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Chapter 4

The recognition of craniomandibular and cervical spinal pain

A study to chronic musculoskeletal pain

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Abstract

The recognition of a craniomandibular or cervical spinal pain is usually based upon the pain complaint of the patient, reported during an oral history, and the pain responses provoked in a clinical examination. Often used clinical tests are palpation, and function tests like dynamic/static tests or active movements. The relative importance of these tests for the recognition of the musculoskeletal pain is important. Therefore, it was the aim of the present study to determine which test, or combination of tests, best discriminates between persons with or without craniomandibular and/or cervical spinal pain complaints. Two hundred and fifty persons participated. From each person, a standardised oral history was taken. Then, in a randomised order, and using a blind design, physical examinations of the craniomandibular system and of the neck were performed. Forward stepwise logistic regression analyses showed that the dynamic/static tests discriminated better between persons with or without pain complaints than the other tests did. In conclusion, in studies to craniomandibular and cervical spinal pain, it may be a good choice to base the recognition of these disorders on the pain complaints reported in the oral history, which are verified by the pain response of the dynamic/static tests.

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 these disorders have in common, is pain originating from the musculoskeletal structures. which usually aggravates by chewing or other jaw function (Solberg, 1986; McNeill et al., 1990; Okeson, 1996), or by moving the head or adopting certain working positions (Grant and McKenzie, 1994). The craniomandibular system and the cervical spine are often regarded a functional biomechanical entity (Brodie, 1950) which has led to the suggestion that patients with a CMD are more likely to suffer from a cervical spine disorder than persons without a CMD (Clark et al., 1987; Cachiotti et al., 1991; De Laat et al., 1998; Ciancaglini et al., 1999). However, often different signs and/or symptoms were used to describe the prevalence of the CMD and the CSD, and also different examination techniques were employed, such as questionnaires (Clark et al., 1987; Cachiotti et al., 1991; Ciancaglini et al., 1999) or various clinical tests (Clark et al., 1987; Cachiotti et al., 1991; De Laat et al., 1998). The choice of the investigation technique is an important one since the technique used to recognise a CMD or CSD influences the outcome of the study. This is illustrated in a study by Clark et al. (1987) that showed a statistically significant difference in CSD signs and symptoms between CMD patients and controls when the scores were based on both a questionnaire and a clinical examination. This difference was not significant any more when these items were considered independently. Therefore, in studies to the coexistence between CSD and CMD it is to be preferred that similar diagnostic criteria are used for the recognition of these musculoskeletal disorders. For CMD, the Research Diagnostic Criteria have been introduced in 1992 and these criteria are now widely used for research purposes (Dworkin and LeResche, 1992). They allow standardisation and replication of research into the most common forms of 3 categories of muscle- and joint related craniomandibular disorders. The International Association for the Study of Pain has proposed a classification for chronic pain, which, among others, also includes a classification of cervical spinal and radicular pain syndromes into 17 subcategories (Mersky and Bogduk, 1994). However, the examination techniques of the IASP classification system are partly different from those of the RDC and their subcategories cannot be translated to the craniomandibular system or vice versa. So, there is no universal diagnostic system that can be applied for the recognition of a CMD as well as a CSD. Since pain is the dominant symptom of disorders of the craniomandibular system and the cervical spine, this study focuses on the recognition of craniomandibular and cervical spinal pain.

In common clinical practice, the recognition of a musculoskeletal pain is usually based upon the symptoms of the patients, reported during an oral history, and the signs found in a physical examination. In the physical examination, the pain responses provoked during active movements, palpation of the muscles and joints, and resisted movements play an important role (Dworkin and LeResche, 1992; Cyriax and Cyriax, 1998). However, in individual patients, these tests sometimes yield contradictory results and then the relative importance of these tests in the recognition of the musculoskeletal pain is important. Therefore, it was the aim of the present study to determine which test, or combination of tests, best discriminates between persons with or without craniomandibular or cervical spinal pain complaints, as reported in the oral history, using a controlled, single-blind design.

