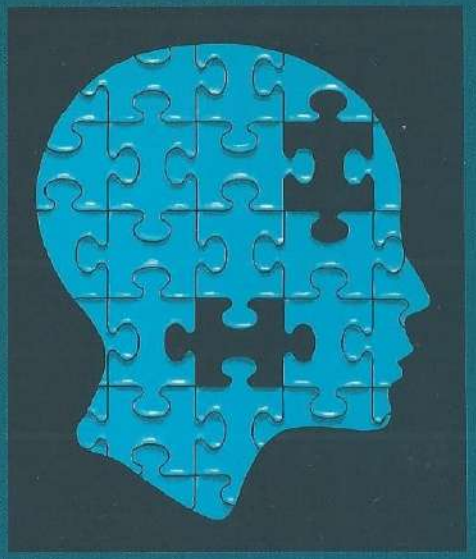
PAUL SCHOKKER

CRANIOMANDIBULAR DISORDERS IN HEADACHE PATIENTS



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CRANIOMANDIBULAR DISORDERS IN HEADACHE PATIENTS

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1. Schokker R.P., Hansson T.L., Ansink B.J.J : Craniomandibular Disorders In Headache Patients.
   Journal of Craniomandibular Disorders Facial & Oral Pain
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2. Schokker R.P., Hansson T.L., Ansink B.J.J. : Craniomandibular Disorders In Patients With Different Types Of Headache.
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4. Schokker R.P., Hansson T.L., Ansink B.J.J. : The Results Of Treatment Of The Masticatory System Of Chronic Headache Patients.
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5. Schokker R.P., Hansson T.L., Ansink B.J.J. : Differences In Headache Patients Regarding Their Response To Treatment Of The Masticatory System.
   Journal of Craniomandibular Disorders Facial & Oral Pain
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CONTENTS

"if I wished to show a student the difficulties of practice, I should give him a headache to treat."

(Oliver Wendell Holmes)

"Wo Begriffe Fehlen, stellt ein grosses Wort sich helfend ein."

(Goethe)

chapter 1

INTRODUCTION

INTRODUCTION

Headaches have troubled mankind for a long time. From archeological excavations it is known that already in 3000 B.C. our ancestors adopted rather drastic measures to alleviate pain in the head[1]. They did not hesitate to penetrate the bony skull to free the evil demons who were believed to cause the agony. In 400 B.C. Hippocrates described the combination of visual disturbances, headache and nausea. Approximately 200 years later Galenus named this combination of symptoms "Hemicrania". In course of time this word has been corrupted to become "migraine".

In 1934 Costen, described a combination of signs and symptoms connected with the pathological temporomandibular joint[2]. During the years this, the so called "Costen syndrome", became a source of the inspiration for the dental profession and led to an increasing interest in the function and dysfunction of the stomatognathic system[3-8]. During the last two decades a variety of names of the diseases of this system have been proposed. At present there seems to be a reasonable consensus that the pathology should be generally accepted as Craniomandibular Disorders (CMD)[10].

Although Costen (1934) mentioned headache as one of the symptoms in his original article, Berlin and coworkers (1960) were the first ones to draw attention to the close relationship between CMD and headache[11]. The results of many subsequent studies on CMD patients confirmed this association[5,7,8,12-17]. Recently some studies have been performed on general headache patients focusing signs and symptoms attributable to CMD and the results of CMD treatment[18-21]. These studies highlighted the incidence of CMD in headache patients and showed an alleviation of headache after treatment of the stomatognathic system. Lous and Olesen (1982) and later Forssell (1985) were the first ones to consider the neurologic diagnosis of the headache in studies on the prevalence of CMD in general headache patients[22,23].

One of the problems with a retrospective analysis of the results of many previous studies is the lack of uniformity in the stomatognathic examinations and in the modalities of CMD treatment. The multifactorial etiology of CMD is increasingly supported. However, there is still disagreement about the relative importance of each factor[24]. The conflicting hypotheses of CMD etiology result in different CMD-treatment approaches[25].
None of the before mentioned studies separated the patients into different CMD diagnoses[26]. Furthermore, the "Helkimo index" was often used to describe the condition of the stomatognathic system[7]. This index, however, does not show the relative importance of distinct signs or symptoms of CMD in the headache patients examined. The aim of the present study was therefore to study the prevalence of CMD signs and symptoms and the CMD diagnosis in patients suffering from different types of recurrent headache. Additionally the response of the patient's headache to CMD splint therapy was the subject of the present investigations.
Headache localization is important for the neurologic diagnosis of headache but its significance for the differentiation of CMD in headache patients is unknown[27]. Recent electromyographic and radiographic studies (1988) have indicated the role of asymmetry in the development and maintenance of CMD[28,29]. The importance of asymmetrical loading of the stomatognathic system in the complicated mechanism of headache has never been studied.
Therefore the present thesis also attempts to focus the relationship between morphologic asymmetry, headache diagnosis and localization / incidence of CMD. The thesis also focuses in finding parameters which could isolate a CMD related headache.

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chapter 2

CRANIOMANDIBULAR DISORDERS IN HEADACHE PATIENTS

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Journal Craniomandibular Disorders
Facial & Oral Pain
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SUMMARY

Fifty patients with recurrent headache who had been referred to a neurologist were randomly invited for an examination of their stomatognathic system. The prevalence and distribution of the findings in many ways resemble the clinical findings in CMD patients. In 66% of the patients, a myogenous or arthrogenous origin of CMD pain could be detected. Headache occurred more bilaterally, but unilateral findings were more common at the functional examination. The results did not show any statistical differences between the sexes.

INTRODUCTION

Diffuse headache or facial pain is a common symptom of stomatognathic dysfunction. The prevalence of such a headache in the general population is around 20%[1-4]. In a group of patients with craniomandibular disorders (CMD), 70% reported suffering from recurrent headache[5]. That study clearly showed headache to be a much more common symptom among persons with CMD than among the general population.

In the last decade several studies have been published on clinical materials consisting of recurrent headache patients[6-10]. These studies registered the amount of CMD signs and symptoms in chronic headache patients. Almost all of the studies focussed on just a few, but the most accepted, CMD parameters. The Helkimo-index was often used to describe the clinical materials. However, this index does not separate the patient material into different CMD diagnoses. Some studies of CMD patients have highlighted the relationship between headache and a myogenous origin of CMD pain[11-13].

Whether a headache is unilateral or bilateral plays an important role in the neurological diagnosis[14]. Bezuur concluded that in his clinical CMD material the findings were predominantly unilateral[15]. Recent studies in the field of CMD using radiographic and electromyographic techniques have focussed on the role of asymmetry[16,17]. The aim of this study was therefore to investigate the signs and symptoms of CMD in a group of recurrent headache patients and to see whether their presence is of a unilateral or a bilateral nature.

MATERIAL AND METHODS

Fifty patients with recurrent headache who were referred to the Department of Neurology at the Sint Lucas Hospital in Amsterdam were randomly selected and examined at the Department of Masticatory Function at the University of Amsterdam. The mean age of the subjects was 42 years (SD=15). There were 37 women with a mean age of 42 years (SD=16) and 13 men with a mean age of 42 years (SD=14). Most of the patients suffered from chronic recurrent headache. The neurologic diagnosis of the headache was determined by the same neurologist based upon the criteria of the Ad Hoc Committee on Classification of Headache[14]. Examinations of the stomathognatic system were all performed by one and the same dentist according to established and earlier described methods[18,19]. Extensive occlusal analysis and evaluation of the condition of the muscles of mastication and the cervical spine system were included in the functional examination. In the present study only the signs and symptoms mentioned in Table 2 were used.

At the time of examination, the dentist was not aware of the results of the previously performed neurologic and radiologic examinations. At the end of the

functional examination of the stomatognathic system a preliminary CMD diagnosis was made using the origin of pain as the criterion. This was determined by the signs and symptoms found, and their interpretation according to the method described by Naeije and Hansson[20]. Three different CMD diagnoses were possible: (1) No CMD pain, (2) myogenous origin of CMD pain, or (3) arthrogenous origin of CMD pain.
Comparisons between the sexes and the location of the signs and symptoms were made with the chi-square test and the Student's t test. The level of significance used was $p < 0.05$.

RESULTS

The distribution of headache parameters is shown in Table 1.
No statistically significant differences were found between the sexes regarding the distribution of the headache parameters mentioned and the location of pain.

Table 1 Percentage distribution of headache parameters

Headache parameters	Total (%) (n= 50)	Women (%) (n= 37)	Men (%) (n=13)
Unilateral headache/facial pain	44	46	38
Bilateral headache/facial pain	56	54	62
Attacks of pain	60	62	54
Permanently present pain	64	65	62
Sharp pain	42	46	31
Dull pain	84	81	92
Pulsating pain	8	8	8
Pain starts mostly at the same time	38	43	23
Involvement of subjective neck problems	74	78	62
Trauma or injury in the history	40	49	15
Headache more than 1 year	86	86	85
Headache more than 5 years	72	73	69

"Tension headache" had been neurologically diagnosed in 42% of the patients. In 22%, the neurologic diagnosis was "migraine". The diagnosis "combination headache" had been determined in 34%. Only one patient (2%) had another neurologic diagnosis. There were no statistical differences found between men and women regarding neurologic diagnosis.
The distribution of CMD signs and symptoms and their location are shown in the Table 2.

Table 2 Percentage distribution of signs and symptoms of CMD and their location (n = 50)

CMD signs/symptoms	Total (%)	Unilateral (%)	Bilateral (%)
Fatigue of the muscles of mastication	36	8	28
Masseter muscle tender to palpation	64	40	24
Temporalis muscle tender to palpation	54	40	14
Macroscopic facial asymmetry	24	–	–
Deviation of the mandible on maximum opening	20	–	–
Pain on maximum opening	58	24	34
Restriction of maximum opening	6	–	–
Clicking of the joint	60	40	20
Crepitation of the joint	24	18	6
Stiff endfeel at maximum opening	20	–	–
Elastic endfeel at maximum opening	80	–	–
Painful joint play	38	24	14
Dynamic pain	22	20	2
Static pain	64	36	28
Slide from RCP to ICP more than 0.5 mm	74	68	6
Evident bruxoposition	52	46	6
Provocation of headache by clenching of the teeth	36	18	18

Almost no significant differences were found between the sexes regarding prevalence of the findings. It was noteworthy that a positive headache-provocation test was predominantly found in women ($p < 0.05$). When the location of the findings was tested against the hypothesis that the distribution of unilateral and bilateral findings was equal, the "bruxoposition" and the "slide between RCP and ICP" were more unilateral ($p < 0.05$).
The maximum mouth opening was measured as the distance between the incisal edges of the maxillary and mandibular incisors with the inclusion of the vertical overbite in millimeters. The difference in millimeters between the passive and active maximum mouth opening was also noted. The mean values are listed in Table 3. The highest score for maximum opening of the mouth was 62 mm. and the lowest was 38 mm. The values of the difference between passive and active opening ranged between 2 and 10 mm. No statistical differences were found between men and women regarding these measurements of mouth opening.
Sixty percent (n = 30) of the recurrent headache patients had a myogenous origin of CMD pain and 6% (n = 3) had an arthrogenous origin of CMD pain. In 34% (n = 17) the preliminary diagnosis of NO CMD pain was noted. There was no significant difference between men and women regarding the functional diagnoses made.

