., 1991; Ciancaglini et al., 1999) and various clinical tests (Clark et al., 1987; Cacchiotti et al., 1991; De Laat et al., 1998) were employed to establish the presence of the disorders. The study by Clark et al. (1987) clearly showed that the method used to recognise a CMD or CSD is of
importance for the outcome of the investigation. A statistically significant difference in CSD signs and symptoms between their CMD patients and controls was found when the scores were based upon both a questionnaire and a clinical examination. However, this difference was not quite significant any more when these items were considered independently.

In order to avoid bias, studies on the prevalence of CSD signs and/or symptoms in CMD patients should preferably be performed under blind conditions with regard to the classification of the participants. Until now, the study by De Laat et al. (1998) is the only study on this subject performed in a controlled, single blind design. However, one of their inclusion criteria for the CMD patients was that no evaluation or treatment for cervical problems had been performed in the past, whereas the control subjects were not only free from CMD but also from subjective complaints of cervical dysfunction. This hampers the answer to the question whether participants with CMD complaints more often show signs and/or symptoms of CSD than participants without CMD complaints.

Since pain, experienced during normal daily activities, is the most important reason to seek treatment for a CMD or CSD, in this study it played a prominent role in the recognition of a CMD or CSD. Therefore, the aim of the present study was to determine the prevalence of cervical spinal pain in persons with or without craniomandibular pain, using a controlled, single blind design. To study the influence of the examination methods used, the presence of the two disorders was established in three different ways. It was based on the presence of well-described pain complaints reported in the oral history, upon pain which was provoked in well-defined clinical tests, or upon the combination of pain reported in the oral history and that provoked in the clinical examination. The presence of cervical spinal pain was also established in subgroups of craniomandibular pain patients.
Prevalence of cervical spinal pain

Materials and methods

Participants

This investigation is part of a study on the relationship between craniomandibular and cervical spinal pain. In total, 250 persons, 179 women and 71 men, with a mean age of 34 ± 13.3 years, participated. These participants were consecutively recruited from persons referred to the Academic Centre for Dentistry Amsterdam (ACTA) for CMD complaints, were friends or relatives of the recruited persons, or were friends or relatives of co-workers from the department. Exclusion criteria were the presence of general joint disorders that might involve the head and neck region (e.g., rheumatoid arthritis), a history of jaw fractures or orthognathic surgery, or active treatment for a CMD. Inclusion criterion was a good understanding of the Dutch language.

From each participant an oral history was taken and a physical examination of the masticatory system and of the neck was performed. The scientific and ethical aspects of the protocol were reviewed and approved by the review board of the Netherlands Institute for Dental Sciences, and written informed consent was obtained from all participants.

Oral history taking

All oral histories were taken by the same examiner (CV) and included questions on pain in the orofacial region and neck. When pain was present, its location, nature, duration, and radiation were determined. Moreover, aggravation of pain on function of the masticatory system or the neck was noted.

Physical examination of the craniomandibular system and the neck

The physical examination of the craniomandibular system was performed by one of three calibrated dentists; that of the neck, by one of two calibrated physical therapists or by one of four calibrated last year physical therapy students. The examiners were blind to the presence or absence of the participant’s CMD or neck complaints. In the examinations, pain was provoked by palpation, by performing active and passive movement tests and by dynamic/static tests. During palpation, the muscular and joint structures of the masticatory system and the neck were examined. During active
movements the participant was asked to move the mandible or the head in several directions; during passive tests the examiner passively prolonged these movements. For the dynamic tests, each of the movements was performed under the guidance of the examiner by applying a small manual resistance to the mandible or to the head. For the static tests, the manual resistance applied by the examiner was so high that no movement of the mandible or the neck could occur. The pain responses provoked by the different tests were scored on a 5 point verbal scale whereas the pain responses to the palpation tests and to the dynamic/static tests were also rated on a 100-mm visual analogue scale (VAS). Details of these procedures are given elsewhere (Visscher et al., Chapter 4).

**Recognition of craniomandibular and cervical spinal pain**

The presence of the two disorders was established in three different ways. First, all participants were classified based upon the symptoms they reported in the oral history (‘symptoms model’). The participant was classified as having a craniomandibular or cervical spinal pain, when there were complaints of pain or tenderness in the orofacial region or the neck, during the previous month. Otherwise, the oral history was considered negative. Two investigators independently evaluated the oral histories, and decided whether pain was present. The investigators were blind to the outcome of the physical examinations. They initially disagreed on two persons, discussed the oral histories, and came to an agreement.