Materials and methods

Participants

This paper is part of a study to the relationship between craniomandibular pain and cervical spinal pain. In this study, 250 persons (179 women, 71 men, mean age 34 years, SD=13.3) participated. One hundred and forty seven participants were consecutively recruited from persons referred to the Academic Centre for Dentistry Amsterdam (ACTA) for CMD complaints and 103 participants were friends or relatives of the recruited persons, or were friends or relatives of co-workers from the department of Oral Function of ACTA. 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 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 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 and instructions

The oral history taking mainly included questions on pain in the orofacial region and the 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. Joint sounds, limited movements, parafunctional habits, and trauma were also asked for. This oral history was always taken by the same examiner (CV).

After the history taking, each participant was instructed on how to use the pain scales in the forthcoming physical examinations of the craniomandibular system and the neck. They were told to rate their pain intensity during the different tests on a 5-point (verbal) ordinal scale and, for some of the tests, also on a visual analogue scale (VAS). The English equivalents of the Dutch reference words for the verbal scale were 'none' (assigned as a value of 0), 'sensitive' (1), 'painful' (2), 'very painful' (3), or 'unbearably painful' (4). The VAS consisted of a 100-mm line with ends defined as 'no pain' (left end) and 'worst pain imaginable' (right end) (Seymour et al., 1985). The participant was asked to mark the pain intensity with a pencil on this line. Pain intensity was then expressed as the distance in millimetres from the left end point to the pencil mark.

Physical examination of the craniomandibular system and of the cervical spine

The physical examination of the craniomandibular system was performed by one of three calibrated dentists, and that of the cervical spine was performed by one of two calibrated physical therapists or by one of four last year physical therapy students. They were all trained to give the same standardised instructions to the participants, to perform all tests likewise, and in accordance with the protocol. On a regular basis, the examiners were re-calibrated. At the time of the examination, the examiner was blind

to the presence or absence of the participant's craniomandibular or neck complaints. An assistant observed whether the protocol was followed and wrote down the results. The physical examinations consisted of active and passive movements, dynamic/static tests, palpation, algometry, joint play, and, for the examination of the craniomandibular system, of an intra-oral inspection and the recognition of joints sounds.

In the present study, the ability of the function tests (active and passive movement tests and dynamic/static tests) and of palpation to discriminate between persons with or without pain complaints were analysed. Therefore, these tests are described in more detail in the next paragraphs.

Active and passive movements of the craniomandibular system

The participant was asked to open the mouth, to move the mandible to the right side and to the left side, and to protrude the mandible. When necessary, the dentist encouraged the participant to maximally move the mandible. To test the passive maximal mouth opening, the dentist's thumb and index finger were placed on the participant's frontal teeth, while the mandible was gently moved to its border position. After each test, the pain intensity was rated on the verbal scale, and its location was noted. Results of a reliability study from our department, involving 30 CMD patients, showed that the agreement between two investigators ranged from 0.59 to 0.73 (Kappa values).

Dynamic/static tests of the craniomandibular system

For each type of movement (opening, closing, laterotrusion to the right and the left side, and protrusion) the dynamic test was performed first, followed by the static test. 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. For the static tests, the manual resistance applied by the examiner was so high that no movement of the mandible could occur: the mandible was motionless in a position approximately 5 millimetres in the direction of the intended movement. Pain intensities were scored on the verbal scale and on the visual analogue scale, and the locations of the pain were also noted. The interrater reliability ranged from 0.43 to 0.89 (Kappa values) for the verbal scores and from 0.46 to 0.91 (Pearson's correlation) for the VAS scores.

Palpation of the craniomandibular system

Palpation was performed using the index and middle finger, at a force of approximately 10 N. Test sites were: the temporomandibular joint (laterally and posteriorly); the anterior, middle and posterior part of the temporalis muscle; the upper, middle, and lower part of the masseter muscle (palpated bimanually, one finger placed intraorally and two fingers of the other hand placed extraorally), and the deep part of the masseter muscle (extraorally). During palpation, the participant was asked to relax the muscles. Pain intensities were scored on the verbal scale and on the visual analogue scale. The interrater reliability ranged from 0.42 to 0.74 (Kappa values) for the verbal scores and from 0.58 to 0.90 (Pearson's correlation) for the VAS scores.