Table 3 Mean figures of maximum mouth opening and difference between passive and active maximum mouth opening

Patients	Average maximum opening (mm)	Average difference between passive and active opening (mm)
Total (n = 50)	49.8 (SD = 6.3)	5.0 (SD = 2.0)
Women (n = 37)	49.4 (SD = 6.5)	5.1 (SD = 1.9)
Men (n = 13)	50.8 (SD = 5.8)	4.7 (SD = 2.3)

DISCUSSION

The subjects of most clinical studies on headache as well as on CMD are predominantly women. The fact that in this study the female to male ratio was almost 3:1 indicates its similarity to other study materials. However, this group of patients did not show any statistical differences in findings between the sexes. Seventy two percent of the patients in this study had recurrent headache for more than 5 years. This is a remarkably high percentage for a random sample of headache patients[6,10]. The explanation could be found in the fact that the Department of Neurology of the Sint Lucas Hospital functions as a headache center. Most of the patients are referred by other neurologists, which might explain the duration of the complaints (as only the most severe cases have been referred). This could also be the reason why there was only one patient in the group of "other neurologic diagnosis".
There were more patients with a bilateral headache (56%) than with a unilateral headache (44%). However, the findings in Table 2 are predominantly unilateral. Bezuur stated in his thesis that clinically, unilateral findings are more common than bilateral findings in patients with craniomandibular disorders[15]. Although it is certain that bilateral signs or symptoms should not necessarily rule out CMD, the outcome of the functional examination of the present study corroborated the findings of Bezuur[15]. All of the "signs of CMD" in Table 2 occur more unilaterally than bilaterally and this applies also for most of the "symptoms of CMD". Only "muscle fatigue", "pain on maximum opening" and headache after the "provocation test" were found to be more bilateral.
In a comparable study of a group of 96 recurrent headache patients Forssell[9] found 52% clicking, 8% crepitation, 14% TMJ locking and 52% muscle fatigue. The results of the present study show 60% clicking, 24% crepitation, 6% TMJ locking and 36% jaw fatigue. The difference in the figures of the prevalence of crepitation might be explained by the difference in age between the materials (mean age of 30 versus 42 years). Wanman[21] found only 21% joint sounds in 19 year old adolescents who suffered from headache more than once a week. In the same study, however, the figures concerning muscle tenderness are comparable with the present findings.
The mean value for maximum mouth opening in the general population found by Hansson and Nilner[1] is 53 mm. Bezuur[15] found 42 mm in patients with disease related to the function of the masticatory system. The mean maximum mouth opening found in this study was 49.8 mm. Since one third of the recurrent headache patients were diagnosed as "No CMD" it is not surprising that the figure of mouth opening lies between the previously mentioned 53 mm and 42 mm. McCarroll et al[22] found the average difference between passive and active mouth opening among healthy students to be between 2 and 3 mm. The comparable figure in this study is approximately 5 mm (Tabel 3). This difference between the two materials supports the clinical experience that there is a bigger

difference between passive and active mouth opening in patients with a myogenous origin of pain.

Sixty six percent of the patients in this study showed a myogenous or arthrogenous origin of CMD pain. It was surprising that, given the poor condition of the stomatognathic system of some of the patients, they had never realized the severity of the problem. The fact that headache was their main complaint could be an explanation as to why they never felt the need for treatment of their CMD problems. The prevalence and distribution of the findings of the functional examination in many ways resembles the clinical material of CMD patients.

Pincus[23] stated that in his neurologic practice, the TMJ dysfunction syndrome is a more common cause of headache than migraine. He found 26% CMD versus 20% migraine. Reik and Hale[6] identified CMD in 14 of 100 consecutive headache clinic patients. Yusuf and Rothwell[10] detected CMD in 78% of 50 neurologic patients suffering from atypical facial pain. As 60% of the patients showed a preliminary diagnosis of myogenous origin of CMD pain, this finding supports the results of aforementioned studies indicating the relationship between headache and the condition of the masticatory muscles.

Forssell[9] demonstrated the differences in signs and symptoms of CMD among different headache groups. The outcome of such comparisons in the present clinical material will be presented in a future paper. The conclusion of this part of the investigation, however, is that a relationship between headache and dysfunction of the stomatognathic system can be suspected in several patients with recurrent headache. The results of CMD therapy on the headache could further elucidate this relationship, and this will be the subject of further investigations. In the present study a selection was made out of the available information concerning the signs and symptoms of CMD (Table 2). It may be more appropriate to evaluate the importance of all additional clinical data when further investigation clarifies the precise relationship between headache and CMD.

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CRANIOMANDIBULAR DISORDERS IN PATIENTS WITH DIFFERENT TYPES OF HEADACHE

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SUMMARY

One hundred (100) recurrent headache patients, referred for neurologic examination, were randomly invited for a functional examination of their stomatognathic system. The patients were grouped on the basis of headache localization, neurologic diagnosis of the headache and the stomatognathic diagnosis. The relationship between groups was analyzed. Several significant correlations were found between the clinical findings and the localization of headache ($p < 0.05$ - $p < 0.001$). Patients with or without a definite CMD pain (CMD = craniomandibular disorder) displayed differences in mouth opening capacity ($p < 0.001$). The results indicate a close relationship between recurrent headache and CMD, independent of the neurologic diagnosis of the headache.

INTRODUCTION

In a previous study the prevalence and localization of common signs and symptoms of craniomandibular disorders (CMD) in a group of recurrent headache patients were described[1]. Sixty percent of these patients showed either a myogenous or an arthrogenous origin of CMD pain, although none reported subjective problems during chewing or mandibular movements[1].
Headache is localized mainly unilaterally or mainly bilaterally. The localization of the pain plays an important role in the determination of the neurologic diagnosis of recurrent headache[2,3,4,5]. Signs and symptoms of CMD are predominantly unilateral[6]. The results of the previous study showed this same tendency, even though headache occurred more bilaterally[1].
The aim of the present study is to investigate the relationship between the localization of headache and the distribution of signs and symptoms of CMD. Secondly, the relation between the functional diagnosis of the stomatognathic system and the neurologic diagnosis of headache is studied. The initial patient group of 50 recurrent headache patients was expanded to 100 to enable statistical analysis.

MATERIAL AND METHODS

One hundred patients with recurrent headache, referred to the Department of Neurology at the Sint Lucas Hospital in Amsterdam were randomly selected and examined at the Department of Masticatory Function at the university of Amsterdam. The only exclusion criterion was if the patient refused participation in the study which occurred only twice. The recurrent headaches in most of these patients were chronic.
The neurologic diagnosis of the headache had been determined by one experienced neurologist based upon established diagnostic criteria[2,3,4,5]. The functional examination of the stomatognathic system was performed by one dentist, specialized in CMD, according to established and earlier described methods[7,8,9]. The orthopaedic parameters of "endfeel", "jointplay" and the "dynamic and static pain tests" have been shown to distinguish a myogenous from an arthrogenous origin of CMD-pain and were therefore included in the functional examination protocol[8,9]. Based upon the findings at the functional examination the dentist determined the presence or absence of CMD pain and established its origin when present[8].
The maximum mouth opening of the patients was measured as the distance in millimeters between the incisal edges of the upper and lower incisors. The vertical overbite was included. Recordings were made also of the difference in millimeters between the passive and active maximum mouth opening.
At the time of the stomatognathic examination the dentist was not aware of the

previously determined neurologic diagnosis of the headache. The time between the neurologic and the stomatognathic examination never exceeded 4 months.
On completion of the stomatognathic examination the neurologic diagnoses were revealed. The patients were grouped subsequently according to the localization of headache, its neurologic diagnosis and the presence or absence of CMD pain. The following neurologic diagnoses were studied: Tension Headache (muscle contraction headache), Migraine and Combination Headache (headache of mixed origin). Regarding the localization of headache the patients were asked whether pain occurred mainly unilaterally or mainly bilaterally.
The results were statistically analyzed using the chi-square test, the Fisher's exact test and the Student's t test to study the relationship between groups.

RESULTS

The patients consisted of 66 women and 34 men with a mean age of 41 years (SD=15).
Forty-one percent of the patients had mainly unilateral headaches and 59% mainly bilateral. The distribution of headache parameters and the neurologic diagnoses for patients with an unilateral or bilateral recurrent headache is shown in Table 1.
In total 55 patients displayed pain of a CMD origin. In 51 patients a myogenous origin was determined. Four patients had an arthrogenous origin of CMD pain. The remaining 45 patients showed no CMD pain and were classified as "NO CMD". The distribution of common signs and symptoms of CMD and the functional diagnoses for patients with a unilateral or bilateral headache is presented in Table 2[a/b].
The neurologist diagnosed tension headache in 42 patients, migraine in 29 patients and combination headache in 26 patients.
Three (3) patients exhibited an other neurologic diagnosis. These 3 patients were excluded from table 3 where common signs and symptoms of CMD and CMD pain origins are shown in relation to headache subgroups. The results of prevalence of CMD signs and symptoms presented in table 3 were tested against the hypothesis that no differences would be found between the headache subgroups. Tension headache patients showed a higher prevalence of dynamic-pain ($p < 0.05$). Combination headache patients displayed greater prevalence of tenderness to palpation of the masseter and temporal muscles ($p < 0.05$). Comparison between two subgroups (Tension - Migraine; Tension - Combination ; Migraine - Combination) revealed further differences. Migraine patients showed less crepitation of the joint ($p < 0.01$) and less muscle fatigue ($p < 0.05$) than tension headache patients. Combination headache patients showed a higher prevalence of a bruxoposition and provocation of headache by clenching of the teeth compared with tension headache patients ($p < 0.05$). Painful jointplay and

Table 1 The percentage distribution of headache parameters and the neurologic diagnosis between patients with a mainly unilateral headache and patients with a mainly bilateral headache

Headache parameters	Unilateral headache (n= 41)	Bilateral headache (n= 59)	Significance
Attacks of pain	46	59	–
Permanently present headache	56	59	–
Sharp pain	51	24	p<0.01
Dull pain	80	88	–
Pulsating pain	2	15	p<0.05
Pain starts mostly at the same day time	34	42	–
Involvement subjective neck problems	76	78	–
Trauma or injury in the history	59	31	p<0.01
Headache more than 1 year	85	83	–
Headache more than 5 years	63	66	–
Neurologic diagnosis	100	100	
tension headache	46	39	–
migraine	27	31	–
combination headache	24	27	–
other neurologic diagnosis	2	3	–

lack of molar support were found more often in patients with combination headache than in migraine patients ($p < 0.05$).

The headache patients (100) were divided according to the presence or absence of a definite CMD pain. For these 2 groups the prevalence of headache parameters was analyzed. Patients with CMD pain were suffering more often from a permanently present headache ($p < 0.001$) and subjective neck problems ($P < 0.01$).
Maximum mouth opening capacity did not statistically differ between patients with a different neurologic diagnosis. Whether the headache was unilateral or bilateral did also not significantly influence the maximum mouth opening capacity. However, patients with CMD pain showed a decreased active maximum mouth opening compared to the patients without CMD pain (48.2 mm versus 53.1 mm)

Table 2A The percentage distribution of common signs and symptoms of CMD, their localization and the preliminary functional diagnosis between patients with a mainly unilateral headache and patients with a mainly bilateral headache

CMD signs/symptoms	Unilateral headache (n= 41)	Bilateral headache (n= 59)	Significance
Myogenous origin of CMD pain	51	51	–
Arthrogenous origin of CMD pain	7	2	–
Macroscopic facial asymmetry	32	12	p<0.01
Deviation on maximum opening	20	15	–
Elastic endfeel at maximum opening	83	88	–
Locking of the joint	5	5	–
Clicking of the joint	59	44	–
localization unilateral	37	25	–
localization bilateral	22	19	–
Crepitation of the joint	32	24	–
localization unilateral	29	10	p<0.01
localization bilateral	3	14	p<0.01
Slide RCP to ICP more than 0.5 mm	80	71	–
direction unilateral	55	54	–
direction bilateral	25	17	–
Lack of molar support	34	29	–
localization unilateral	22	10	–
localization bilateral	12	19	–
Dynamic pain	29	17	–
localization unilateral	29	9	p<0.01
localization bilateral	0	8	p<0.01
Static pain	56	52	–
localization unilateral	32	15	p<0.05
localization bilateral	24	37	p<0.05

Table 2B The percentage distribution of common signs and symptoms of CMD, their localization and the preliminary functional diagnosis between patients with a mainly unilateral headache and patients with a mainly bilateral headache

CMD signs/symptoms	Unilateral headache (n= 41)	Bilateral headache (n= 59)	Significance
Pain on maximum opening	51	48	–
localization unilateral	29	12	p<0.05
localization bilateral	22	36	p<0.05
Painful jointplay test	39	32	–
localization unilateral	32	11	p<0.01
localization bilateral	7	21	p<0.01
M. masseter tenderness	55	54	–
localization unilateral	40	37	–
localization bilateral	15	27	–
M. temporalis tenderness	56	50	–
localization unilateral	51	21	p<0.01
localization bilateral	5	29	p<0.01
Fatigue of muscles mastication	34	39	–
localization unilateral	7	2	–
localization bilateral	27	37	–
Evident bruxoposition	54	49	–
localization unilateral	41	30	–
localization protrusive	13	19	–
Provocation of headache by clenching of the teeth	29	37	–
localization unilateral	27	5	p<0.001
localization bilateral	2	32	p<0.001

Table 3 The percentage distribution of common signs and symptoms of CMD and the preliminary functional diagnosis. The patients are divided in 3 headache subgroups: tension headache (Te), migraine (Mi) and combination headache (Co)

CMD signs/symptoms	Headache subgroups (%)			Significance between	
	Te (n = 42)	Mi (n = 29)	Co (n = 26)	Te-Mi-Co	separate groups
Myogenous origin of CMD pain	52	45	58	–	–
Arthrogenous origin of CMD pain	7	0	4	–	–
Macroscopic facial asymmetry	26	14	19	–	–
Deviation on maximum opening	19	14	15	–	–
Pain on maximum opening	52	41	54	–	–
Elastic endfeel at maximum opening	83	86	92	–	–
Locking of the joint	7	0	8	–	–
Clicking of the joint	52	48	50	–	–
Crepitation of the joint	36	10	31	–	Te-Mi $p<0.01$
Slide from RCP to ICP more than 0.5 mm	74	76	73	–	–
Lack of molar support	33	17	42	–	Mi-Co $p<0.05$
Dynamic pain	33	10	15	$p<0.05$	Te-Mi $p<0.05$
Static pain	57	45	62	–	–
Painful jointplay test	40	21	46	–	Mi-Co $p<0.05$
M. masseter tenderness	55	38	73	$p<0.05$	Mi-Co $p<0.01$
M. temporalis tenderness	48	41	73	$p<0.05$	Mi-Co $p<0.05$
Fatigue of muscles mastication	48	21	38	–	Te-Mi $p<0.05$
Evident bruxoposition	45	45	69	–	Te-Co $p<0.05$
Provocation of headache by clenching of the teeth	26	31	50	–	Te-Co $p<0.05$

($p < 0.001$). Furthermore the mean distance between passive and active maximum mouth opening was greater in patients with a CMD pain, compared with patients classified as "NO CMD" (5.9 mm versus 3.9 mm) ($p < 0.001$). Passive maximum mouth opening did not differ between these groups.

