Craniomandibular disorders and general joint mobility

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The purpose of the investigation was to study the relationship between general joint mobility and dysfunction among patients with craniomandibular disorders (CMD). Joint mobility was assessed in 74 female patients and 73 controls, using Beighton's modification of the Carter & Wilkinson hypermobility score. Twenty-five (83%) of 30 patients with score ≥3 (lax joints) had temporomandibular joint (TMJ) involvement. Eighteen (41%) of 44 patients with score 0–2 (no laxity) had TMJ involvement. The difference between these groups was statistically significant ($p < 0.001$). General joint laxity should therefore be taken into consideration in diagnosis and treatment of CMG. □ *Headache; hypermobility score; masticatory myalgia; osteoarthrosis; temporomandibular joint derangement*

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The characteristic signs and symptoms of craniomandibular dysfunction (CMD) are considered to be pain and tenderness in the temporomandibular joint (TMJ) and surrounding muscles, impaired mobility of the mandible, and joint sounds. Scientific evidence to support one primary etiologic factor in functional disturbances of the masticatory system is lacking. A complex and multifactorial etiology of CMD is widely accepted, but opinions diverge as to the relative importance of the different factors suggested. Measurement of jaw movements in different planes has been regarded as one of the most objective ways of analyzing the degree of CMD (1). A high correlation between restricted mandibular mobility and various signs and symptoms of CMD has been found. However, for a joint the opposite phenomenon, hypermobility, may be as alarming as hypomobility. Previously, it was pointed out that subluxation of the TMJ might be the effect of congenital weakness of the capsule (2).

Hypermobility is an important concept in rheumatologic practice because excessive joint laxity produces a wide variety of articular complications. Clinical observations led Kirk et al. (3) to define the 'hypermobility syndrome' in a group of patients with joint laxity and musculoskeletal complaints but absence of demonstrable systemic rheumatologic disease. Similar observations have been reported in recent years (4–6). Age, sex, and racial differences in joint mobility have been described (7–10).

Scott et al. (11) compared joint mobility in 50 consecutive females with symptomatic osteoarthrosis with that in age- and sex-matched controls. They demonstrated a significantly higher prevalence of hypermobility among the patients with osteoarthrosis.

In more recent studies a possible association between TMJ dysfunction and general joint mobility has been discussed (12–14). Patients with internal derangements who reported generalized joint laxity seemed to be more resistant to conservative treatment (14). A highly significant correlation between wrist and elbow joint laxity and internal derangement of the TMJ for females has been reported (12).

Katzberg et al. (15) found, on tomographic and arthrographic evaluation of 102 joints, that in 28 patients who had disk displacement with reduction (painful clicking) the condylar translation on the symptomatic side was greater than on the asymptomatic side. This was defined as hypermobility of the condyle on the symptomatic side. In a

recent investigation (16) of dental students, only a few, weak correlations were found between mandibular border position measurements and peripheral joint mobility measurements.

The aim of this investigation was to assess the peripheral joint mobility in random patients referred to a clinic with different diagnoses of CMD.

Materials and methods

Seventy-six female patients ≤35 years of age (mean age, 24.8 years; range, 13–35 years), referred to the Department of Stomatognathic Physiology of the University of Gothenburg, were randomly selected for examination. All patients were examined for joint mobility by me before any information concerning the patient's history and clinical signs was obtained at the first visit. Two patients with suspected rheumatoid arthritis were excluded.

In a control group of 81 healthy dental assistants and female dental students ≤35 years of age (mean, 23.9 years; range, 17–35 years) 8 were excluded because of signs of TMJ disorder at clinical examination. The study consequently comprised 74 patients and 73 controls.