Active and passive movements of the cervical spine

The participant was asked to bend the head forward, backward, sideward to the right and the left, and to rotate the head to the right and the left side. Then, movement tests of the high cervical region (C0C1) were performed; the participant was asked to rotate the head to the right side, and, while keeping the head maximally rotated, to bend the head forward and backward. First, each movement was performed actively; when necessary, the participant was encouraged to maximally move the head. Second, after the participant was asked to relax the neck musculature, the according passive movement was performed. After each combination of active and passive movements, the pain intensity was scored on the verbal scale, and its location was noted. Kappa values for interrater agreement ranged from 0.56 to 0.89.

Dynamic/static tests of the cervical spine

During the dynamic tests the participant was asked to bend the head forward, backward, sideward to the right and the left, and to rotate the head to the right and the left side, under the guidance of the examiner who applied a light manual resistance to the head. For the static tests, the manual resistance applied by the examiner in the before described directions was so high that no movement of the head could occur. The position of the head was standardised using the so-called mirror position; the participant looked into his own eyes in a mirror placed in front of him (Solow and Tallgren, 1976). Pain intensities were scored on the verbal scale (Kappa values ranged

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from 0.43 to 0.80) as well as on the visual analogue scale (Pearson's correlation coefficients ranged from 0.60 to 0.97), and the pain locations were noted.

Palpation of the muscles of the cervical spine

Palpation was performed using the index and middle finger, at a force of approximately 10 N. Only those parts of the neck muscles were palpated that are not covered by other muscles. The descending part of the trapezius muscle was divided in quadrants; the middle of each quadrant was palpated. The splenius capitis muscle was palpated approximately 2 cm below its insertion, between the lateral border of the trapezius muscle and the posterior border of the sternocleidomastoid muscle. The sternocleidomastoid muscle was palpated on 3 sites, approximately 5 cm below its insertion, 2 cm above its origin at the clavicle, and 2 cm above its origin at the sternum. The levator scapulae muscle was palpated in its middle part. After each palpation, pain was scored on the verbal scale (Kappa values ranged from 0.46 to 0.73) and on the visual analogue scale (Pearson's correlation coefficients ranged from 0.61 to 0.92).

Classification

Two investigators evaluated the oral histories, and independently determined whether or not persons were suffering from a craniomandibular or cervical spinal pain. They were blind to the outcome of the physical examinations. The criterion for a craniomandibular pain was the presence of pain or tenderness in the area of the masticatory muscles, the preauricular area, or the temporomandibular area, during the previous month (n=148). Persons were classified as not suffering from a craniomandibular pain, when no pain complaints in the orofacial area were present (n=102). As a result of this procedure, five persons recruited from our CMD clinic were placed in the non-pain group, and six persons recruited from the friends and relatives were placed in the craniomandibular pain group.

Persons were classified as having a cervical spinal pain when they complained of pain or tenderness in the neck/shoulder area during the previous month (n=135). When no pain complaints in the neck/shoulder region were present, that person was classified as not suffering from a cervical spinal pain (n=115). According to the oral history.

91% of the persons classified as having craniomandibular and/or cervical spinal pain had chronic pain complaints (>6 months), 6% had subacute complaints (3-6 months), and 3% had acute complaints (<3 months).

Statistical analysis

For the dynamic/static tests and for palpation, the maximal VAS scores were determined and used in the subsequent analyses. For the dynamic/static tests, for palpation, and for the active movements (craniomandibular system) or the combination of active and passive movements (cervical spinal system), the maximal verbal scores were also determined. Non-patients seldom rated their pain as 'very painful' or 'unbearably painful'. This led to empty cells in the Loglinear test and hampered the statistical analyses. Therefore, the scores 'painful', 'very painful' and 'unbearably painful' were pooled and given the verbal score 'painful' (2).

Analysis of variance (ANOVA), preceded by logit transformation to approach normality, and followed by contrast analysis, was used to compare maximal VAS values between the groups and the tests, and to determine their interaction. Loglinear analysis and standardised residuals were used to compare the maximal verbal pain scores between the groups and the tests, and to determine their interaction. To determine the ability of the active/passive movements, the dynamic/static tests and of palpation to discriminate between persons with or without pain complaints, single logistic regressions, with the maximal pain score of each test as predictor, were performed. The Nagelkerke R² results of the logistic regression were used as indicator of the proportion of explained variation. The maximal pain scores of the tests were also entered as predictors into a forward stepwise logistic regression analysis to determine which (combination of) test(s) best explained the presence or absence of a pain complaint. The p-value to enter the model was set at 0.05. Moreover, sensitivity and specificity were determined. Sensitivity and specificity depend upon the cut-off value chosen. For this study, that cut-off value was chosen for which the sensitivity and specificity were as much as possible the same. Levels of p<0.05 were considered statistically significant. For all statistical analyses, the SPSS 9.0 package (SPSS Inc., 1998) was used.