DISCUSSION

In more than half of the recurrent headache patients, investigated here, CMD pain was found. Few patients (4%) were found with an arthrogenous origin of CMD pain. Considering the age of the patients, the proportion between the number with a myogenous or an arthrogenous origin of CMD pain is surprising. Other studies have reported higher percentages of arthrogenous patients among CMD populations[6,9].

Fifty-seven percent of the patients complained of the permanent presence of headache. It is not known whether the presence of headache at the time of the stomatognathic examination had an impact on the investigated parameters of CMD. Therefore the results of the present study must be seen in this perspective.

Patients suffering from unilateral headache described the pain more often as "sharp". Furthermore they mentioned more frequently a trauma or injury in the history. The analysis of the findings at the functional examination in patients with unilateral headache revealed a higher prevalence of "macroscopic facial asymmetry". This may indicate that variations in the morphology of the skull are related to headache. This conclusion is supported by other recent findings indicating that the asymmetric loading of the stomatognathic system may play a major role in the development and maintenance of CMD[10,11].

Several common signs and symptoms of CMD were found to differ between patients with either unilateral or bilateral headaches.

The prevalence of the findings at the stomatognathic examination supports the results of the previous study on 50 headache patients[1]. Rieder et al. performed an epidemiologic study on the prevalence of CMD in normal dental patients[12]. In this study headache was registered in about 20% of the patients. Comparison of their results with the findings of the present study clearly showed a much higher incidence of CMD in a population of recurrent headache patients.

There can be no doubt that these results support the close relationship between recurrent headache and CMD. They therefore confirm Magnusson's conclusion, that an examination of the stomatognathic system should be performed at any medical examination of headache or facial pain[13].

In a similar study Forssell[14] did not find significant differences in CMD symptoms between groups with a different neurologic diagnosis of headache. This contrast with the results of the present study deserves some consideration. The results in table 3 confirm the findings by Lous and Olesen[15] and Forssell[14] regarding the

relative prevalence of tenderness of the masticatory muscles in patients with migraine, tension headache and combination headache. In tension headache "dynamic pain", "fatigue of the muscles of mastication" and "temporomandibular joint crepitation" were predominant. This underlines the close relation between muscle and joint function. Further study is however needed before definite suggestions can be proposed regarding the implications of these results for CMD treatment in headache patients.

The results regarding the prevalence of common signs and symptoms of CMD in patients with combination headache are confusing. Muscle tenderness, bruxopositions and a provocation of the headache by clenching imply muscle engagement. Therefore two separate and independent pathological conditions may be present. Regarding the design of therapy, the relevance of the diagnosis "Combination Headache" is questionable. One of the two conditions should probably be given priority in the therapeutic approach for achieving clinical result and reduction of pain.

The difference in passive and active mouth opening capacity between patients with and without CMD pain is interesting. It confirms the findings on healthy subjects by McCarroll et al[16] and also indicates the possibility for an increased reliability in the clinical separation of patients suspected for CMD.

The close relationship between CMD and recurrent headache, found here seems to be independent of the neurologic diagnosis of the headache. Additional information from radiography of the temporomandibular joint areas of these headache patients may elucidate the role of morphologic asymmetry in the pathogenesis of headache and facial pain. This will be the subject of an ongoing study.

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CRANIOMANDIBULAR ASYMMETRY IN HEADACHE PATIENTS

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SUMMARY

The stomatognathic system was examined in one hundred chronic recurrent headache patients. The asymmetry in clinical and radiographical findings was studied. A clinically determined facial asymmetry was found more frequently in patients with CMD pain ($p < 0.001$), in patients with mainly an unilateral headache ($p < 0.01$) and in patients with a trauma in the history ($p < 0.05$). The radiographically determined condylar asymmetry in headache patients was high. In patients with migraine more condylar asymmetry was found than in patients with tension headache ($p < 0.05$). Asymmetry in the hard tissue condition of the temporomandibular joint was more prevalent in patients with CMD pain and in patients with mainly a bilateral headache ($p < 0.05$).

INTRODUCTION

In previous studies the close relationship between chronic recurrent headache and craniomandibular disorders (CMD) was outlined[1,2]. Recent clinical investigations highlight the asymmetry in the stomatognathic system to be an important factor in the pathogenesis of CMD[3,4]. The results of the earlier mentioned study[2] may indicate an important role of asymmetrical loading in the etiology of headache and facial pain.

Habets et al[5] suggested the use of rotational panoramic radiography as a tool in exploring differences between the right and the left side of the stomatognathic system. The findings of measurements of the vertical condylar height revealed the asymmetry to be bigger in CMD patients than in routine dental patients. Other investigations also demonstrated the diagnostic value of the rotational panoramic radiography in elucidating pathological hard tissue conditions of the temporomandibular joints[6,7].

The clinical findings at the stomatognathic examination together with the panoramic radiograph, thus provide information to study variations in the morphology of the skull and the mandible. The aim of the present study was to investigate the morphological asymmetry of the stomatognathic system in patients suffering from recurrent headache.

MATERIAL AND METHODS

One hundred (100) patients with chronic recurrent headache, who were referred to the Department of Neurology at the Sint Lucas Hospital in Amsterdam were randomly selected and examined at the Department of Masticatory Function at the University of Amsterdam (ACTA). The only criterion of exclusion was if the patient refused to participate in the study, which occurred only twice.

The neurologic diagnosis of the headache was determined by the same neurologist based upon established criteria[8,9]. The functional examination of the stomatognathic system was performed by the same dentist according to earlier described methods[10,11]. Results of the functional examination of all the patients and their neurologic diagnoses have been extensively described in a previous study[2]. Fifty five patients (55%) demonstrated CMD pain. In forty five patients (45%) no CMD pain was determined. These patients were classified as "No CMD". Forty two (42%) patients were diagnosed suffering from a tension headache (muscle contraction headache). Migraine was diagnosed in 29 patients (29%). In 26 patients (26%) the diagnosis combination Headache (headache of mixed origin) was determined. Three patients (3%) exhibited an other neurologic diagnosis.

At the time of examination a present visible vertical asymmetry of the face of the patient was recorded. The patient was sitting in an upright position in a dental

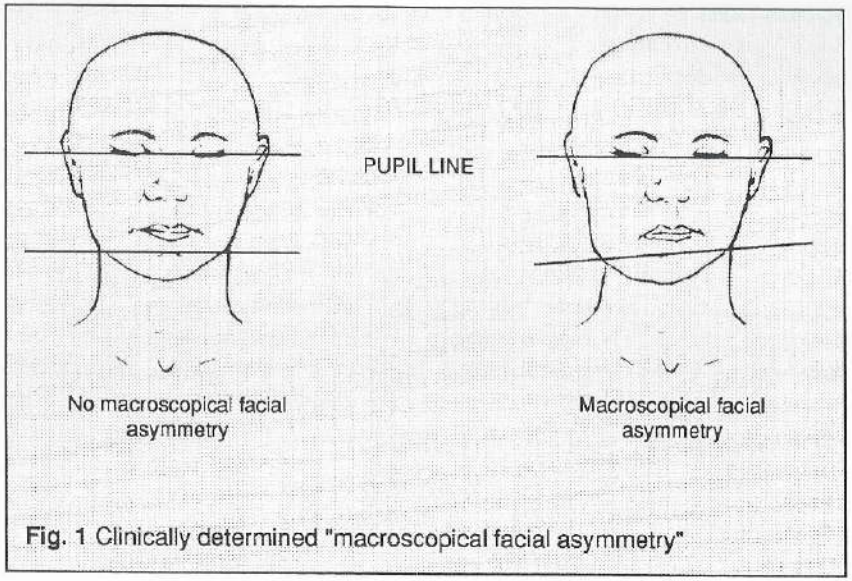

Fig. 1 Clinically determined "macroscopical facial asymmetry"

chair. Marked differences in vertical height between the two sides of the lateral part of the lower third of the face in relation to the "pupil-line" were determined as a "macroscopical facial asymmetry" (see fig. 1).
The functional examination of the stomatognathic system was completed with a rotational panoramic radiograph. All the radiographs were obtained using an OPG-5 unit of Siemens. The evaluations of the radiographs were performed by one and the same observer without any preknowledge of the findings at the clinical examination. The vertical height of the condyle and of the ramus was assessed on the radiographs and the measurements were performed using a digital micrometer.The vertical asymmetry was calculated with the formula:
| (R-L) / (R+L) | X 100% as described by Habets et al[5].

The hard tissue condition of the temporomandibular joint was evaluated on the radiograph using the following criteria:

* structural changes of the joint. (sclerosis, erosion, irregular surface, flattening and osteophyte formation)
* distinct differences in shape and/or form between the right and left side of the joint regarding the condylar and/or temporal components.

The material was divided into different subgroups according to the following criteria :

* the neurologic diagnosis of the headache.
* the presence of a determined CMD pain.
* the unilateral or bilateral localization of the headache.

* the presence of a trauma in the history.
* the presence of macroscopical facial asymmetry at examination.

The data was statistically analyzed using the chi-square test, the Fischer's exact test and the Student's t test to study the relationship between different groups of patients.

RESULTS

Headache patients with a determined origin of CMD pain showed significantly more macroscopical facial asymmetry compared to patients classified as "No CMD" ($p < 0.001$). Patients suffering from mainly an unilateral headache showed more macroscopical facial asymmetry than patients with mainly a bilateral headache ($p < 0.01$). The prevalence of macroscopical facial asymmetry was also higher in patients with a trauma or injury in the history ($p < 0.05$). No statistically significant differences were found in the prevalence of a macroscopical facial asymmetry between headache patients with different neurologic diagnoses.
The condylar asymmetry of the total group was 9.24%. The ramus asymmetry was 2.27% and the condyle + ramus asymmetry was 2.29%. The figures representing the asymmetry in vertical height registered in the subgroups are shown in fig.2,3,4.

