

Symptoms and signs of temporomandibular disorders in patients with fibromyalgia and local myalgia of the temporomandibular system

A comparative study

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Symptoms and signs of temporomandibular disorders (TMD) in 46 patients were investigated and compared with those in 20 healthy individuals. Twenty-three patients had fibromyalgia (FM) and 23 had local myalgia (LM). Facial pain was assessed with a visual analogue scale, and a clinical examination was performed, including maximum voluntary mouth opening, temporomandibular joint sounds, tenderness to digital palpation in the masticatory muscles, pressure pain threshold and tolerance level of the superficial masseter muscle, intramuscular temperature, and maximum voluntary bite force. There was a difference in the number of tender muscles between the groups. Pressure pain threshold and tolerance levels were lower in the FM than in the LM group, whereas both showed lower values than a control group (C). The intramuscular temperature and maximum voluntary mouth opening were lower in the patient groups than in the C group. TMJ sounds showed a difference between all three groups. In conclusion, this study shows that FM patients frequently have TMD and indicates several differences between patients with FM and LM with regard to clinical variables. **□** *Bite force; chronic pain; hyperalgesia; superficial masseter muscle; temperature*

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Pain from mandibular muscles—that is, localized myalgia (LM)—is the commonest condition in patients with temporomandibular disorders (TMD). It is a clinical experience that patients with fibromyalgia (FM) also have pain in the facial muscles. A pilot study of eight patients with fibromyalgia supports this view, since all patients reported muscle pain and tenderness to palpation of the mandibular muscles (1). FM is a generalized form of myalgia. Characteristics of this disease are general muscle pain, diffuse tenderness, stiffness, muscle tiredness, numbness, and sleep disorders (2). In both LM and FM the pain has been suggested to be caused by some form of myositis (3); however, on muscle biopsy no classical signs of inflammation have been shown (4). The origin of the pain is thus not yet fully understood. Tenderness to digital palpation is a clinical sign of inflammation in which the pressure level and the pressure rate depend on the examiner. Normal tissues do not generate pain on gentle pressure. Pressure pain threshold (PPT), on the other hand, is defined as the minimum pressure that induces pain and is the point at which the patient reports that the feeling of pressure changes into a painful sensation. The change in reactivity of the primary afferent fibers making normally non-painful mechanical pressure painful is caused by a process called sensitization, which in turn leads to the condition of hyperalgesia (5). PPT and pressure pain tolerance level (PPTL), which both reflect hyperalgesia, have been used previously for assessment of myofascial pain and evaluation of treatment results (6).

The intramuscular temperature (IMT) of the masseter muscle in healthy individuals has been determined (7), but, to our knowledge, the IMT of patients with facial pain due to local myalgia or fibromyalgia has not been investigated. Knowledge about the IMT may contribute to answer the question whether the microcirculation or metabolism is changed in these two conditions.

The maximum voluntary bite force (MVBF) in patients with pain from masticatory muscles is reported to be significantly lower than in healthy individuals (8–10). A generalized muscle fatigue has also been reported to be one of the symptoms in FM (2), and the grip force in patients with fibromyalgia has been found to be significantly reduced and more variable than in the healthy population (11). The question whether the bite force in FM patients is lower than in healthy individuals remains to be answered. Investigators have found that mandibular movements are significantly reduced in patients with TMD of muscular origin compared with a control group (12), but the condition in FM patients is less well known. The average maximum voluntary mouth opening (MVM) in FM patients was not found to be lower than in healthy individuals in a previous study (1). A large portion of temporomandibular joints otherwise asymptomatic emit sounds, and approximately 25% of asymptomatic individuals have clicking joints, whereas the frequency of crepitus is 20% (12–14). The condition in FM patients is unknown. The aim of this study was to investigate whether there are any differences with regard to muscle pain or

Table 1. Age (years), gender (M/F), duration of general (dur. gen.) and local (dur. loc.) symptoms, number of painful joint/muscle regions of the body (NPR), and degree of facial pain assessed with a visual analogue scale (VAS) in patients with fibromyalgia (FM group) and patients with local myalgia of the temporomandibular system (LM group) and in healthy individuals (C group)