Methods

Joint mobility was assessed in each individual by determining the mobility score as

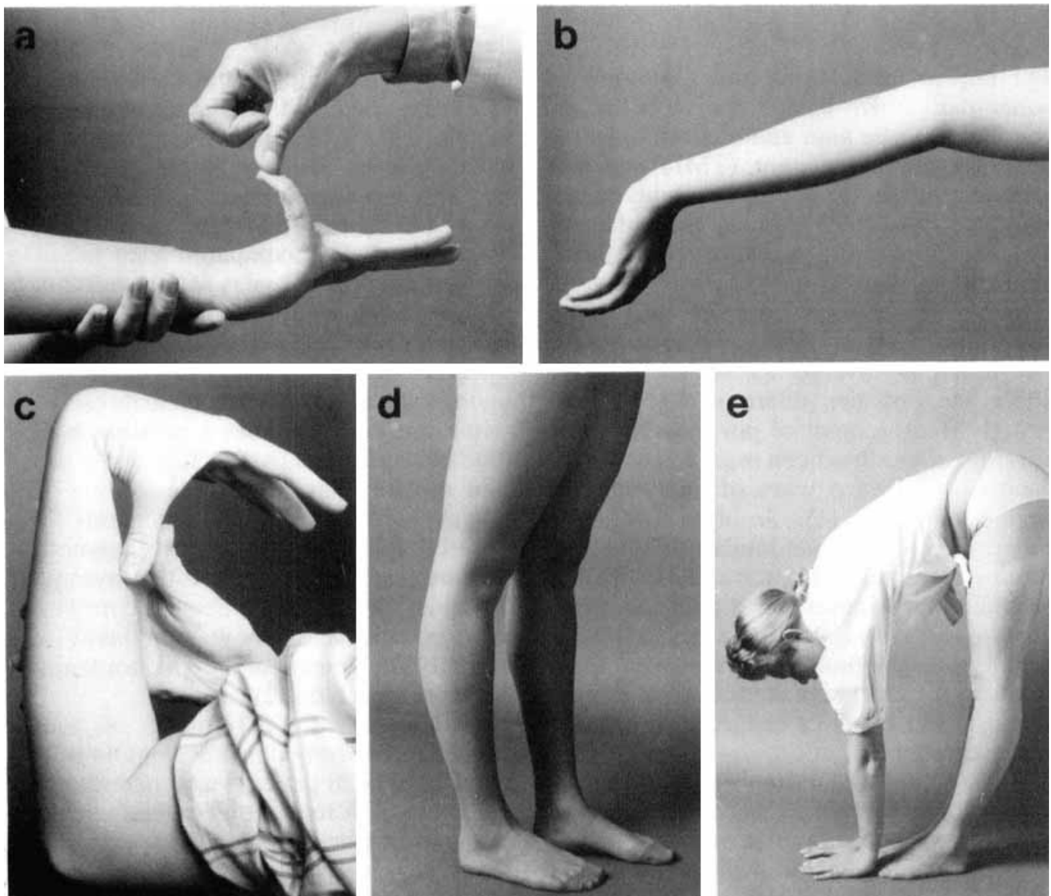

Fig. 1. The maneuvers used in the joint mobility score modified by Beighton et al. (8) (see text)

proposed by Carter & Wilkinson (17) and modified by Beighton et al. (8). The maneuvers used in this scoring system are as follows: a) passive dorsiflexion of the little fingers beyond 90° (1 point for each hand), 2 points; b) hyperextension of the elbows beyond 10° (1 point for each elbow), 2 points; c) passive apposition of the thumbs to the flexor aspects of the forearm (1 point for each thumb), 2 points; d) hyperextension of the knee beyond 10° (1 point for each knee), 2 points; e) forward flexion of the trunk with the knees fully extended so that the palms of the hands rest flat on the floor, 1 point (Fig. 1).

The measurements were made by means of a protractor.

The range of scoring is thus 0–9, with the higher scores denoting greater joint laxity. A score of ≥3 indicates widespread hypermobility of the joints. Only female patients were recorded, because of reported differences in joint mobility between the sexes (7–9).

The methods used for recording the history and the clinical signs of functional disturbances in the masticatory system followed the routine procedures at the department (18, 19). After these data had been obtained, the patients were categorized into different groups regarding signs and symptoms (20–22) (Table 1).

Statistical methods

Correlations between joint mobility and diagnoses were tested for statistical significance with the chi-square test (Yates's correction). The following levels of significance were used: $0.05 \leq p$ not significant (NS); $0.01 \leq p < 0.05$*; $0.001 \leq p < 0.01$**; and $p < 0.001$***.