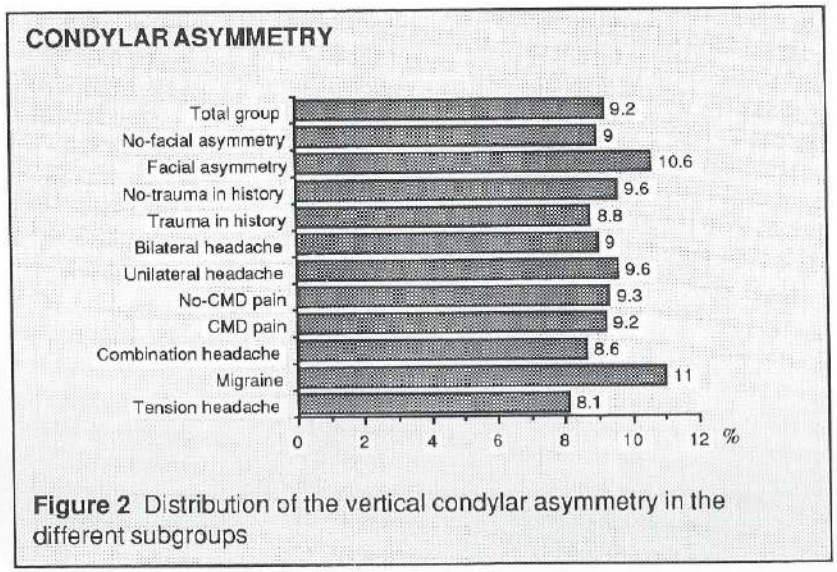

Figure 2 Distribution of the vertical condylar asymmetry in the different subgroups

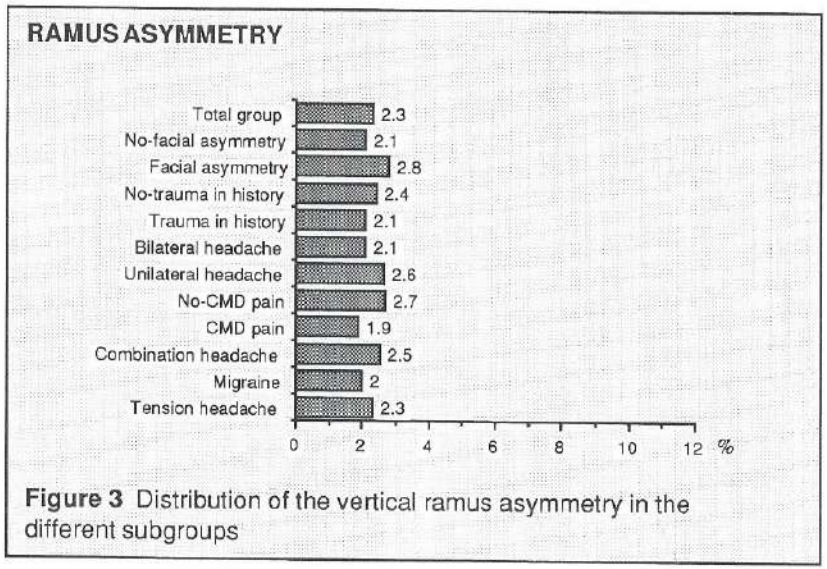

Figure 3 Distribution of the vertical ramus asymmetry in the different subgroups

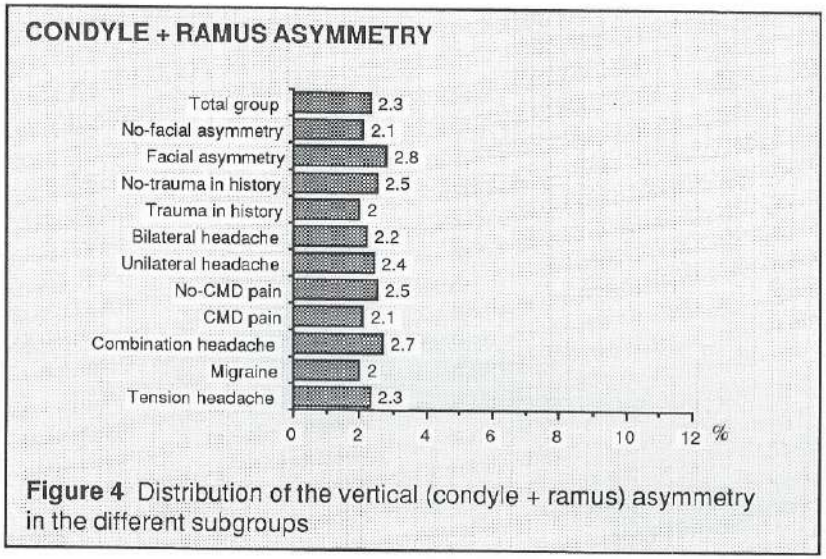

Figure 4 Distribution of the vertical (condyle + ramus) asymmetry in the different subgroups

Condylar asymmetry was bigger in patients with migraine than in patients with tension headache ($p < 0.05$). No significant difference was found between patients with CMD pain and patients classified as "No CMD" regarding the condylar asymmetry. Neither was any other statistical difference found between the subgroups regarding the radiographically determined vertical asymmetry.
In 27% of the patients structural changes in the hard tissue of the joint were visible. The localization of the structural changes was predominantly unilateral (70%). Distinct difference in shape between the right and left condyle was found in 34%. Difference in form between the temporal components of the joint could be determined in 14% of the patients examined. The distribution of the radiographical findings regarding the condition of the temporomandibular joints in the different subgroups is presented in Table 1.

Table 1 The percentage distribution of the findings on the rotational panoramic radiogram regarding the condition of the hard tissue of the temporomandibular joint in the different subgroups of recurrent headache patients (* = $p<0.05$)

	percentages of patients with (%)	structural hard tissue changes (%)	shape of condyle between right-left (%)	form of fossa between right-left (%)
Tension headache	42	24	40	10
Migraine	29	31	24	17
Combination headache	26	27	35	15
CMD pain	55	35*	42*	16
No-CMD pain	45	18*	24*	11
Unilateral headache	41	17*	34	12
Bilateral headache	59	34*	34	15
Trauma in history	42	24	31	17
No-trauma in history	58	29	36	12
Facial asymmetry	20	35	50	25
No-facial asymmetry	80	25	30	11
Total group of patients	100	27	34	14

Patients with a clinically determined origin of CMD pain showed more structural changes of the joints and more difference in shape between the condyles compared to patients classified as "No CMD" ($p < 0.05$). In patients suffering from mainly a bilateral headache more abnormalities of the hard tissue of the joints were found compared to patients with mainly an unilateral headache ($p < 0.05$). No other statistically significant differences concerning the condition of the temporomandibular joints were found between the subgroups.

DISCUSSION

Habets et al. found a mean vertical condylar asymmetry of 6% in routine dental patients[5]. In recent studies on CMD patients a vertical condylar asymmetry of about 8% was noted[7,12]. In this respect the asymmetry of the vertical condylar height in patients suffering from recurrent headache is remarkably high. The vertical asymmetry of the ramus and of the condyle + ramus were within the normal range in comparison with the literature[5].

The expected difference in vertical condylar asymmetry between patients with and without a determined origin of CMD pain was not found in the present study. This might be explained by the method this group of patients was selected and the possible similarity in the experience of headache and CMD pain. Condylar height asymmetry was found to be most pronounced in patients with migraine and also statistically bigger compared to the condylar asymmetry in patients with tension headache ($p < 0.05$).

Macroscopical facial asymmetry was more prevalent in patients with a determined origin of CMD pain ($p < 0.001$). However, macroscopical facial asymmetry was not significantly correlated to the asymmetry of the hard tissues measured on the radiographs (fig.2,3,4). This indicates soft tissue changes also to be responsible for the variation in the morphology of the face. The close relationship between the condition of the muscles of mastication and headache has been found in other studies[3,13].

The results of the present study therefore support the earlier conclusions, indicating asymmetry to play an important role in the pathogenesis of headache / facial pain. The results of the present study also confirm the suggestions made by R. Moss[14] regarding structural muscular imbalance as a source of migraine.

A trauma or injury in the patients history was not found to be significantly related to asymmetry in the findings on the radiograph. However, patients with no head injury in the history showed less macroscopical facial asymmetry. One explanation could be, the fact that no distinction was made in the recording of head injuries with respect to different direction or location. Therefore the relation between a trauma and the consequences for the condition of the temporomandibular joint area is unclear in the present material.

The results showing more macroscopical facial asymmetry in patients with mainly an unilateral headache and more structural changes of the joints in patients with mainly a bilateral headache are difficult to explain. However, it is noteworthy that in the previously published results of the same clinical material it was found that patients with mainly an unilateral headache mentioned more frequently a head injury in the history ($p < 0.01$)[2]. There was a higher incidence of structural changes of the temporomandibular joint ($p < 0.05$) in patients with mainly a bilateral headache. But, as the localization of the structural changes was mostly unilateral (70%), the results might only underline the bilateral effect of mandibular function.

The radiographical findings regarding the condition of the joint in patients with CMD pain corroborated the clinically determined stomatognathic diagnosis (Table 1).

In conclusion from the results of the present study can be stated that the connection between headache and variations in the morphology of the skull and the mandible seems to be close. However, more research is necessary to elucidate the mechanism and localization of headache and facial pain being related to asymmetry and imbalance of the stomatognathic system.

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chapter 5

THE RESULTS OF TREATMENT OF THE MASTICATORY SYSTEM OF CHRONIC HEADACHE PATIENTS

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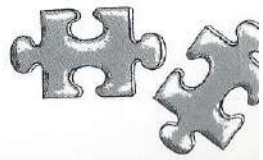


SUMMARY

Fifty-five out of 100 recurrent headache patients, referred consecutively to a neurologist, exhibited a CMD pain during the examination of the stomatognathic system. This suggests a possible relationship between the headaches and the condition of the masticatory muscles. The patients were randomly divided into two groups. One group was treated by the neurologist and the other by the dentist. More of the patients treated by the dentist reported a decreased intensity of the headache ($p < 0.025$) or a reduction in medication ($p < 0.05$). Changes in headache frequency were also reported more often in the CMD treatment group ($p < 0.025$).

INTRODUCTION

Headaches are known to have plagued mankind for about 5000 years[1]. Although we have come a long way with our treatment modalities and classifications of the symptom, the clinical results thus far achieved in the reduction of pain are disappointing. Further research focussing on various therapeutical approaches in the treatment of headache patients remains needed.

Previous studies have shown a close relationship between craniomandibular disorders (CMD) and recurrent headache[2,3,4]. In over 50% of the headache patients, referred for neurologic examination, CMD pain was identified[4]. The last mentioned study revealed no significant difference between CMD and headache of different neurologic categories[4]. These results suggest that the dental profession can make a valuable contribution to the diagnosis and management of headache, when findings attributable to CMD are present.

The aim of the present study was to investigate the results of CMD treatment in headache patients with a clinically determined presence of CMD pain with respect to changes in the frequency of the headache, the intensity of the headache and the intake of drugs to control the headache.

MATERIAL AND METHODS

In 55 out of 100 chronic headache patients, referred consecutively to the neurologist, a myogenous or an arthrogenous origin of CMD pain could be determined at the examination of the stomatognathic system[4]. None of these patients reported subjective problems connected with chewing or other mandibular movements. All functional examinations were performed by one and the same dentist at the Department of Masticatory Function at the University of Amsterdam (ACTA). The neurologic examinations were performed by one experienced neurologist at the Department of Neurology of the Sint Lucas Hospital in Amsterdam. At the time of the functional diagnosis the dentist-examiner was not aware of the results of the previously performed neurologic examination. The time between the neurologic examination and the examination of the stomatognathic system was no more than 4 months.

The 55 patients were divided at random into two groups. One group of 28 patients was treated by the neurologist, according to established treatment modalities for the various headache subtypes[5,6,7]. In this group no attention was paid to the condition of the masticatory system. The 27 patients in the other group were invited to undergo treatment for a suspected and headache related craniomandibular disorder. These patients were treated by the same dentist and were not further treated by the neurologist. The CMD therapy included a stabilization splint which the patients wore 24 hours a day for a minimum of six weeks. The splint was checked weekly and, if necessary, adjusted by the dentist.

Four patients with major coexisting problems of the cervical spine received additional physical therapy. Two patients, with CMD pain of mainly an arthrogenous origin were also treated with infra-red laser[a]. Headache frequency, headache intensity and the medication to control the headache were recorded before treatment and again after a treatment period of at least six weeks by means of a questionnaire to be completed by the patient. The change in headache frequency and intensity was additionally scored by means of a headache diary. The information from the questionnaire and the headache diary was analyzed. The results of CMD therapy were compared with the outcome of the neurologic treatment.

Seven of the 55 patients did not participate during the entire study. Two of these patients refused to wear a stabilization splint. Three patients did not complete the study because of time consuming aspects. Two patients moved out of the district. As a result there were 25 persons in the neurologic treatment group and 23 in the CMD treatment group. The characteristics of the two treatment groups are given in Table 1.

The material was statistically analyzed using the chi-square test and the Fischer's exact test.