Results

Figures 1 and 2 show box-and-whisker plots of the maximal VAS scores for palpation and for the dynamic/static tests.



Figure 1. Box-and-whisker plots of the maximal VAS scores of palpation and dynamic/static tests, for the groups with or without craniomandibular pain.



Figure 2. Box-and-whisker plots of the maximal VAS scores of palpation and dynamic/static tests, for the groups with or without cervical spinal pain.

Persons with a craniomandibular or cervical spinal pain complaint rated their maximal VAS pain intensities higher than persons without a pain complaint, and the maximal pain scores of the palpation tests were higher than those of the dynamic/static tests (Table 1, and contrast analyses, p=0.000). Moreover, there was less overlap in pain scores between persons with and without a pain complaint for the dynamic/static tests than for palpation (Table 1 interaction term, and contrast analysis, p=0.000).

missing values in the data).				
Source of variation	df	F	р	
Craniomandibular system				
Pain group vs. non-pain group	1,245	141.96	0.000	
Dynamic/static vs. palpation	1,245	80.81	0.000	
Groups by tests	1,245	22.53	0.000	
Cervical spinal system				
Pain group vs. non-pain group	1,245	56.46	0.000	
Dynamic/static vs. palpation	1,245	51.43	0.000	
Groups by tests	1,245	12.22	0.001	

 Table 1. Results of ANOVA for data shown in Figures 1 and 2, with

 the maximal VAS score as dependent variable (n=247; there were 3

 missing values in the data).

Table 2 shows frequencies of the maximum verbal pain intensities on palpation, dynamic/static tests and active/passive movements for the non-pain and pain groups.

 Table 2. Frequency (%) of maximum verbal scores for the non-pain group vs. the pain group (in parentheses).

· · · ·	Cranion	nandibular	systema	Cervical spinal system ^b		
Max. verbal score	0	1	2	0	1	2
Palpation	21(1)	46 (25)	34 (74)	21 (4)	55 (44)	24 (52)
Dynamic/static	55 (6)	38 (32)	7 (62)	48 (8)	41 (49)	11 (43)
Active movements	67 (13)	28 (38)	5 (49)	_	_	_
Passive opening	63 (20)	27 (29)	10 (51)	_	_	_
Act/pas movements	_	_	_	12(0)	48 (24)	40 (76)

a n=245; there were 5 missing values in the data

b n=244; there were 6 missing values in the data

Persons with a craniomandibular or cervical spinal pain complaint showed higher maximum verbal pain intensities than persons without pain complaints (Table 3, p<0.000). Moreover, Table 3 shows a difference in pain scores between the various tests (p<0.000). For the craniomandibular system, the maximal pain intensity rated on palpation was highest, followed by pain on dynamic/static tests, then pain on passive opening and finally pain on active movements (standardised residuals). For the cervical spinal system, the maximal pain intensity on combined active and passive movements was rated highest, followed by pain on dynamic/static tests (standardised residuals).

able 5. Results of Loginical-tests for		erour puin daa	
Source of variation	df	χ^2	р
Craniomandibular system ^a			
Pain group vs. non-pain group	2	325.67	0.000
Dynamic/static, palpation, active	6	83.04	0.000
movements, passive opening			
Cervical spinal system b			
Pain group vs. non-pain group	2	134.05	0.000
Dynamic/static, palpation.	6	72.57	0.000
active/passive movements			

 $b_{n=244}$

Table 4 shows the results of the single logistic regressions with the maximal VAS scores of dynamic/static tests or of palpation as predictor. The dynamic/static tests discriminated better between persons with or without a craniomandibular or cervical spinal pain complaint than palpation did. Moreover, the VAS cut-off value (the value discriminating best between persons with or without a pain complaint) was higher for palpation than for the dynamic/static tests. Only the maximal VAS scores of the dynamic/static tests were selected in the forward stepwise logistic regression analysis. Palpation did not significantly improve the ability of the model to discriminate between persons with or without a craniomandibular or cervical spinal pain complaint.