Results

The highest mobility score was 7 among the patients and 6 among the controls. The distribution of mobility scores is shown in Fig. 2. Forty-one per cent of the patients and 30% of the controls had score ≥3 ($p < 0.05$).

The distribution of joint mobility was wide, but it had a tendency to decrease with age both in controls and in CMD patients without observed TMJ disorder. In patients

Table 1. Distribution of diagnoses and clinical signs in 74 female patients (≤35 years) at a CMD clinic

	n	MT	JT	PM
Patients with TMJ involvement				
Clicking of TMJ only or a single locking (stage one)	10	4	6	2
Intermittent locking (stage two)	16	8	5	4
'Closed lock' (stage three)	10	5	7	5
Osteoarthrosis	6	4	3	4
Luxation	1	1	1	1
Total	43	22	22	16
Percentage		52	52	38
Patients with no or insignificant TMJ invovlement				
Headache*	17	12	5	0
Masticatory myalgia	7	3	2	1
Attrition	4	0	1	0
Tongue pain	2	0	0	0
Posttraumatic symptoms	1	0	1	0
Total	31	15	9	1
Percentage		49	30	4

MT = more than 3 muscles tender on palpation; JT = posterior joint tenderness; PM = pain on more than one movement.

* Including three patients with clicking.

with TMJ diagnoses the mobility score was evenly distributed over the age groups.

More than half of all patients (43 of 74) had pain and dysfunction deriving from the TMJ (Table 1). Thirty-six of these had internal derangement of various extents. The TMJ patients were slightly (NS) younger (mean, 24.1 years) than those with no joint symptoms (mean, 26.0 years).

Twenty-five (83%) of 30 patients with a joint mobility score ≥3 had TMJ problems (Fig. 3). Eighteen (41%) of the 44 without joint hyermobility (score, 0–2) had a TMJ diagnosis ($p < 0.001$). The mean age was 24 years in both groups. The distribution of diagnoses in relation to joint mobility and statistical analysis is shown in Table 2. Three of the four patients with headache in the hypermobile group also had loud clicking. As their main problem was recurrent headache, these patients did not receive a TMJ diagnosis.

The TMJ patients showed considerably more generalized joint hypermobility (Table 2 and Fig. 3). Twenty-five (58%) had a score ≥3, and 21 of these had some kind of internal derangement. Five (16%) of 31 patients without TMJ symptoms had ≥3 points.

There was a difference in voluntary mouth-opening capacity between diagnostic groups but no significant difference in mouth opening between generally tight and lax patient groups.

Discussion

There are two methodologic difficulties in this study: the classification of joint hypermobility and the diagnosis of CM dysfunction.

At quantitative measurements of joint mobility in 446 normal adolescents the comparison of the criteria of Beighton et al. (8) well exceeded the mean mobility plus 2 standard deviations (23). Previous studies using the scoring system proposed by Carter & Wilkinson (17) and modified by Beighton et al. (8) have grouped their material scores of 0–2, 3–5, and 6–9 (8) or 0–2 and ≥3 (6). Other studies have divided the results into 0–3, 4–6, and 7–9 (9, 10). The great majority (about 80%) of normal adults have score values of 0, 1, or 2 on the 0–9 mobility scale (8–10). Not making the groups dissimilar in size, controls and patients in this study are grouped into 0–2 and ≥3. This leads to similar distribution of laxity when comparing the control group with the Beighton report of females in equivalent age groups.