Table 1 Characteristics of the treatment groups

	neurologic treatment group (n = 25)	CMD treatment group (n = 23)
mean age	45 (SD = 13)	44 (SD = 14)
men	4	6
women	21	17
tension headache	11 (44%)	11 (48%)
migraine	8 (32%)	4 (17%)
combination headache	6 (24%)	7 (30%)
other diagnosis	0 (0%)	1 (4%)
myogenous CMD pain	23 (92%)	21 (91%)
arthrogenous CMD pain	2 (8%)	2 (9%)

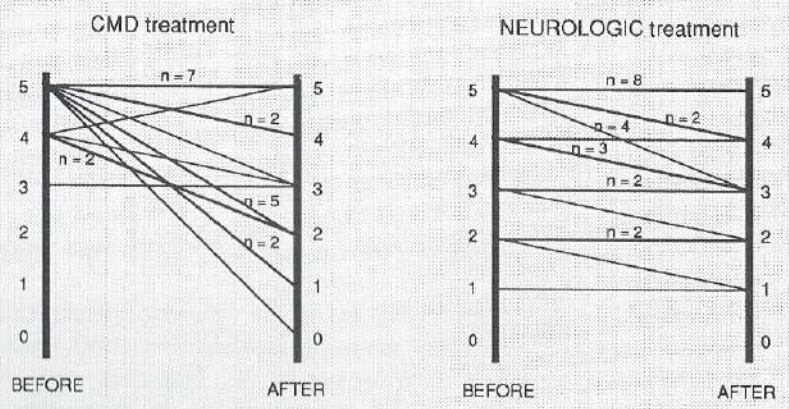
RESULTS

In the CMD treatment group headache frequency decreased in 56% of the patients. In 35% of the patients the headache frequency remained unchanged while in 9% headaches were more frequent.

In the neurologic treatment group 32% of the patients reported a decrease in the frequency of the headaches while 68% remained unchanged (see fig.1).

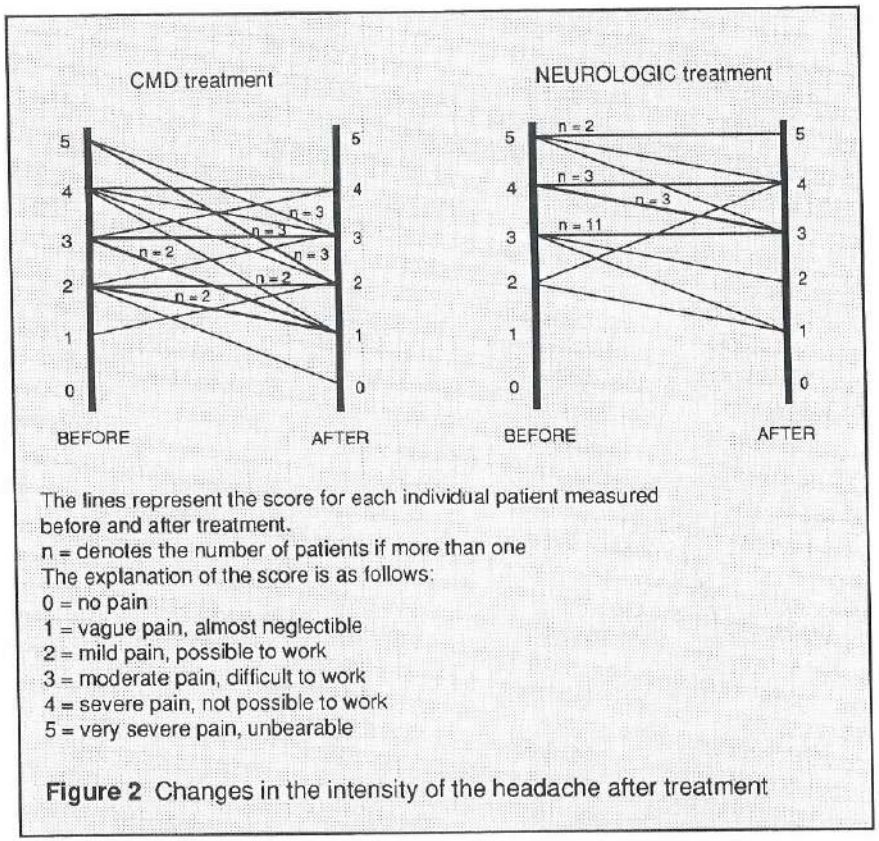
The intensity of headache in the CMD treatment group decreased in 65% of the patients, remained unchanged in 22% and increased in 13%. The intensity of headache in the patients treated by the neurologist showed in 32% a decrease, no change in 64% and an increase in 4% (see fig.2).

Drug intake to control the headache had decreased after CMD treatment in 52% of the patients. It was the same in 44% and increased in 4% of the patients. In the neurologic treatment group a decreased intake of drugs was reported in 24% of the patients and no changes in 52%. Six patients (24%) in the neurologic treatment group reported an increased intake of drugs for headache after the treatment period (see fig.3).



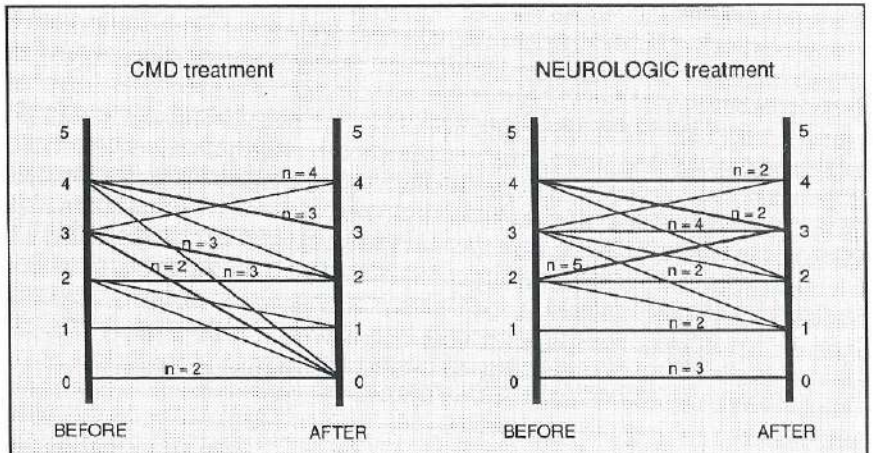
The lines represent the score for each individual patient measured before and after treatment.
n = denotes the number of patients if more than one
The explanation of the score is as follows:
0 = no headache
1 = headache once a month
2 = headache several times a month
3 = headache once a week
4 = headache several times a week
5 = headache daily

Figure 1 Changes in the frequency of the headache after treatment



The lines represent the score for each individual patient measured before and after treatment.
n = denotes the number of patients if more than one
The explanation of the score is as follows:
0 = no pain
1 = vague pain, almost neglectible
2 = mild pain, possible to work
3 = moderate pain, difficult to work
4 = severe pain, not possible to work
5 = very severe pain, unbearable

Figure 2 Changes in the intensity of the headache after treatment



The lines represent the score for each individual patient measured before and after treatment.
n = denotes the number of patients if more than one
The explanation of the score is as follows:
0 = less than 1 intake a month
1 = less than 5 intakes a month
2 = between 1 and 5 intakes a week
3 = between 5 and 10 intakes a week
4 = more than 10 intakes a week

Figure 3 Changes in the intake of drugs agains the headache after treatment

The information from the questionnaire and the headache diary was found to be consistent in 88% of the cases.
Statistical analysis of the treatment results led to the following conclusions. More patients reported a decreased intensity of the headache after CMD treatment ($p < 0.025$). More patients reported a reduction in the intake of drugs against headache after CMD treatment ($p < 0.05$). Changes in frequency of the headache and in the intensity of the headache were seen more often in the patients with CMD treatment ($p < 0.025$ and $p < 0.01$ respectively).

DISCUSSION

Magnusson and Carlsson (1978) found in a study that 70% of the CMD patients who had previously reported headache stated a decrease in headache frequency after CMD treatment[9]. In the same study 42% of the patients reported the headaches to be less severe after treatment. Forssell (1985) found in a study of headache patients after CMD treatment a reduction in the frequency of the headaches in 79%[10]. A decrease of the headache intensity was found in 53% while 49% of the patients also reported a reduction in medication after CMD treatment[10]. These figures are corroborating the results of the present study. They suggest an important role for CMD management in the multidisciplinary therapeutic approach of headache. However, the results of this study were achieved during only a short period of time and the need for a long term treatment evaluation is obvious. As it is also known that pain is dependent on a variety of factors the conclusion of the results of the present study must be considered critically[11]. Since the registration of pain is accepted to be very difficult, it is astonishing to find the consistency between the findings of the questionnaire and the headache diary to be in the range of 88% of the cases[12].
The placebo effect is well known in patients suffering from craniomandibular disorders as well as in headache patients[13,14]. It is reported to be between 20% and 35% and susceptible to various circumstances[10,13,14]. In the present study the CMD treatment of headache patients was presented to the patients by the neurologist as something new and possibly contributing to a solution of a severe

problem. The average treatment time and the amount of visits at the dentist exceeded the ones of the neurologic treatment. This difference might result in a more extensive placebo effect in the CMD treatment group. The statistically significant differences found between the groups, however, are probably not merely explained by an increased placebo effect. They also underline the reliability of the outcome of the extended functional examination of the stomatognathic system. Furthermore these results confirm that parts of the complicated pattern of the etiology of headache and facial pain initially can be managed with simple methods in changing the loading of the stomatognathic system.

In over one-third of the patients with a determined CMD pain the headache was not influenced by the CMD therapy. Comparison of the available data concerning the variables of headache and the condition of the stomatognathic system between patients respondive and irrespondive to CMD treatment will be presented in a following paper.

In conclusion the results of the present study confirm that dentistry provides a valuable contribution to the treatment of headache patients when findings attributable to craniomandibular disorders are present.

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chapter 6

DIFFERENCES IN HEADACHE PATIENTS REGARDING THEIR RESPONSE TO TREATMENT OF THE MASTICATORY SYSTEM

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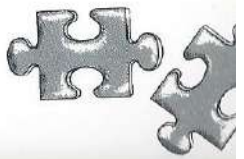

SUMMARY

Twenty three neurologically examined headache patients completed a treatment of a concomitantly diagnosed craniomandibular disorder (CMD). More than two third of the subjects responded favorably to the treatment and headaches decreased. Differences between patients regarding the response to CMD treatment were studied. Patients with a decreased headache intensity reported more coexisting neck problems ($p < 0.05$). Patients with an alleviation of headache showed before treatment a larger distance between passive and active maximum mouth opening ($p < 0.05$). The probability of headache improvement by CMD treatment was found greater in patients with a difference between passive and active maximum mouth opening of 5 millimeters or more ($p < 0.05$).

INTRODUCTION

Treatment of the masticatory system of patients suffering from recurrent headaches can result in an alleviation of headache[1,2,3,4,5]. In a previous study headache patients with a clinically determined CMD pain (CMD = craniomandibular disorder) reported a decrease in headache frequency and intensity after CMD treatment[6]. However, in about one-third of the patients studied the headaches did not respond to the CMD treatment. And yet in these patients headache was assumed to be related to CMD according to the findings at the examination of the stomatognathic system[6].

The aim of the present study was therefore to investigate the differences between headache patients who did benefit from the CMD treatment and those who did not. The study deals with established parameters in the examination of headache as well as clinical and radiographical findings of the stomatognathic examination.

MATERIAL AND METHODS

A CMD pain had been determined in 23 neurologically examined headache patients at the examination of the stomatognathic system[7]. The subjects had a mean age of 44 years (SD=14). There were 17 women and 6 men. None of the persons complained of problems connected with chewing or mandibular movements. The stomatognathic examination was performed by one dentist according to established and earlier described methods[7,8]. The maximum mouth opening of the patients was measured as the distance between the incisal edges of the maxillary and mandibular incisors with the inclusion of the vertical overbite. Additionally the difference between passive and active maximum mouth opening (endfeel) was recorded[9]. The passive maximum mouth opening was performed by expanding the active opening with the examiner's middle finger and thumb on the lower and upper incisors (see fig.1). Rotational panoramic radiographs were analyzed for joint pathology and the vertical condylar asymmetry was assessed according to methods described in a previous article[10].

CMD treatment was given by the same dentist and included the wear of a stabilization splint for 24 hours of the day. The splint was checked weekly by the dentist and the treatment period ranged from 6 to 10 weeks[6]. During the CMD therapy the patients were not further treated by the neurologist. None of the subjects was actively using medications except few incidents of the intake of pain-killers. Headache frequency and intensity had earlier been recorded before treatment and after the treatment[6]. The recordings had been made by means of a questionnaire and a headache diary which were completed by the patient. The consistency between the two methods of headache registration had been shown to be high[6].