andes (min) for the maximal VAS-scores. R-: explained variance,									
	Craniomandibular system					Cervical s	pinal system		
	R ²	sensitivity	specificity	cut-off	R ²	sensitivity	specificity	cut-off	
Palpation	0.21***	71.4	72.0	24	0.11***	61.7	57.9	21	
Dynamic/static	0.46***	78.8	77.0	12	0.24***	70.7	69.3	13	

Table 4. Results of the single logistic regressions, the sensitivity (%), specificity (%), and cut-off values (mm) for the maximal VAS-scores. R^2 : explained variance, ***: p<0.001, n=247.

Table 5 shows the results of the single logistic regression analyses with the maximal verbal pain scores as predictor. The dynamic/static tests discriminated best between persons with or without craniomandibular or cervical spinal pain.

Table 5. Results of the single logistic regressions, the sensitivity (%), specificity (%), and cut-off values for the maximal verbal scores. R^2 : explained variance, ***: p<0.001.

	С	Craniomandibular system ^a				Cervical spinal systemb			
	R ²	sensitivity specificity cut-off		R ²	Sensitivit	specificit	cut-off		
						У	У		
Palpation	0.28***	74.5	67.0	2	0.16***	52.3	76.3	2	
Dynamic/static	0.50***	62.8	93.0	2	0.30***	91.5	47.4	1	
Active movements	0.44***	86.9	67.0	1	_	_	-	_	
Passive opening	0.32***	80.0	64.0	ł	_	_	_	_	
Act/pas movements	-		-	_	0.21***	75.4	60.0	2	

an=245

 $b_{n=244}$

In the forward stepwise logistic regression, the dynamic/static tests were selected as the first predictor. For the craniomandibular pain, pain on active movements was selected as second predictor and pain on palpation as the third one (Table 6). Passive opening did not further improve the prediction of the model. Also for cervical spinal pain, the dynamic/static tests were selected as first predictor. The combined active and passive movements of the cervical spine further improved the model. The cut-off values of the (combination of) tests are given in Table 6. Table 6. Results of the forward stepwise logistic regression, sensitivity (%), specificity (%), and cutoff values for the maximal verbal scores.

Cranion	nandibular system ^a					
Step	Variables	R ²	p (of the step)	sensitivity	specificity	cut-off
I	Dynamic/static	0.50***	0.000	62.8	93.0	2
Н	Dy/st + active movements	0.56***	0.000	86.2	77.0	2¢
III	Dy/st + active movements +	0.59***	0.020	81.4	82.0	d
. <u></u>	palpation					
Cervica	l spinal system ^b					
I	Dynamic/static	0.30***	0.000	91.5	47.4	I
П	Dy/st + active/passive	0.35***	0.002	75.4	66.7	le
	movements					

R²: explained variance, dy/st: dynamic/static tests, ***: p<0.001.

a n=245

b n=244

^c sum score of the dynamic/static tests and of the active movements ≥ 2 .

d cut-off: sum score of dynamic/static tests and active movements ≥ 3 , and ≥ 1 on palpation.

e sum score of the dynamic/static tests and of the active/passive movements ≥ 1 .

In none of the regressions used, a significant interaction was found between the predictor and gender or age. Moreover, none of the predictors for craniomandibular pain showed an interaction with the presence or absence of cervical spinal pain, and vice versa.

Discussion

This paper is part of a study to the prevalence of cervical spinal pain in craniomandibular pain patients. To study the prevalence of a musculoskeletal pain, well-defined criteria are needed to separate patients from non-patients. Unfortunately, for chronic musculoskeletal disorders, such as CMD and CSD, there are usually no specific tissue changes that can objectively diagnose its presence, and the recognition is usually based upon a selection of signs and symptoms. Since pain is the main reason for a patient to seek treatment for a musculoskeletal disorder, we have focused our study on the pain complaints of the patients and on the signs, which best confirm the presence of these pain complaints. In particular, this study investigated the ability of function tests (*i.e.*, active and passive movements and dynamic/static tests) and of palpation to discriminate between patients with or without craniomandibular or cervical spinal pain complaints. In order to avoid bias, the physical examinations of the craniomandibular system and the cervical spine were performed under blind conditions with regard to the pain complaints of the persons involved.