	FM, n = 23					LM, n = 23				C, n = 20		
	Age	Dur. gen	Dur. loc.	NPR	VAS	Age	Dur. loc.	NPR	VAS	Age	NPR	VAS
$\bar{x}$	48	10	10	7	7	48	8	1	7	41	0	0
s_x	11.8	5.9	6.4	1.2	2.5	12.6	5.2	1.6	1.7	9.5	0	0
Median	44	8	10	7	5.9	45	6	0	6.7	40	0	0
r	25–75	0–26	1–28	4–8	0–10	23–73	2–10	0–4	2–10	24–64	0	0
% F	96					91				79		
% M	4					9				25		

Difference in NPR between the FM and LM groups and between the FM and C group ($P < 0.001$). Difference with regard to VAS between the patient groups and the C group ($P < 0.001$).

tenderness, TMJ sounds, intramuscular temperature or bite force between patients with FM or LM in comparison with a control group.

Materials and methods

Patients

The study included patients attending the Clinic of Oral Physiology. The following inclusion criteria were used: 1) Pain from the region of the superficial masseter muscle for more than 3 months; 2) Tenderness to digital palpation of the masseter muscle; and 3) No symptoms that could be referred to disease in other components of the temporomandibular system (for example, toothache, neuralgia, local TMJ disease).

This study comprised 46 patients, 3 male (1 in the FM group and 2 in the LM group) and 43 female (Table 1). Twenty-three of the patients had been given a diagnosis of fibromyalgia by their physician on the basis of the criteria of the American College of Rheumatology (1). The FM patients were a consecutive sample of the members of the Stockholm Rheumatology Association, section of Fibromyalgia, accepting invitation to the clinic for examination.

Twenty-three patients had local myalgia in the masticatory muscles and were consecutively included for treatment in our study. The mean age was 48 years for both patient groups. The mean duration of general muscle symptoms in the FM group was 10 years, and the mean duration of symptoms from the temporomandibular system was also 10 years. The mean duration of symptoms in the LM group was 8 years. A control group (C) consisting of 20 healthy volunteers among the staff at the Department of Clinical Oral Physiology, 15 women and 5 men, was included in the study. Effort was made to match the C group on the basis of gender and age. The mean age of the C group was 41 years. The patients' systolic and diastolic blood pressures, which were measured over the right upper arm with a standard blood pressure cuff after 10 min in the supine position, were within normal ranges in all groups. Analysis of blood samples from the two patient groups showed values within normal ranges with regard to erythrocyte sedimentation rate, rheumatoid factor, antinuclear antibody, hemoglobin, and creatinine. The number of occluding teeth in the upper and lower jaw in intercuspidal position was similar in all three groups.

The patients were examined by one of two investigators (B. Hedenberg-Magnusson, M. Ernberg).

The methods used and the selection of patients were

Table 2. Tenderness to palpation of the superficial masseter muscle (scale, 0–2: 0 = no tenderness, 1 = mild tenderness to palpation, 2 = moderate tenderness to palpation) and number of mandibular muscle regions tender to palpation of mild or moderate extent (NTM; 0–12) in 23 patients with fibromyalgia (FM group), 23 patients with local myalgia of the temporomandibular system (LM group), and 20 healthy individuals (C group)

	Score 1–2						Score 2					
	FM		LM		C		FM		LM		C	
	Both sides	NTM	Both sides	NTM	Both sides	NTM	Both sides	NTM	Both sides	NTM	Both sides	NTM
n	46		46		40		46		46		40	
$\bar{x}$		10		8		2		5		4		0
s_x		1.7		2.7		1.5		1.9		2.5		0.1
Median	2	10	2	8	0	1.5	2	5.5	2	4	2	0
r	0–2	4–12	0–2	2–12	0–2	0–6	0–2	0–9	0–2	0–10	0–1	0–1
% muscles	96	81	82	62	21	17	50	45	50	34	0	0

Difference in NTM between the FM and the LM groups ($P = 0.041$) and between the two patient groups and the C group ($P < 0.001$) with regard to NTM score 1–2 and score 2.