Second, the participants were classified according to their pain signs, recorded during the physical examination of the masticatory system and the neck (‘signs model’). As reported in a previous study (Visscher et al., Chapter 4) the maximum pain scores of the active/passive movement tests, palpation, and dynamic/static tests have been entered into a forward stepwise logistic regression analysis to determine which (combination of) test(s) best discriminated between persons with or without craniomandibular or cervical spinal pain, as reported in the oral history. This was done twice, for the verbal scores and for the VAS scores. For both analyses, the pain experienced during the dynamic/static tests best discriminated between persons with or without a pain complaint in the masticatory system or in the neck. Incorporation of the scores of the other tests into the regression model did not or only slightly improve the
outcome of the regression model and resulted in rather complicated combinations of pain cut-off values. Therefore, only the maximum VAS scores from among the dynamic/static tests were used in the signs model. The VAS cut-off value, which discriminated best between persons with or without a pain complaint, was 12 mm for the masticatory system and 13 mm for the neck. So, the physical examination of the masticatory system or the neck was considered positive when the participant rated the pain intensity of at least one of the dynamic/static tests equal to or higher than the VAS cut-off value. Otherwise, the physical examination of the masticatory system or neck was considered negative.

Third, the participants were classified according to the combined presence of symptoms and signs (‘symptoms & signs model’). They were classified as having craniomandibular or cervical spinal pain, when both the ‘symptoms model’ and the ‘signs model’ were positive. When both models were negative, the participant was classified as not having the pain disorder. When either the ‘signs model’ or the ‘symptoms model’ was positive, it was considered questionable whether or not the participant had the disorder and the person was assigned to a group with equivocal craniomandibular or cervical spinal complaints.

**Recognition of myogenous and arthrogenous craniomandibular pain**

The craniomandibular pain patients, classified according to the ‘symptoms & signs model’, were also subdivided into three craniomandibular pain subgroups: patients with mainly myogenous pain, mainly arthrogenous pain, and both myogenous and arthrogenous pain. Two highly experienced investigators independently classified all craniomandibular pain patients. When a person reported pain complaints in the area of the masseter muscle and/or the temporalis muscle, which were confirmed by pain in the same area on dynamic/static tests or active movements, the person was assigned to the myogenous group. Pain complaints localised in the pre-auricular area can have an arthrogenous as well as a myogenous origin. In that case, the following signs were regarded indicative for arthrogenous pain: more pain on dynamic than on static tests, pain on lateral or posterior palpation of the temporomandibular joint area, and pain during the joint play tests. Indications for myogenous pain were then: more pain on static than on dynamic tests, no pain on palpation of the joint area, and no pain on the
joint play tests. When a person had substantial signs and symptoms of a myogenous and an arthrogenous character, the person was assigned to a group with myogenous and arthrogenous pain. After the first, independent classification, the percentage of agreement between the two investigators was 79%. When the investigators disagreed, they discussed it, and came to an agreement.

Statistics
Cohen's Kappa was used to assess agreement between the 'symptoms model' and the 'signs model'. \( \chi^2 \)-tests were used to compare the prevalence of CSD in the non-CMD group, the CMD-patient group, and the CMD subgroups. In the same analyses, the influence of gender upon the possible relationship between CMD and CSD was verified. Levels of \( p<0.05 \) were considered statistically significant. For all statistical analyses, the SPSS 9.0 package (SPSS Inc., 1998) was used.

Results
Table 1 shows the results of the classification of the participants into persons with or without craniomandibular or cervical spinal pain, based on the 'symptoms model', the 'signs model' and the 'symptoms & signs model'. According to the oral history, 91% of the patients had chronic pain complaints (>6 months), 6% had subacute complaints (3-6 months), and 3% had acute complaints (<3 months). The agreement between the 'symptoms model' and the 'signs model' was moderate for the craniomandibular pain classification (\( \kappa=0.53 \)), and only fair for the cervical spinal pain classification (\( \kappa=0.38 \)). For the 'symptoms & signs model', 57 and 77 persons respectively could not be classified unequivocally as having craniomandibular or cervical spinal pain.