The comparison of the results of the dynamic/static tests with those of palpation showed, that the maximal pain scores of the palpation tests were higher than those of the dynamic/static tests, and that there was less overlap in pain scores between persons with and without pain complaints for the dynamic/static tests than for palpation. Consequently, the cut-off value to discriminate between pain patients and non-patients was lower for the dynamic/static tests than for palpation, see Table 4. For this analysis, those cut-off values were chosen for which the sensitivity and the specificity were as much as possible the same. The choice for a cut-off value is not a statistical decision, but a decision based upon the nature of the disease (Dworkin et al., 1990). In this respect, it was considered to be equally important to be able to identify those persons who are suffering from musculoskeletal pain (sensitivity) and those who are not (specificity). The relatively high cut-off value for palpation stresses that persons without pain complaints may rate their pain intensity on palpation already quite high. For example, in this study about 25%-40% of the persons without craniomandibular or cervical spinal pain complaints rated their maximal pain on palpation higher than the corresponding cut-off value (derived from Table 4 and 5). Dworkin et al. (1990)

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reported that the prevalence of pain on palpation of the masticatory system in a group of community controls varied from 2% - 45%, and Kirveskari *et al.* (1988) showed that more than half of a group of participants without neck complaints reported tenderness on palpation of the neck-shoulder muscles.

The results of the single logistic regressions suggest, that the maximal pain experienced during the dynamic/static tests better discriminates between persons with or without craniomandibular or cervical spinal pain complaints than the pain responses on the other tests. This is not surprising in the light of the clinical observation that the craniomandibular and cervical spinal pain usually aggravate during function, *e.g.*, by chewing or yawning (Solberg, 1986; McNeill *et al.*, 1990; Okeson, 1996), or by moving the head or adopting certain working positions (Grant and McKenzie, 1994). The dynamic/static tests of the masticatory system and the cervical spine imitate joint and muscle function. During the dynamic tests, the joint structures are tested for pain on articulation, whereas during the static tests the muscles are tested for pain on isometric contraction.

The forward stepwise logistic regression analysis for the maximal VAS scores, with the maximal pain on the dynamic/static tests and on palpation as predictors, showed that palpation did not improve the discriminative power of the dynamic/static tests alone. For the verbal pain scores the results showed that the active (and passive) movements did improve the discriminative power of the dynamic/static tests. In addition, for the craniomandibular system, also palpation slightly improved the regression model. However, the use of the verbal pain scores of the individual tests has the disadvantage that the sensitivity and specificity are rather skewed, whereas the inclusion of more tests in the regression model only leads to relatively small improvements of the model at the expense of more complicated and impractical combinations of verbal pain cut-off values (see Table 6). Moreover, the sensitivity and specificity of the combinations are comparable to those of the VAS scores of the dynamic/static tests alone: about 70% to 80%. Either way, still for 20%-30% of the persons the results of the tests did not coincide with those of the oral history. This may partly be due to the fact that clinical tests give only a momentary impression of the status of the musculoskeletal structures whereas musculoskeletal pain complaints may vary over time. Moreover, it is also possible that the pain complaints from the orofacial or neck region did not originate from the musculoskeletal structures but that they were due to other problems, such as pulpitis. The results of our study are partly in accordance with those of Lobbezoo-Scholte *et al.* (1993). These authors concluded that the combination of pain on active movements, passive opening, and palpation, rated on a verbal scale, discriminated best between CMD patients and controls. However, the dynamic/static tests were not included in their protocol, only static pain tests were. Moreover, their CMD group was not based upon the outcome of an independently performed oral history, but consisted of persons with signs and/or symptoms of CMD referred to their department, and the physical examination of the masticatory system was not performed under blind conditions.

In conclusion; the results of this study indicate that the dynamic/static tests best discriminate between persons with or without craniomandibular or cervical spinal pain complaints. Since the recognition of these disorders is usually based upon a combination of signs and symptoms, the use of reported pain complaints and the results of the dynamic/static tests may be a good suggestion. Further longitudinal studies on samples of the population at large are needed to verify this suggestion.