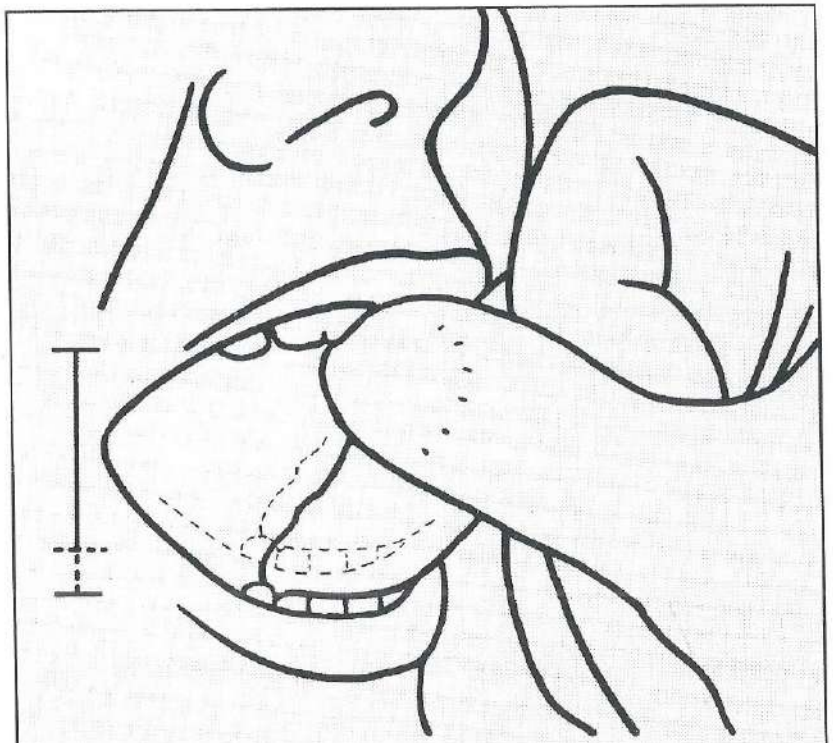

Figure 1 Difference between passive and active maximum mouth opening

Frequency of headaches had decreased in 14 patients (56%) while it had remained unchanged in 8 patients (35%). Besides, the intensity of headache had decreased in 15 patients (65%). It had not changed after treatment in 5 patients (22%)[6]. Patients with a decreased headache frequency or intensity after CMD treatment were compared with the patients in whom the headache remained unchanged. Four patients with an increased headache frequency or intensity after treatment were excluded. The investigations focused on differences in headache characteristics and in the clinical and radiographic findings of the stomatognathic examination. The available data were statistically analyzed using the Fischer's exact test and the Student's t test.

RESULTS

The mean age of the patients in the subgroups ranged from 42 to 48 years. Age and sex did not significantly differ between groups. The distribution of the headache variables and the neurologic diagnoses for headache patients with a

Table 1 Percentage distribution of headache variables recorded before treatment in the groups studied (* = $p<0.05$)

	After CMD treatment			
	Decreased headache frequency (n = 14) (%)	Unchanged headache frequency (n = 8) (%)	Decreased headache intensity (n = 15) (%)	Unchanged headache intensity (n = 5) (%)
Headache unilateral	35	63	40	60
Headache bilateral	65	37	60	40
Attacks of pain	36	50	33	60
Permanently present pain	71	75	80	60
Sharp pain	43	50	40	60
Dull pain	79	75	80	60
Pulsating pain	7	0	7	0
Pain at the same time of the day	36	50	47	20
Neck involvement (subjective)	100	75	100*	60*
Neurologic diagnosis:				
tension headache	50	50	53	40
migraine	14	13	7	40

different response to CMD treatment is shown in Table 1. Patients with a decreased headache intensity more often reported coexisting neck problems compared to patients with an unchanged headache intensity ($p < 0.05$). Statistical analysis of the results presented in Table 1 revealed no other significant differences.

The distribution of the clinical findings attributable to CMD between the patients studied is given in Table 2. No significant differences were found between the subgroups regarding the data given in Table 2.

The measurements of the mouth opening capacity recorded before treatment are shown in Table 3. The mean distance between passive and active maximum mouth opening (endfeel), measured before the treatment, was larger in patients with decreased headaches after CMD treatment ($p < 0.05$). Before treatment a distance between passive and active opening of 5 millimeters or more was recorded more often in patients with a decreased headache frequency or intensity after treatment ($p < 0.05$). The mouth opening capacity measured after CMD therapy did not differ between the groups studied.

Table 2 Percentage distribution of signs and symptoms of craniomandibular disorders and the determined origin of CMD pain recorded before treatment between the groups studied

	After CMD treatment			
	Decreased headache frequency (n = 14) (%)	Unchanged headache frequency (n = 8) (%)	Decreased headache intensity (n = 15) (%)	Unchanged headache intensity (n = 5) (%)
Myogenous origin of CMD pain	93	88	93	80
Arthrogenous origin of CMD pain	7	13	7	20
Macroscopic facial asymmetry	36	50	33	60
Deviation on maximum mouth opening	36	38	33	20
Elastic endfeel	100	100	100	80
Painful jointplay test	71	100	80	100
Locking of the joint	14	13	20	0
Clicking of the joint	64	63	53	80
Crepitation of the joint	43	25	47	20
Positive dynamic pain test	50	63	53	60
Positive static pain test	100	100	100	100
Pain on maximum mouth opening	100	88	100	80
Slide from RCP to ICP more than 0.5 mm	100	100	100	100
Lack of molar support	57	75	73	40
M. masseter tenderness	93	88	87	100
M. temporalis tenderness	86	100	93	100
Fatigue of muscles of mastication	57	50	60	60
Existence of a bruxoposition	93	88	93	80
Provocation of headache by clenching of the teeth	71	50	67	40

Table 3 Measurements of the maximum mouth opening capacity recorded in millimeters before treatment among the groups studied

	After CMD treatment			
	Decreased headache frequency (n = 14)	Unchanged headache frequency (n = 8)	Decreased headache intensity (n = 15)	Unchanged headache intensity (n = 5)
Mean active maximum mouth opening (mm)	47.1	47.0	46.4	47.6
Mean distance between passive and active maximum mouth opening (endfeel, mm)	7.0*	4.5*	6.9*	3.4*
Number of patients with endfeel of 5 mm or more	12*	2*	11*	1*
Number of patients with endfeel of 4 mm or less	2	6	4	4

Table 4 Distribution of radiographical findings before treatment on the rotational panoramic radiogram of the temporomandibular joint areas between the groups studied

	After CMD treatment			
	Decreased headache frequency (n = 14) (%)	Unchanged headache frequency (n = 8) (%)	Decreased headache intensity (n = 15) (%)	Unchanged headache intensity (n = 5) (%)
Difference in shape between right and left condyle	57	50	47	60
Difference in form between right and left joint fossa	14	25	20	40
Signs of hard tissue joint pathology	36	50	33	20
Mean vertical condylar asymmetry index	9.3	12.6	9.7	6.6

The distribution of radiographical findings regarding the hard tissue condition of the temporomandibular joints is shown in Table 4. The results did not significantly differ between the subgroups studied.

DISCUSSION

Reik and Hale (1981)[11] stated in their study that headache linked to mandibular dysfunction is continuous and unilateral. The results of the present study show only a tendency of these headaches to be "permanently present". However, in the present study the headaches decreasing after CMD treatment were mainly bilateral. These results therefore do not confirm the earlier mentioned statement made by Reik and Hale.

In a similar study Forssell (1986)[12] tried to distinguish between patients who benefitted from occlusal therapy and those who did not. She found significantly more patients reporting "pain while chewing" among those with a decreased headache frequency after occlusal treatment. In that study this finding was the only significant difference found between the groups tested. As a result she concluded the probability of headache improvement by CMD treatment to be greater for patients who had reported pain while chewing.

In the present study patients with a decreased headache intensity after CMD therapy reported more often subjective neck problems. This finding supports the clinical experience of the beneficial effect of physical therapy of the neck region in certain CMD patients. It is also in line with suggestions in the literature of a relationship between CMD and cervicobrachial disorders[13,14].

The differences in maximum mouth opening capacity between the groups tested are interesting. Patients with a headache linked to CMD clearly showed a bigger difference between passive and active maximum mouth opening recorded before treatment. In the majority of these patients this distance was found to be 5 millimeters or more. This movement of the mandible represents the orthopaedic "endfeel-test" in a border position of the temporomandibular joint. Although clinical experience indicates that measurements of mouth opening should be repeated at least several times to get a proper result it seems to be a simple clinical procedure in screening for a possible CMD related headache. The beneficial effect of the performed CMD treatment on muscle function is supported by the fact that after treatment no important difference between passive and active maximum mouth opening was found. McCarroll et al (1987)[9] concluded in their study on joint mobility that women are more mobile than men, in particular when testing the passive range of motion. In this respect it is noteworthy that the findings between the sexes did not differ in the groups tested.

Patients with an unchanged headache frequency showed a high condylar asymmetry (12.6%), but no statistical differences were found between the subgroups. In a previous study it was shown that migraine patients displayed a bigger condylar asymmetry compared to tension headache patients[10]. However, the incidence of these headache types in the subgroup was equal.

The number of patients in this study is small and the clinical result is recorded over a relatively short period of time. Therefore the significance of the conclusions should be considered in this perspective. More research and long term treatment results regarding the close relationship between headache and CMD remains needed. Nevertheless, the difference between passive and active maximum mouth opening seems to be a valuable criterion for the selection of patients with headache suitable for a CMD treatment. The relationship between the condition of the stomatognathic system and the upper part of the cervical spine also emphasizes the necessity of a team approach in the diagnosis and management of CMD linked headache.

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GENERAL DISCUSSION

GENERAL DISCUSSION

Pain is the main reason for patients to seek medical attention and headache is one of man's most common complaints[1]. Headache in itself is not considered to be a disease, but rather a symptom which may occur to a host of diseases or pathological conditions[2,3]. Numerous studies have shown that craniomandibular disorders (CMD) is one of these conditions with headache as a common symptom[4-13].

Most of the studies on headache as well as on CMD are dominated by women. This corroborates the male to female ratio in the present clinical material. The mean age of the subjects in this study was 41 years (SD=15) which is comparable to other studies on headache patients who were referred for neurologic examination[13,14,15]. It is noteworthy that most of the patients seeking CMD treatment are younger. This difference in age is surprising, considering the close relation between headache and CMD which was outlined in several studies and also confirmed in the present study[11,12,16,17]. None of the patients subjectively complained of problems connected with chewing or mandibular movement but headache was their main problem. However, functional problems and pain during mandibular movement are the major complaints in dental patients seeking CMD treatment[9,16,17]. Patients with these kinds of functional disturbances may feel much earlier the need for medical attention. This could be an explanation for the difference in age between CMD patients visiting a CMD clinic and a Headache center.

The majority of the headache patients with signs and symptoms attributable to CMD showed a myogenous origin of CMD pain. This finding supports the statements by Lous and Olesen (1982)[14] in their study on headache which was the first attempt to unify odontological and neurological expertise. Several studies suggested a relationship between CMD and a "muscle contraction type" of headache because of the myogenic character of the symptoms involved[10,12,18]. In the present study, however, the close association between headache and CMD was found also in patients with migraine and combination headache. This confirms the results of more recent studies indicating the pathologic condition of the muscles of the stomatognathic system to be a source of pain in patients with migraine as well as tension headache[14,19,20,21]. Moreover psychologists have questioned that increased muscle tension is the only or even the main cause of tension headache[22,23]. Electromyographical (EMG) studies on pericranial muscles showed increased muscle activity in migraine patients as well as in tension headache patients and that of the two, migraine sufferers have the highest EMG activity[24]. Featherstone (1985) has reviewed the literature concerning tension headache and migraine and demonstrated a great number of overlaps between these two types of headache[25]. All these investigations have led to recently proposed changes in the classification and neurologic diagnoses of headache and facial pain[3]. In this new proposed neurologic headache classification the diagnosis

of "Combination Headache" is eliminated. At present headache patients are believed to represent a continuum varying from those having pure migraine to those having pure tension headache and the patients having moderate amounts of both in between[3,25].

Studies focusing on occlusal habits showed a greater prevalence of parafunctional activity in patients with headache compared to non headache sufferers[6,26,27,28]. These registered parafunctions were independent of the neurologic diagnosis of headache. One of the goals of CMD treatment is to diminish the assumed parafunctional activity. The suggestions made by Lapeer (1988)[29] of the possible reduction of painful sequelae of migraine by means of CMD therapy are confirmed in the present study. In this respect the suggested theory by Moss (1988)[20] of a muscular imbalance as a source of common migraine pain is also interesting.