Independent of the classification used, the prevalence of cervical spinal pain in the craniomandibular pain group was higher than in the group without craniomandibular pain (Table 2). No influence of gender upon the relationship between CMD and CSD was found (\( p=0.437-0.905 \)).
*Prevalence of cervical spinal pain*

**Table 1.** Results of the classification of the participants into persons with or without craniomandibular or cervical spinal pain based on the three classification models.

<table>
<thead>
<tr>
<th>Symptom model</th>
<th>Craniomandibular pain</th>
<th>Cervical spinal pain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Symptoms model</td>
<td>102</td>
<td>148</td>
</tr>
<tr>
<td>Signs model¹</td>
<td>113</td>
<td>136</td>
</tr>
<tr>
<td>Symptoms &amp; Signs model¹</td>
<td>79</td>
<td>113</td>
</tr>
</tbody>
</table>

¹one value was missing for the craniomandibular classification, and three values were missing for the cervical spinal classification.

**Table 2.** The prevalence of cervical spinal pain (%) in the persons without craniomandibular pain and in the craniomandibular pain patients, classified according to the three classification models, and the results of the $\chi^2$-tests. *** $p < 0.001$

<table>
<thead>
<tr>
<th></th>
<th>Symptoms model</th>
<th>Signs model</th>
<th>Symptoms &amp; Signs model</th>
</tr>
</thead>
<tbody>
<tr>
<td>No craniomandibular pain</td>
<td>31</td>
<td>25</td>
<td>13</td>
</tr>
<tr>
<td>Craniomandibular pain</td>
<td>70</td>
<td>67</td>
<td>58</td>
</tr>
<tr>
<td>Equivocal</td>
<td>-</td>
<td>-</td>
<td>21</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>35.51***</td>
<td>43.40***</td>
<td>65.30***</td>
</tr>
</tbody>
</table>

The craniomandibular pain patients, classified according to the 'symptoms & signs model', were also divided in three subgroups. Eighty-two of these patients had mainly myogenous pain, 14 had mainly arthrogenous pain, and 15 had both myogenous and arthrogenous pain. Two craniomandibular pain patients were not classified, because the results of the oral history suggested another classification than those of the physical examination. The prevalence of cervical spinal pain in the myogenous group was 58%, in the arthrogenous group it was 64% and in the group with both myogenous and arthrogenous pain it was 53%. The prevalence of cervical spinal pain was not significantly different between the three subgroups ($\chi^2=0.73$; $p=0.948$).
Chapter 5

Discussion

The aim of this study was to determine the prevalence of cervical spinal pain in persons with or without craniomandibular pain. To determine the prevalence of a disorder, one needs well-defined criteria to separate patients from non-patients. However, for chronic musculoskeletal disorders such as CMD and CSD, there often are no specific tissue changes that can objectively diagnose their presence, and their recognition is usually based upon a selection of signs and/or symptoms. To investigate the importance of the selection of signs and/or symptoms, the prevalence of a cervical spinal pain in (non-)craniomandibular pain patients was analysed for three classification models: the ‘symptoms model’, the ‘signs model’ and the ‘symptoms & signs model’. The symptoms model is likely to include all persons with craniomandibular or cervical spinal pain. However, it cannot be excluded that persons with pain complaints in the orofacial region or neck that do not originate from the muscles or joints are also included in the patient groups. During the dynamic/static tests the musculoskeletal structures of the masticatory system and the neck are loaded, and therefore the signs model is likely to include persons with craniomandibular or cervical spinal pain into the respective patient groups. However, this model only gives a momentary impression of the status of the musculoskeletal structures, whereas the presence of pain can fluctuate over time. Despite the fact that the dynamic/static tests discriminated best between persons with or without pain complaints (Visscher et al., Chapter 4), some of the non-patients will still be included into the patient groups, and vice versa. For this reason, we also used the ‘signs and symptoms’ model. This is in accordance with common clinical practice, that the recognition of a musculoskeletal disorder is usually based upon the combination of the symptoms of the patient and the signs found in a physical examination (Spitzer et al., 1987; Dworkin and LeResche, 1992; Mersky and Bogduk, 1994; Okeson, 1996). In the Research Diagnostic Criteria for CMD (Dworkin and LeResche, 1992), palpation tests play an important role in the physical examination. Since previous results showed that the pain intensity during dynamic/static tests is more closely related to the CMD or CSD pain complaints than palpation, we preferred the use of dynamic/static tests instead of palpation (Visscher et al., Chapter 4). The persons who were included in the patient and non-patient groups
very likely had or did not have craniomandibular or cervical spinal pain. Participants who were assigned to the equivocal groups may have experienced pain in the previous month, which could not be provoked at the time of the physical examination. However, it is also possible that their pain complaints did not originate from the musculoskeletal structures, but for example were based on a dental problem.