Table 3. Pressure pain threshold (PPT; kPa) and pressure pain tolerance level (PPTL; kPa) measured at the point of maximum tenderness of the most tender side (tender side) and on the same point on the contralateral side (both sides) of the superficial masseter muscle in 23 patients with fibromyalgia (FM group), 23 patients with local myalgia of the temporomandibular system (LM group), and a control group (C group) of 20 healthy individuals

	PPT, both sides			PPT, tender side		PPTL, both sides			PPTL, tender side	
	FM	LM	C	FM	LM	FM	LM	C	FM	LM
<i>n</i>	46	46	40	23	23	46	46	40	23	23
$\bar{x}$	98	147	206	79	147	226	265	392	206	245
<i>s_r</i>	29	49	29	20	29	49	69	88	49	69
Median	79	147	196	79	128	206	274.7	421.8	275	275
<i>r</i>	49–343	49–392	147–319	49–147	0–221	343	49–491	294–491	49–441	49–392

Significant differences in PPT and PPTL between the FM and LM groups on both sides ($P < 0.001$) and tender side ($P < 0.001$ and $P = 0.046$, respectively) and between the two patient groups and the C group ($P < 0.001$).

approved by the local ethical committee at Huddinge Hospital, Karolinska Institutet, Stockholm (151/93).

Methods

Assessment of pain. A 100-mm visual analogue scale (VAS) with end-points marked with 'No pain' and 'Worst pain ever experienced' (ACO Co, Sweden) was used to assess the worst degree of local pain from the temporomandibular system during the past week. The patients were also asked to report pain from eight joint/muscle regions of the body including neck, thoracic part of the back, lumbar part of the back, shoulders, elbows, hands, knees, and feet, which were counted as number of painful regions, 0–8 (NPR).

Clinical examination. Routine clinical examination methods were used, including examination for tenderness to digital palpation of mandibular muscular regions. Palpation was performed at six sites on each side (superficial masseter, anterior temporal, lateral pterygoid, medial pterygoid and trapezius muscles, and the temporal tendon). A three-graded scale was used in which 0 = no tenderness, 1 = mild to moderate tenderness, and 2 = moderate to strong tenderness with a palpebral reflex. The number of tender muscle regions (NTM) was counted (0–12). The PPT and PPTL were assessed over the point of maximum tenderness (PMT) of the superficial masseter muscle and over the corresponding part of the contralateral muscle, by means of an algometer (Pain Diagnostics and Thermography Co., USA). The area of the tip of the plunger was 1 cm², and its range 0–490 kPa. An approximate pressure rate of 50 kPa/sec was used and standardized by training with a stop-watch. Voluntary MVM and maximum passive mouth opening (MPM) were measured in millimeters between the incisors in the upper and lower jaw in the patient, who was told to open the mouth as far as possible even if he/she felt pain. The vertical overbite was then added. The passive movement was assisted by the examiner. Pain during MVM and MPM was recorded (PMVM and PMPM, respectively), as was TMJ clicking and crepitation.

Bite force measurement. The MVBF in newtons (N) was

measured between the incisors (11/41). The equipment used consisted of a bite fork (Dentoforce, T. Ljungström AB, Sweden) connected to an oscilloscope (Gould 20 Mhz Digital Storage, type 1425). The participants were told to place their upper and lower incisors in a groove on the bite fork and then to bite as hard as possible for 3–4 sec. This was repeated with a relaxation period of 30 sec between bites. The highest value of triplicate readings was used in the analysis.