The localization of headache registered in patients with a definite CMD origin of pain was more bilateral although the association failed to be significant. Anyhow this does not confirm the suggestions made by some authors that a CMD linked headache is mainly unilateral[30,31]. In the present study several significant correlations were found between the findings of the clinical examination and the localization of the headache. Nevertheless the clinical findings at the examination of the stomatognathic system were predominantly unilateral which supports the results by Bezuur et al.[32]. The findings of the present study are conflicting with the hypothesis that the localization of headache is ipsilateral with the possible underlying CMD problem[9,33]. However, the outcome of the present investigations is supported by the results of Roberts et al (1987)[34]. That study showed by means of arthrographic documentation that the localization or character of the patient's headache has no relationship with the presence or absence of intracapsular disease. In conclusion can be said that bilateral recurrent headaches certainly do not rule out a CMD linked headache.

The fourth chapter of this thesis deals with the incidence of morphologic asymmetry in the craniofacial complex. A clinically determined macroscopic facial asymmetry was found more frequently in headache patients with a definite CMD pain. This underlines the important role of asymmetrical loading of the stomatognathic system in the development and maintenance of CMD, as shown in recent radiographic and EMG studies[35,36].

The relationship between headache and morphologic asymmetry is a more or less virginal area of research. Mongini (1987)[37] drew attention to a compensatory mandibular and condylar growth as a consequence of minimum mandibular displacement. Furthermore, it is known from embryonic research that changes in the surrounding soft tissue may influence the morphology of the bony structures of the facial skeleton[38]. These findings together with the association between facial asymmetry, headache diagnosis and localization and presence of a trauma or injury in the patient's history, found in the present study may indicate morphologic asymmetry to play a role in the pathogenesis of headache. Future

research in this direction is, however, needed.

Two thirds of the patients with headache and a definite CMD pain responded favorably to the CMD treatment as headaches decreased. In this respect the clinical result of CMD therapy exceeded the outcome of the neurologic treatment in patients in whom headache was assumed to be related to CMD. This result supports the statement by Kreisberg (1986)[30] that knowledgeable dentists can play a vital role in the management of patients suffering from headache or facial pain.

The necessary stomatognathic examination of headache patients may rule out the possibility of a CMD linked headache. On the other hand in many headache patients the clinical findings will highlight a close relationship between the headache and the pathological condition of the masticatory muscles. In case of doubt the recorded distance between passive and active maximum mouth opening could prove to be a valuable discriminating clinical test. The significance of a big difference between passive and active maximum mouth opening in selecting patients with headache suitable for CMD treatment should be further investigated in future clinical studies.

Dentists have traditionally accepted interceptive occlusal contacts as the primary etiologic factor in CMD[39,40]. However, parafunctional activity of the masticatory muscles may also be centrally induced and patterns of jaw movement are subject to a variety of influences other than contacts between the teeth[41,42]. In the present study CMD treatment included a stabilization splint, counseling, physical therapy and in two subjects with an arthrogenous origin of pain, laser treatment[43]. As there exist so many different subdiagnoses it is not known which factor of the treatment was the most important one in each patient. Anyhow it is the author's opinion that clinicians in general should not limit themselves to just one therapeutic modality when treating patients with headache or CMD. Each individual patient displays special problems and needs an individual treatment.

The area of pain caused by CMD appears to be widely spread and craniofacial pain lends itself to consultations of multiple professions. The re-emphasis on the stomatognathic examination of any patient suffering from headache or craniofacial pain may lead to pain reduction in many patients. If dentists, however, extend their clinical horizon beyond the "CMD-field", they will recognize that craniofacial pain may originate from a number of painful sources. It is for this reason that the multidisciplinary approach for patients suffering from headache or facial pain becomes more and more accepted. Dentists, physicians, physical therapists and psychologists should continue to expand this consulting partnership.

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SUMMARY AND CONCLUSION

RESUMEN Y CONCLUSION

SAMENVATTING EN CONCLUSIE

SUMMARY

Chapter one starts with a brief overview of some historical facts regarding headache and CMD and the suggested association of these two disorders. Some previous studies concerning headache and CMD are reviewed. The aims of the investigations, presented in this thesis, are discussed.

Chapter two deals with the initial study on 50 headache patients who had been referred for neurologic examination. Findings at the neurologic and the stomatognathic examinations of these patients were studied. More than half of the patients displayed CMD pain and in many ways headache patients resembled CMD patients. Unilateral findings were more common at the stomatognathic examination while headache occurred more bilaterally. No differences were found between the sexes.

In chapter three the initial patient group of 50 recurrent headache patients was expanded to 100. The patients were grouped on the basis of headache localization, the neurologic diagnosis of headache and the stomatognathic diagnosis. The relationship between groups was studied. In total 55 patients displayed pain of a CMD origin. Several significant correlations were found between the clinical findings and headache localization. Mouth opening capacity differed between headache patients with and without a definite CMD pain. The results confirm the close relationship between headache and CMD pain of a myogenous origin. The close association between headache and CMD found in this study was independent of the neurologic diagnosis of the headache.

Chapter four covers the investigations regarding the morphologic asymmetry of the stomatognathic system in these 100 headache patients. Rotational panoramic radiography was performed on all the patients and evaluated by a radiologist. The asymmetry in the clinical findings as well as in the radiographic findings was studied. A clinically determined macroscopic facial asymmetry was found more frequently in headache patients with a definite CMD pain. Additionally, asymmetry of the face was also correlated to headache localization and the presence of a trauma in the history. The vertical height of the condyle and the ramus were assessed on the radiographs. Condylar asymmetry in headache patients was remarkably high compared to normal dental patients. Migraine patients displayed a bigger condylar asymmetry than tension headache patients. Asymmetry in the morphology of temporomandibular joint hard tissue was more prevalent in patients with CMD pain and with mainly bilateral headaches. The results indicate that there seems to be an association between headache and the morphologic asymmetry or imbalance of the stomatognathic system.

Chapter five deals with the CMD treatment results regarding the changes in headache frequency, headache intensity and the intake of drugs to control the headache. All headache patients with a definite CMD pain were randomly divided into two groups. One group was treated by the neurologist and the other one by the dentist. The results of CMD therapy were compared with the outcome of the neurologic treatment. Patients treated by the dentist more often reported a decreased headache intensity or a reduction in medication. Furthermore, the CMD treatment resulted more often in changes in the frequency of the headaches. These results suggests that the dental profession can provide a valuable contribution to the treatment of headache or facial pain, when findings attributable to CMD are present.

In chapter six differences between the headache patients regarding their response to the CMD treatment are studied. All these patients displayed pain of CMD origin and headache was assumed to be related to CMD. Nevertheless in about one third of the subjects the headaches did not respond to the CMD treatment. Patients with a decreased headache intensity more frequently reported coexisting neck problems. Patients who benefitted from the CMD treatment showed before treatment a different maximum mouth opening capacity compared to patients where headache remained unchanged. The distance between passive and active maximum mouth opening, as recorded before treatment, was larger in patients with a decreased headache. The probability of headache improvement after CMD therapy is greater in patients with a difference between passive and active maximum mouth opening of 5 millimeters or more. Although clinical experience indicates that measurements of mouth opening should be repeated at least several times to get a proper result this simple clinical test could provide a parameter for a possible CMD related headache.

In chapter 7 the results of the separate studies presented in this thesis are discussed. Previous research in this field is reviewed and the conclusions of the present studies are compared with the findings of other investigators. The need for a multidisciplinary therapeutic approach of patients with headache or facial pain is emphasized.

CONCLUSION

1. The prevalence of signs and symptoms of craniomandibular disorders in chronic headache patients in many ways resemble the clinical findings of patients treated in a CMD clinic.

2. The close association between headache and craniomandibular disorders of myogenous origin in patients with migraine, tension headache or combination headache seems to be independent of the neurologic diagnosis of headache.

3. Bilateral recurrent headaches certainly do not rule out the possibility of a CMD linked headache.

4. Macroscopic facial asymmetry was found more often in headache patients with a definite CMD pain than in headache patients were no CMD pain could be determined.

5. Migraine patients displayed more vertical condylar asymmetry than tension headache patients.

6. Morphologic asymmetry of the skull and the mandible may play a role in the complicated mechanism of the etiology of headache.

7. In more than half of the headache patients with a concomitantly determined CMD pain headaches decreased after CMD treatment.

8. A large distance between passive and active maximum mouth opening could be a selection criterion to isolate headache patients suitable for CMD treatment.

RESUMEN

El capítulo uno comienza con un breve resumen de hechos históricos observando dolor de cabeza, desórdenes craneomandibulares (= DCM) y la asociación posible entre estos dos desórdenes. Son revisados también en este capítulo, previos estudios concerniendo dolor de cabeza y DCM. Los objetos de las investigaciones presentadas en esta tesis son discutidas.

El capítulo dos trata con el estudio inicial de 50 pacientes con dolor de cabeza que han sido examinados neurológicamente. Son estudiados los resultados de los exámenes neurológico y estomatognático de estos pacientes. Más de la mitad de los pacientes mostraban dolor DCM y en muchos aspectos dolor de cabeza pacientes y DCM pacientes se asemejaban. Hallazgos clínicos unilaterales fueron más comunes en el exámen estomatognático mientras el dolor de cabeza occuría más bilateralmente. No se encontraron diferencias entre sexos.

En el capítulo tres, el grupo inicial de 50 pacientes con dolor de cabeza se extendió a cien. Los pacientes se agruparon con respecto al la localización del dolor de cabeza, la diagnosis neurológica del dolor de cabeza y la diagnosis estomatognático. La relación entre grupos fue estudiada. Un total de 55 pacientes mostraban dolor de origen DCM. Se descubre también un número significante de relaciones entre los hallazgos clínicos y la localización del dolor de cabeza. La capacidad de abertura bucal difería entre pacientes con dolor de cabeza con o sín un definido dolor DCM. Los resultados confirman una estrecha relación entre dolor de cabeza y dolor DCM de origen miógeno. La estrecha relación entre dolor de cabeza y DCM descubierta en este estudio, fue independiente del diagnóstico neurológico del dolor de cabeza.

El capítulo cuatro expone las investigaciones relativas a la asimetría morfológica del sistema estomatognático de los ya mencionados cien pacientes con dolor de cabeza. Se tomaron rotatonamente radiografías panorámicas de cada uno de los pacientes y fueron estas evaluadas por un especializado radiólogo. Se estudió la asimetría de los hallazgos clínicos y radiográficos. En pacientes que sufrían del dolor de cabeza con un definido dolor DCM se daba con más frecuencia una asimetría macroscópica facial determinado clínicamente. Además, esta asimetría facial se relacionó también con la localización del dolor de cabeza y la presencia de un trauma en la historia del paciente. La altura vertical del cóndilo y el ramus fue apreciada en las radiografías. Asimetría condilar era notablemente más grande en pacientes con dolor de cabeza que en pacientes dental. Migraña pacientes mostraban una asimetría condilar más grande que pacientes con dolor de cabeza de tensión muscular. Asimetría en la morfología de los tejidos duros de la juntura temporomandibular eran más frecuentes en pacientes con dolor DCM y con dolor de cabeza principalmente bilaterales. Los resultados indicaron que parece haber una asociación entre dolor de cabeza y asimetría morfológica o desbalance del sistema estomatognático.

El capítulo cinco trata de los resultados del tratamiento DCM observando la frecuencia del dolor de cabeza, su intensidad y el consumo de drogas para controlarla. Todos los pacientes con un definido dolor DCM fueron divididos al azar, en dos grupos. El primero fue tratado por el neurólogo y el segundo por el dentista. El tratamiento DCM fue comparado con el tratamiento neurológico. Los resultados de los pacientes tratados por el dentista mostraron con más frecuencia un descenso en la intensidad del dolor de cabeza o una reducción en el consumo de drogas. Además, en el grupo que fue tratado por el dentista, se notó más un cambio en la frecuencia del dolor de cabeza. Estos resultados sugieren que la odontología puede proveer una contribución importante para el tratamiento del dolor de cabeza o dolor facial cuando se tienen presentes los hallazgos atribuidos al DCM.