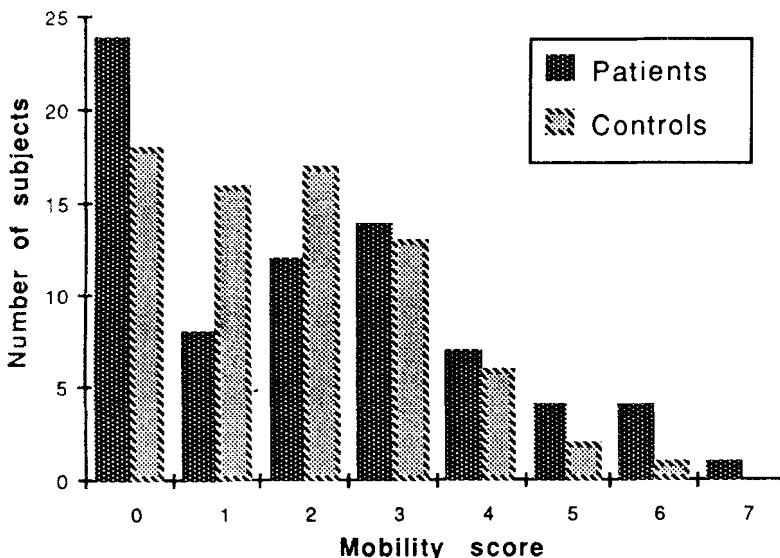

Fig. 2. Distribution of patients and controls with regard to joint mobility score 0–9.

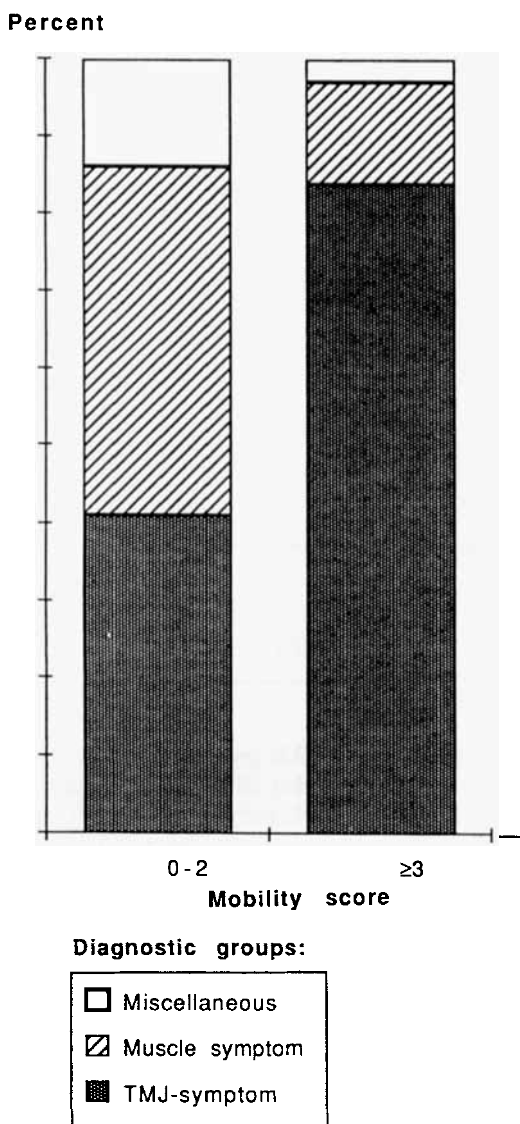

Fig. 3. Percentage distribution of main diagnostic groups with regard to mobility score grouped into 0–2 ($n = 44$) and ≥3 ($n = 30$). The distribution in the groups is significantly different ($p < 0.001$).

It may be questioned how individuals with scores of 2 and 3 influence the results. When patients with scores of 2 and 3 are excluded from the material, 48 patients will be left, 32 with score 0–1 and 16 with 4 or more. The distribution of diagnoses compared with division into 0–1 and ≥4 shows no difference on comparison with the distribution presented in Fig. 3. In the lax group (score ≥4) there were three patients with recurrent headache and annoying clicking. But as their main problem was headache, they have been placed in the group of 'pain of muscular origin'. However, it has been proposed (24) that TMJ derangement leads to headache, and it has also been postulated to be due to a systemic connective tissue disorder (25).

Previous studies indicate that at any age, females are more mobile than males (7, 8). However, the degree of joint laxity diminishes rapidly throughout childhood, continuing to fall at a slower rate in adult life. On comparison with corresponding sex and age groups in an epidemiologic study (8) similar alteration of laxity could be observed in the controls and in the patients without TMJ problems. But patients with TMJ diagnoses had hardly any visible change in joint mobility from 13 to 35 years of age.