Temperature recordings. The IMT of the PMT area of the masseter muscle was measured with a sterile probe (diameter, 0.7 mm) containing a thermocouple (Exacon C-N7), which was inserted through a standard catheter (Venflon 2, Viggo-Spectramed, Sweden). The catheter had a diameter of 1.2 mm and was inserted after subcutaneous anesthesia with 1.0 ml lidocaine (Xylocaine[®], 20 mg/ml, Astra, Sweden). The temperature was recorded with a digital thermometer (Exacon MC 9200) with an accuracy of 0.1°C. The measurement was

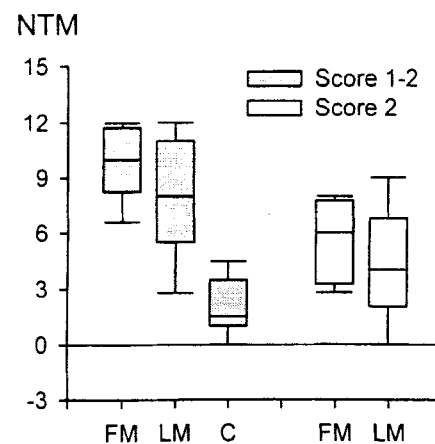


Fig. 1. Number of mandibular muscles tender to digital palpation (NTM) in 23 patients with fibromyalgia (FM), 23 patients with local myalgia from the temporomandibular system (LM), and a control group (C) of 20 healthy controls. Score: 1 = mild tenderness of palpation, 2 = moderate tenderness of palpation with palpebral reflex. The number of tender sites could vary between 0 and 12 with both sides combined.

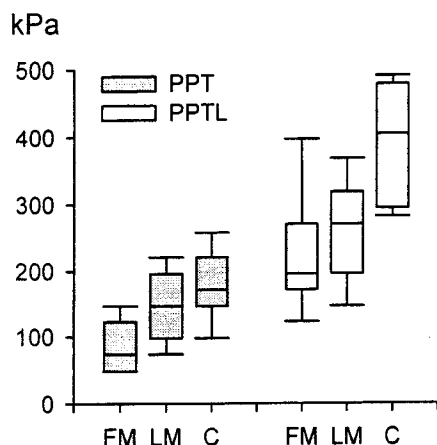


Fig. 2. Mean pressure pain threshold (PPT; kPa) and pressure pain tolerance level (PPTL; kPa) applied on the point of maximum tenderness (PMT) of the superficial masseter muscle in 23 patients with fibromyalgia (FM), 23 patients with local myalgia of the temporomandibular system (LM), and 20 healthy controls (C).

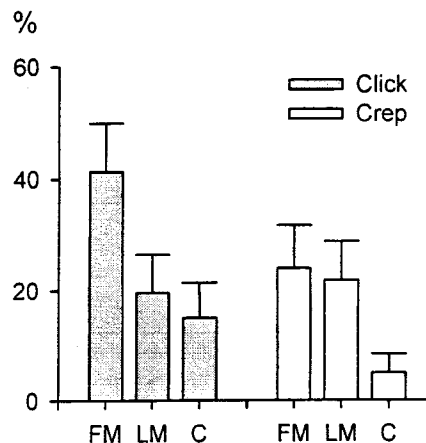


Fig. 3. Clicking (click) and crepitation (crep) from the temporomandibular joint during mouth opening in 23 patients with fibromyalgia (FM), 23 patients with local myalgia of the temporomandibular system (LM), and 20 healthy controls (C).

made when the temperature had been stable for 15 sec. The room (RT) and sublingual (SLT) temperatures were recorded simultaneously with the muscle recordings. The sublingual temperature varied between 35.7 and 37.3°C, with an average of 36.7°C, and the room temperature between 22 and 26°C, with a mean of 23.2°C (93% of the recordings were made at a temperature between 22 and 24°C).

Statistics

The differences in clinical variables between groups were tested with the Mann-Whitney U-test. The level of significance was set to $P < 0.05$.

