Longitudinal Outcome of Temporomandibular Disorders: A 5-year Epidemiologic Study of Muscle Disorders Defined by Research Diagnostic Criteria for Temporomandibular Disorders

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Aims: *To investigate the course of myofascial pain defined by Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) over a period of 5 years, and to identify prognostic factors from baseline data.* ***Methods:*** *Subjects were 155 consecutive patients and 80 community cases identified from an age-stratified representative population sample; all met the primary selection criterion of reporting pain in the temporomandibular joint (TMJ) or masticatory muscles. The 2 groups were combined to yield a total sample of 235 subjects (50 male, 185 female; mean age = 39 years). Subjects were evaluated at baseline, 1 year, 3 years, and 5 years by trained examiners using standardized, reliable methods. Psychological and behavioral factors were assessed by self report.* ***Results:*** *According to RDC/TMD criteria, 50 (31%) of the 165 subjects presenting with myofascial pain (MFP) at baseline continued to have their disorder over a period of 5 years; 55 (33%) remitted, and 60 (36%) were recurrent cases. Bivariate statistics and multivariate logistic regression analyses indicated that baseline pain frequency, number of painful palpation sites, and total number of body sites with pain were significant predictors of persistent vs remitted and recurrent cases. No predictors that distinguished remission vs recurrence could be identified. Thirty subjects from the 70 without a diagnosis of MFP at baseline developed a new MFP. A high baseline somatization score (without pain items) was a significant risk factor for onset of MFP.* ***Conclusion:*** *Muscle disorders classified by RDC/TMD are predominantly chronic or fluctuating pain conditions, with a modest probability (31%) of remission.*

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Key words: epidemiology, myofascial pain, temporomandibular disorders, diagnosis, longitudinal study

Temporomandibular disorders (TMD) are a set of clinical conditions presenting with signs and symptoms in masticatory and related muscles of the head and neck and the soft tissue and bony components of the temporomandibular joint (TMJ). Clinical signs and symptoms can be clustered into muscle disorders, intracapsular derangements of the TMJ, and degenerative changes of the bony components of the joint. Despite this consensus, there has been no agreement in the past on how to classify subjects with signs and symptoms of several subtypes of TMD. Another obstacle to the understanding of TMD and the comparability of previous research has been a lack of reported reliability data, or low inter-examiner reliability in assessing TMD signs and symptoms, when examiners were not calibrated.[1]

Previously developed Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[2] use a dual-axis classification system that allows a physical diagnosis placed on Axis I, and an assessment of TMD-related behavioral limitations, psychological distress, and psychosocial dysfunction on Axis II. Diagnoses are assigned on the basis of physical examination and case history in 3 major Axis I groups: *(1)* muscle disorders, *(2)* disc displacements, and *(3)* arthralgia/arthritis/arthrosis. The diagnostic system is nonhierarchical and allows for the possibility of multiple diagnoses for a subject. Thus, a subject can be assigned a muscle diagnosis and 1 diagnosis from Group 2 and Group 3 for each joint. Muscle disorders are divided into 2 subgroups: *(a)* myofascial pain (MFP) and *(b)* MFP with limited opening. These diagnoses include a complaint of pain and pain reported in response to palpation of 3 or more of 20 muscle sites.[2]

The RDC/TMD has been found to be reliable and clinically useful. Epidemiologic studies showed similar prevalence rates of both Axis I and Axis II disorders in different clinic populations.[3,4] In earlier reports, Dworkin[5,6] has described the relationship between the longitudinal course of signs of TMD dysfunction and the concomitant symptom of TMD-related pain. Ohrbach and Dworkin evaluated the 5-year outcomes of pain-related signs and symptoms of TMD based on 5 patterns of fluctuations in pain.[7] However, comparable longitudinal outcomes for subgroups classified according to RDC/TMD Axis I have not yet been described.