The diagnoses make no claim to be free from criticism. For example, no arthrographic examination was performed. Questionnaires and clinical examination have been the basis of diagnosis. It is therefore possible that patients with TMJ disorder have been overlooked and erroneously classified among headache or masticatory myalgia.

The high prevalence of osteoarthrosis in hypermobile patients, as seen in rheumatologic practice (3–6, 11, 17), renders a pathogenetic relationship very likely, notwithstanding the influence of other important factors such as age and congenital articular dysplasia. There seems thus to be a strong clinical impression that hypermobility may predispose to the development of premature osteoarthrosis, particularly in weight-bearing joints. Positive proof of this hypothesis awaits controlled prospective studies.

There is no agreement in defining hypermobility of the TMJ. Measurement of mandibular movements or registration of condylar position gives no true answer about laxity of the TMJ. In CMD patients internal derangements or muscular restriction may conceal a slackness of the capsular ligaments. Mandibular border position registration measuring the distance between the teeth of

Table 2. Distribution of diagnoses of CMD in 74 female patients (≤35 years) with different joint mobility

	Joint mobility score		
	0–2, $n = 44$	≥3, $n = 30$	Test of difference between 0–2 and ≥3
TMJ involvement			
TMJ derangement			
Stage one	7	3	
Stage two	4	12	**
Stage three	4	6	
TMJ derangement, total	15	21	**
Osteoarthrosis	3	3	
Luxation	0	1	
TMJ involvement, total	18	25	***
No or insignificant TMJ involvement			
Headache	13	4	
Masticatory myalgia	7	0	
Pain of muscular origin, total	20	4	**
Attrition	3	1	
Tongue pain	2	0	
Posttraumatic arthritis	1	0	
No TMJ involvement, total	26	5	***

both the jaws is dependent on use of teeth and also of the length of the jaw (1, 16, 26). Radiographic methods are thought to be the most accurate (15, 26) but cannot be used for epidemiologic purposes. The condylar position in front of the articular eminence on wide opening (15) and condylar retroposition (13) may indicate TMJ hypermobility. Measurements of groups of joints with a simple scoring system may be useful if they mirror the state of most other joints in the body.

The study cannot answer the question as to why the TMJ patients show more general joint laxity than those without TMJ dysfunction. Biomechanical factors depending on lax TMJ capsules and ligaments leading to instability may increase the likelihood of joint injury. Another explanation is that the particular condition of collagen that contributes to hyperlaxity may be identical to that which leads to internal derangements in the TMJ. If the fibroelastic tissue of the posterior disk attachment is in one state in the stiff and another in the hypermobile individual, then its control of the TMJ disk will differ. However, hypermobile patients belonging to the TMJ group do not necessarily have hypermobility of the TMJ. Widespread generalized joint laxity manifested by a high Beighton score is suggestive of a generalized abnormality of collagen structure and may both in the TMJ and in other parts of the body produce different complications (27). Further investigations into these questions seem to be urgently needed.

Lax joints (score ≥3) was exhibited by 41% of the patients (58% with TMJ involvement and 16% with no or insignificant TMJ involvement) and by 30% of the controls. These figures may indicate the presence of other factors to produce pain and dysfunction in a lax person—perhaps a sufficiently large influence of bruxing and jaw traumata. This was probably lacking in the control group. Ongoing investigations will show whether differences in joint laxity influence signs and symptoms in patients with a history of bruxism and/or jaw trauma.

This study shows a significantly higher prevalence of TMJ dysfunction among females with hypermobility of peripheral joints than in female CMD patients without hypermobility. The generally increased joint

mobility not including the TMJ ought to be observed as a predisposing factor in causing TMJ dysfunction. The patient with hypermobile joints may need special considerations in CMD therapy and in restorative dentistry, first of all preventing excessive opening of the TMJ—for example at mandibular molar extractions and long periods of dental treatment. The reactions to parafunctions and trauma to the TMJ in individuals with different mobility merit further investigation.

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