Results

Pain and tenderness

Pain assessed with the VAS (Table 1) did not differ significantly between the two patient groups, but the difference between these two groups and the control group was significant ($P < 0.001$). Tenderness to digital palpation of the superficial masseter muscle did not differ significantly between the two patient groups (Table 2). The C group showed only minor tenderness to palpation of the superficial masseter muscle. The NTM score showed a significant difference between the FM and LM groups ($P = 0.041$) and between the patient groups and the C group ($P < 0.001$) (Table 2, Fig. 1). The NPR is shown in Table 1. Significant differences with regard to NPR was found between the FM and LM groups ($P < 0.001$), between the FM and C groups ($P < 0.001$), and between the LM and C groups ($P < 0.001$).

PPT and PPTL

The PPT and PPTL of both sides and the PPT and PPTL of the tender side (Table 3, Fig. 2) were significantly lower in the FM group than in the LM group ($P < 0.001$, $P = 0.012$ and $P < 0.001$, $P = 0.046$, respectively). Both the PPT and PPTL were significantly lower in the patient groups than in the C group ($P < 0.001$).

Maximum mouth opening capacity and associated pain

The MVM showed a mean value of 43 mm in the FM group and 45 mm in the LM group, and the difference was significant ($P = 0.022$). These values were significantly lower than those in the C group ($P < 0.001$ and $P = 0.009$, respectively), in which the MVM was 50 mm. Pain associated with MVM was reported by 65% of the FM and LM patients, which differed significantly from that of the C group ($P < 0.001$), in which no pain at all was reported during MVM. MPM was also significantly lower in the two patient groups than in the C group ($P = 0.009$ and $P = 0.048$, respectively). Pain associated with MPM was reported in 70% of the FM group and in 61% of the LM group; these values differed significantly ($P < 0.001$ and $P = 0.005$, respectively) from that of the C group, in which it was 20%.

TMJ sounds

Clicking sounds from the TMJ were found in 43% of the FM group and 22% of the LM group (Fig. 3). The C group reported a lower frequency of clicking (15%). The difference was significant between the two patient groups ($P = 0.029$) and between the FM group and C group ($P = 0.012$). The frequency of crepitation from the TMJ

Table 4. Intra-muscular temperature (IMT; °C) of the superficial masseter muscle measured on the side with the point of maximum tenderness (tender side) and on the contralateral side (both sides), sublingual temperature (SLT), and maximum voluntary bite force (MVBF) measured between the incisors in 23 patients with fibromyalgia (FM group), 23 patients with local myalgia of the temporomandibular system (LM group), and in 20 healthy individuals (C group)

	IMT, both sides			IMT, tender side		SLT			MVBF		
	FM	LM	C	FM	LM	FM	LM	C	FM	LM	C
<i>n</i>	46	46	28	23	23	23	23	14	23	23	20
$\bar{x}$	35.5	35.5	36	35.6	35.5	36.6	36.6	36.8	104	94	106
<i>s_x</i>	0.8	0.8	14.24	0.8	0.9	0.3	0.4	0.3	43.2	26.9	30.7
Median	35.7	35.5	36	35.7	35.5	36.6	36.6	36.8	95.5	90	95
<i>r</i>	33.5–37	33.3–36.7	33.9–36.9	33.8–37	33.8–36.7	36–37.1	36–37.3	36.3–37.4	35–250	40–155	75–225

Differences in IMT on the tender side between the FM and LM groups ($P = 0.044$). With regard to IMT on both sides there was a significant difference between the two patient groups and the C group ($P = 0.013$ and $P = 0.019$, respectively).

was 24% in the FM group, 20% in the LM group, and 0% in the C group. The differences in crepitation between the patient groups and the C group were significant ($P = 0.023$ and $P = 0.025$, respectively).

Bite force measurements

The MVBF between the incisors is shown in Table 4. There was no statistically significant difference between groups with regard to this variable.

Intramuscular and sublingual temperature

The IMT of the superficial masseter muscle is shown in Table 4. There was a significant difference with regard to the IMT of the most tender side between the FM and LM group ($P = 0.044$). The differences between the two patient groups and the C group with regard to IMT on both sides were significant ($P = 0.013$ and $P = 0.019$, respectively). The SLT is shown in Table 4. There was no significant difference in SLT between the two patient groups and the C group, but the patient groups showed a lower SLT than the healthy individuals.