En el capítulo seis se estudian las diferencias entre pacientes con dolor de cabeza, que reaccionaron favorablemente o no al tratamiento de DCM. Todos estos pacientes padecían dolor de origen DCM y se asumió que el dolor de cabeza estaba relacionado con DCM. Sin embargo, en mas o menos un tercio de los sujetos el dolor de cabeza no respondió al tratamiento DCM. Los pacientes que mostraron un descenso en la intensidad del dolor de cabeza acusaron con más frecuencia problemas en la nuca. Los pacientes que se beneficiaron del tratamiento DCM poseían antes del tratamiento una diferente capacidad de la máxima abertura bucal comparados con pacientes en los cuales el dolor de cabeza permanecía sin cambio alguno. La distancia entre la máxima abertura bucal pasiva y la máxima abertura bucal activa, como se recordaba antes del tratamiento, fue mayor en pacientes con una disminución del dolor de cabeza. La probabilidad de mejora del dolor de cabeza después la terapía DCM, es mayor en pacientes en los cuales la diferencia entre la máxima abertura bucal pasiva y la máxima abertura bucal activa es de 5 milímetros o más. A pesar de que la experiencia clínica indica que la medición de la abertura bucal debe repetirse varias veces para conseguir resultados apropiados, este simple test clínico proporcionó un parámetro para la posibilidad de relación entre DCM y dolor de cabeza.

En el capítulo siete se discuten los resultados de los estudios separados que se presentan en esta tesis. Son revisadas en este capítulo también, investigaciónes previas en este campo y las conclusiones de estos estudios son comparados con los resultados de otras investigaciones. Se da énfasis a la necesidad de una terapía multidisciplinaria para el tratamiento de pacientes con dolor de cabeza o dolor facial.

CONCLUSION

1. La prevalencia de signos y síntomas de desórdenes craneomandibulares en pacientes con dolor de cabeza crónica asemeja en muchas maneras a los hallazgos clínicos en pacientes tratados en una clínica de DCM.

2. La estrecha asociación entre dolor de cabeza y desórdenes craneomandibulares de origen miógeno en pacientes con migraña, con dolor de cabeza de tensión muscular o con una combinación de ambos, parece ser independiente de la diagnosis neurológica del dolor de cabeza.

3. Dolor de cabeza bilateral crónico no se descarta la posibilidad de que el origen de ésta sea o tenga una relación con DCM.

4. Se halló una asimetría macroscópica facial con más frecuencia en pacientes con dolor de cabeza con un definido dolor DCM, que en pacientes con dolor de cabeza en los cuales el dolor DCM no pudo definirse.

5. Pacientes con migraña poseían una asimetría condilar vertical mayor que pacientes con dolor de cabeza de tensión muscular.

6. Asimetría morfológica del craneo y la mandibula puede tener una influencia en el complicado mecanismo de la etiología del dolor de cabeza.

7. En más de la mitad de los pacientes con dolor de cabeza y al mismo tiempo con un determinado dolor DCM, la intensidad del dolor de cabeza disminuye después del tratamiento DCM.

8. Una gran diferencia entra la máxima abertura bucal pasiva y la máxima abertura bucal activa puede ser un criterio de selección para determinar pacientes con dolores de cabeza para los cuales sería apropiado la aplicación del tratamiento DCM.

SAMENVATTING

In hoofdstuk één worden enkele details van de geschiedschrijving over hoofdpijn vermeld. De eerste publicaties over afwijkingen van het kaakgewricht en de omliggende weefsels en de mogelijke relatie met hoofdpijnklachten worden aangehaald. Achtereenvolgens wordt een aantal relevante studies op dit terrein besproken. Aan het eind van het hoofdstuk worden de doelstellingen van het hier gepresenteerde onderzoek toegelicht.

Hoofdstuk twee bevat de resultaten van een eerste studie naar afwijkingen binnen het kauwstelsel bij 50 chronische hoofdpijnpatiënten, die vanwege hun klachten werden doorverwezen voor neurologisch onderzoek. De bevindingen van het uitgebreide functieonderzoek (craniomandibulaire dysfunctie-onderzoek) en het neurologische onderzoek worden met elkaar vergeleken. In meer dan de helft van de gevallen was er een duidelijke pijncomponent binnen het kauwstelsel aantoonbaar en deze hoofdpijnpatiënten verschilden niet wezenlijk van de patiënten die worden behandeld voor craniomandibulaire dysfunctie (CMD). Aanwijzingen voor CMD manifesteerden zich meestal enkelzijdig terwijl de hoofdpijn vaker dubbelzijdig was. Er werd geen significant verschil gevonden tussen mannen en vrouwen.

In hoofdstuk drie werd de onderzoekspopulatie uitgebreid tot 100 patiënten. De onderlinge relatie tussen de localisatie van de hoofdpijn, de neurologische diagnose én de conditie van het kauwstelsel werd bestudeerd. Bij 55% van de patiënten werd pijn binnen het kauwstelsel (CMD-pijn) gevonden. Deze pijn was bijna altijd van een myogene oorsprong. Er werd een samenhang gevonden tussen bepaalde uitkomsten van het CMD-onderzoek en de localisatie van de hoofdpijn. Hoofdpijnpatiënten met CMD-pijn hadden bovendien een veranderde mondopening capaciteit. De resultaten bevestigen een nauwe samenhang tussen hoofdpijn en een myogene CMD. Deze samenhang was niet afhankelijk van de neurologische diagnose van de hoofdpijn.

In hoofdstuk vier wordt de klinische en röntgenologische asymmetrie van het gelaat besproken. Er werd van iedere hoofdpijnpatiënt een Orthopantomogram (OPG) gemaakt. De foto's werden geëvalueerd door een ervaren röntgen-specialist. Bij hoofdpijnpatiënten met CMD-pijn werd tijdens het klinisch onderzoek significant vaker een "scheef gezicht" geconstateerd dan bij patiënten zonder CMD-pijn. Bovendien werd er een relatie gevonden tussen asymmetrie van het gelaat, een hoofdtrauma in de anamnese en de localisatie van de hoofdpijn. Via een eerder gepubliceerde meettechniek werd op de OPG de vertikale asymmetrie van de condylus en de ramus bepaald. De gemiddelde condylaire asymmetrie in deze groep hoofdpijnpatiënten was verrassend veel hoger dan eerder gevonden waarden in een populatie van tandartspatiënten. In dit opzicht waren migraine patiënten meer asymmetrisch dan patiënten met spierspannings hoofdpijn.

Individuele vormverschillen binnen het kaakgewricht werden vaker gevonden bij patiënten met CMD-pijn en met dubbelzijdige hoofdpijn. Deze resultaten doen

vermoeden dat er een relatie zou kunnen bestaan tussen asymmetrie in het kauwstelsel en de aetiologie van hoofdpijn.
Hoofdstuk vijf beschrijft de verschillen in het behaalde klinische resultaat met betrekking tot de hoofdpijn van of een CMD behandeling danwel een neurologische behandeling. Alle hoofdpijnpatiënten waarbij CMD pijn werd gevonden tijdens het functie onderzoek werden zonder voorkeur of door de neuroloog verder behandeld danwel door de tandarts. De CMD-behandeling resulteerde vaker in een verminderde intensiteit van de hoofdpijn en een vermindering van het gebruik van pijnstillers in vergelijking met de behandeling door de neuroloog. Ook werd in de groep die door de tandarts werd behandeld vaker een verandering in de frekwentie van de hoofdpijn gerapporteerd. Deze behandelingsresultaten geven aan dat tandartsen een waardevolle bijdrage zouden kunnen leveren in de bestrijding van chronische hoofdpijn wanneer er tijdens een CMD onderzoek afwijkingen worden gevonden.
Hoofdstuk zes gaat over mogelijke verschillen tussen hoofdpijnpatiënten die baat hadden bij een CMD-behandeling en diegenen waarbij de hoofdpijn niet was veranderd na CMD-behandeling. Bij ongeveer één derde van de patiënten met CMD-pijn reageerde de hoofdpijn niet of nauwelijks op de CMD-behandeling. Patiënten die ook nek problemen hadden tijdens de hoofdpijn gaven vaker aan dat de intensiteit van hun hoofdpijn was verminderd na de CMD- behandeling. Patiënten waarbij de frekwentie of de intensiteit van de hoofdpijn verminderde na de CMD-behandeling hadden een afwijkende mondopening capaciteit voor de behandeling begon. Bij deze patiënten was het verschil tussen de passieve en actieve maximale mondopening duidelijk groter dan bij de patiënten waarbij de hoofdpijn niet veranderde. Bij patiënten die minder hoofdpijn hadden na de behandeling was het verschil tussen passieve en actieve maximale mondopening voor de behandeling significant vaker 5 millimeter of meer. Hoewel klinische ervaring aangeeft dat dit soort metingen een aantal malen na elkaar moeten worden herhaald om betrouwbaar te zijn lijkt dit een eenvoudige klinische test voor hoofdpijn ten gevolge van CMD-problematiek.
Hoofdstuk zeven bevat de algemene discussie over de bevindingen en conclusies van de diverse studies in dit proefschrift. Diverse gepubliceerde onderzoeksresultaten op dit terrein komen aan de orde en worden vergeleken met de uitkomsten van de hier gepresenteerde studie. Dit hoofdstuk eindigt met een aanbeveling voor een multidisciplinaire aanpak van patiënten met hoofdpijn of aangezichtspijn.

CONCLUSIE

1. Er zijn grote overeenkomsten in de conditie van het kauwstelsel tussen patiënten van een dysfunctie kliniek en chronische hoofdpijnpatiënten.

2. De nauwe samenhang tussen hoofdpijn en myogene CMD bij patiënten met spierspannings hoofdpijn, combinatie hoofdpijn of migraine lijkt onafhankelijk van de neurologische diagnose.

3. Dubbelzijdige chronische hoofdpijn sluit CMD niet uit als oorzaak van de hoofdpijnklacht.

4. Hoofdpijn patiënten bij wie in het kauwstelsel een CMD-pijn kon worden opgewekt hadden klinisch significant vaker een asymmetrie van het gelaat dan de patiënten zonder CMD-pijn.

5. De verticale condylaire asymmetrie was groter bij migraine patiënten dan bij patiënten met spierspannings hoofdpijn.

6. Morfologische asymmetrie van de schedel of de onderkaak speelt wellicht een rol in de ingewikkelde pathogenese van hoofdpijn.

7. Bij meer dan de helft van de hoofdpijnpatiënten bij wie in het kauwstelsel een CMD-pijn kon worden opgewekt verminderde de hoofdpijnklachten na een CMD-behandeling.

8. Een groot verschil tussen de passieve en actieve maximale mondopening zou een selectie criterium kunnen zijn voor een hoofdpijn ten gevolge van CMD problematiek.

NAWOORD

NAWOORD

Aan de totstandkoming van dit proefschrift hebben velen direkt en indirekt een waardevolle bijdrage geleverd. Een aantal van hen wil ik met name bedanken zonder anderen tekort te willen doen.

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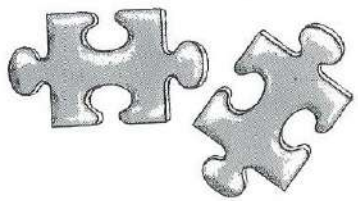
STELLINGEN

BEHOREND BIJ HET PROEFSCHRIFT

"CRANIOMANDIBULAR DISORDERS IN HEADACHE PATIENTS"



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I

Bij het medisch onderzoek van iedere patiënt met aangezichtspijn of chronische hoofdpijn zou aandacht moeten worden geschonken aan de funktionele conditie van het kauwstelsel.

II

Een groot verschil tussen de passieve en actieve maximale mondopening komt vaker voor bij hoofdpijn patiënten die baat hebben bij een craniomandibulaire dysfunctie behandeling.

III

Het vaak gesuggereerde volledig reversibele karakter van een behandeling met een opbeetplaat is discutabel.

IV

Het verschil tussen hoofdpijn en pijn in het hoofd verdient nader onderzoek.

V

Bij de presentatie van onderzoeksresultaten op wetenschappelijke congressen wordt meestal de spreker meer beoordeeld dan de inhoud.

VI

Als je gereedschap slechts bestaat uit een hamer, heb je de neiging om alle problemen te behandelen alsof het spijkers zijn.

VII

Het resultaat van een promotie aan de universiteit of een promotie binnen het bedrijfsleven is in financieel opzicht meestal tegengesteld.

VIII

Een te kleine mondopening is makkelijker te behandelen dan een te grote bek.

IX

Als we elkaar wat vaker prezen zou er minder hoofdpijn wezen.

X

De politieke besluitvorming in ons land ten aanzien van het milieu houdt meer rekening met de volgende verkiezingen dan met de volgende generatie.