The results of this study suggest that the choice for criteria to recognise craniomandibular or cervical spinal pain is an important one: dependent upon the classification model used, the percentage of a cervical spinal pain in persons without craniomandibular pain ranged from 13% to 31%, and in craniomandibular pain patients it ranged from 58% to 70%. This is in accordance with our finding that the agreement between the ‘symptoms model’ and the ‘signs model’ was moderate for the craniomandibular pain classification and only fair for the cervical spinal pain classification, and confirms earlier findings of Clark et al. (1987). Forty percent of their CMD patients rated positive on a cranio cervical questionnaire (symptom) or on a physical examination (sign), whereas only 22.5% rated positive on both items. The present study clearly showed that, irrespective of the classification model used, chronic craniomandibular pain patients more often suffer from a cervical spinal pain than persons without craniomandibular pain. Apparently, the coexistence of craniomandibular and cervical spinal pain is so strong, that it is found regardless of the examination technique used. Our results support the conclusion made by De Laat et al. (1998). A high prevalence of symptoms and signs of CSD in CMD patients was also found in the studies by Lobbezoo-Scholte et al. (1995) and De Wijer et al. (1996), but in these studies, the prevalence of cervical spinal pain in controls was not assessed.

No further attempts were made to divide the cervical spinal pain into subgroups. The International Association for the Study of Pain (Mersky and Bogduk, 1994) suggests a detailed classification scheme for cervical spinal pain. However, they also indicate that for some of their subdiagnoses, such as arthritis and congenital vertebral anomalies, there is only weak evidence that the cervical spinal pain is causally associated with the condition as diagnosed radiologically. Moreover, for most of these subdiagnoses, expensive and relatively inaccessible imaging techniques, like radiology, computer tomography or diagnostic nerve blocks are necessary.
The persons who were classified as having craniomandibular pain according to the 'symptoms & signs' model were further divided in three subgroups. For the diagnosis of a painful CMD, the RDC uses self reported pain and pain reported during palpation and/or mandibular movements. We have added the dynamic/static tests to those described in the RDC in the classification of the craniomandibular subgroups. Our results showed no difference in the prevalence of cervical spinal pain between the three subgroups of craniomandibular pain patients. Lobbezoo-Scholte et al. (1995) did find differences in CSD symptoms and signs between myogenous CMD patients and patients with a disc displacement, and myogenous CMD patients in a study by De Wijer et al. (1996) showed more characteristics in common with CSD patients than arthrogenous CMD patients. Pain, however, did not play a dominant role in their classifications. In the arthrogenous subgroup and in the group with disc displacements, also CMD patients without pain complaints were included. In contrast, in our study, pain was the main feature in the classification of all three craniomandibular subgroups.

The coexistence found between a craniomandibular and cervical spinal pain is most probably multifactorial. Overload plays an important role in the etiology of a musculoskeletal disorder. For the masticatory system and the neck, clenching or grinding teeth, and sustained (working) postures, can overload the musculoskeletal structures and result in pain (Christensen, 1981; Larsson et al., 1998). Many patients claim that they hold tension in both the jaw and neck regions simultaneously (Browne et al., 1998). Such habits often are the result of psychological factors, like stress or anxiety (Eversole and Machado, 1985; Kight et al., 1999). Another possible cause for the coexistence of CMD and CSD may be found in the neurophysiological principles of convergence and sensitisation. A constant nociceptive input on second-order neurons may increase the sensitivity of these neurons. Then, non-nociceptive neural impulses from other areas within the same segment, which converge onto these neurons may give rise to nociceptive sensations. For the craniocervical region, a constant nociceptive input from, for example, the upper part of the trapezius muscle can lead to an increased sensitivity of the spinal trigeminal nucleus. Non-nociceptive stimuli from the masticatory system would then lead to painful sensations from the trigeminal region (Sessle et al., 1986; Codere et al., 1993; Okeson, 1996). In these
cases, the patient will experience craniomandibular and cervical spinal pain at the same time.

In conclusion, this study has shown that chronic craniomandibular pain patients more often suffer from cervical spinal pain than persons without craniomandibular pain. No difference in the prevalence of cervical spinal pain was found between subgroups of craniomandibular pain patients.