Discussion

This study shows that patients with FM also have symptoms and signs of TMD, including facial pain. The two patient groups showed a similar distribution with regard to age and duration of the orofacial symptoms. Epidemiologic studies have shown higher rates of TMD among females (84%) than males, and the ratio between women and men among FM patients in most published studies is approximately 8:1, which is why our material does not differ significantly with regard to gender from earlier findings and should be representative of the two groups. Blood pressure and blood tests showed normal values in all groups, which makes other general diseases a less likely cause of the symptoms. These similarities in background factors indicate that the groups are comparable with regard to the variables under study. Since the three groups

also were similar with regard to the number of teeth and occluding pairs of teeth, these factors should not be the cause of the differences found between groups.

Palpatory tenderness was recorded in the mandibular muscles of almost all patients. Pain assessed with the VAS and tenderness to digital palpation of the superficial masseter muscle were also similar in the two patient groups. However, the NTM was higher in the FM group than in the other groups, which probably means that FM patients have a more extensive mandibular muscle pain involvement than LM patients. This is in agreement with the general character of FM. NTM was significantly lower in the C group than in the patient groups, as could be expected. The C group showed minor tenderness to palpation of the superficial masseter muscle, which could be considered normal, since it has been shown in epidemiologic studies that subjectively symptom-free individuals often show minor tenderness to palpation of a mild degree (12, 16). The number of painful joint/muscle regions (NPR) of the body in general was close to zero in the LM and C groups, in agreement with the inclusion criteria, and differed significantly from that of the FM group, in which all patients reported general muscle pain. The PPT was significantly lower in the FM group than in the LM group, which suggests a difference between the patient groups with regard to the perception of pain induced by external pressure over the muscle. The same condition was found for PPTL. It has been shown previously in a study by Scudds et al. (17) that patients with FM have lower PPT values than patients with LM, and this finding is thus in agreement with the present study. As expected, the PPT and PPTL were significantly higher in the C group than in the patient groups.

The mean MVBF in the FM group was similar to the value reported for healthy females by Helkimo et al. (8). One would have expected reduced values in the present study as a result of the pain from the mandibular muscles (9, 10) and in agreement with the reports of reduced grip force in FM patients (11). This was not found, but there was a wider interindividual variation in bite force between the patients in the FM group, as shown by the standard deviation, than in the LM and C group, which indicates

that the FM group is more heterogeneous with regard to bite force than the LM group. In the LM group the mean MVBF was not significantly lower than in the group of healthy individuals, which is in accordance with earlier findings (9, 10).

MVM was significantly lower in the two patient groups than in the C group, and there was also a statistically significant difference between the patient groups. This is in agreement with previous findings in FM and LM (1). The most probable explanation of the low MVM values in the patient groups is muscular pain during mouth opening. It was interesting to note that clicking was found significantly more often in the FM patients than in the LM patients. The reason might be a more severe and extensive dysfunction of the mandibular muscles in the FM group, decreasing the muscular control of the movement of the condyle and disk in the TMJ.

The IMT in the patient groups was significantly lower than in the C group, which showed values similar to those found among healthy individuals (7). This result is in accordance with earlier reports of a decreased microcirculation and local hypoxia in patients with FM (18) and in patients with LM (19), but the lower IMT may also be a result of a decreased metabolism. SLT was also lower in the patient groups than in the C group, which might be the result of a general decrease in blood circulation or metabolism. The difference in age between the two patient groups and the C group must be considered too small to explain the group differences in IMT and SLT.

In conclusion, this study shows that patients with FM frequently have TMD and differ markedly from patients with LM and healthy controls with regard to the presence of generalized joint/muscle pain, mandibular muscle tenderness, and pressure pain threshold. In addition, the study indicates that patients with FM differ from LM patients and healthy individuals with regard to pressure pain tolerance level, TMJ clicking, and intramuscular temperature.

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