The objective of this study was to investigate the course for patients diagnosed with muscle disorders as defined by RDC/TMD Axis I criteria over a 5-year period, using data from a longitudinal epidemiologic study. Furthermore, the authors attempted to identify prognostic factors predicting longitudinal outcomes associated with these disorders.

Materials and Methods

Subjects

Two groups of subjects were identified from a 5-year longitudinal epidemiologic study of TMD, conducted among enrollees of Group Health Cooperative (GHC) of Puget Sound, a large health maintenance organization (HMO) in the Pacific Northwest. The study methods have been described in detail elsewhere.[8] The first group was selected from an age-stratified probability sample of 1,265 adult enrollees of GHC. From this sample, 1,016 individuals completed a survey questionnaire which included a question regarding the presence of facial pain in the previous 6 months; 121 individuals who reported facial pain (community cases) were identified. The second group comprised 261 consecutive patients who had been referred by GHC to its TMD clinic for evaluation and treatment and agreed to participate. Of these 261 patients, 247 were identified as meeting the primary selection criterion of reporting pain in the TMJ or masticatory muscles (clinic cases).

The present study examines data for 80 community cases and 155 clinic cases who were present for all follow-up evaluations at 1 year, 3 years, and 5 years following study entry. A reduction in sample size of 135 (36%) from a total of 368 was observed over the 5 years in this study. Study subgroups with and without MFP at baseline were compared to drop-outs with the comparable MFP diagnosis on the following baseline characteristics: pain intensity, pain frequency, number of painful intra- and extraoral palpation sites, other Axis I diagnoses, somatization scores, and number of body sites with pain. There were no statistically significant differences between subgroups and drop-outs with MFP except that the number of painful extraoral muscle sites was significantly higher (Mann-Whitney *U* test: $P = .024$) in the drop-out group (median = 6) compared to cases presenting with MFP at baseline (median = 4). No differences were found between subgroups and drop-outs without MFP except that depression scores at baseline were slightly higher in drop-outs ($P = .044$).

Gender composition at study entry was 74% female and 26% male in the community case group and 84% female and 16% male in the clinic case group. In the cohort remaining after 5 years with all follow-ups there were 21 males and 59 females in the community case group and 29 males and 126 females in the clinic case group. After initial analyses showing no statistically significant or clinically meaningful differences between clinic and community cases on the variables investigated in this study, the 2 groups were combined to yield a total sample of 235 subjects. In this sample, the age at baseline ranged from 18 to 82 years, with a mean of 39 years (SD = 12.1).

Independent Variables

The subjects were evaluated at baseline, at 1-year, 3-year, and 5-year follow-up to obtain physical, psychological, and behavioral findings. The methods for obtaining these data have been described extensively elsewhere.[8,9] The physical variables were

measured by trained and calibrated dental hygienist examiners who used a standardized and reliable clinical examination format.[1] Examiners were re-calibrated and re-tested for reliability throughout the longitudinal study. Psychological variables were measured by use of standardized self-report scales. Depression and somatization were assessed based on scales of the symptom checklist-90 (SCL-90) as described in the RDC/TMD.[2,10] The RDC/TMD depression scale assesses negative mood and vegetative symptoms of poor functioning. The somatization scale assesses distress related to non-specific bodily symptoms such as stomach upset, faintness, numbness, and low back pain. For statistical analysis, a reduced somatization scale excluding 5 pain-related items was used to avoid confounding results between the outcome groups that were defined by palpation sites and pain criteria. The raw depression and somatization scores were adjusted for age and gender based on normative data for the scales available from epidemiologic studies of the general population of GHC enrollees. These self-report data were sex and age adjusted and expressed in standard deviation units, where the mean of the population group equals zero.

Definition of Outcome

The use of the RDC/TMD criteria allows for the diagnosis of a muscle disorder on the basis of *(1)* a report of ongoing pain in the jaw, temples, face, preauricular area, or inside the ear; *(2)* specific identification, in the examination, of a muscular site of pain; and *(3)* pain reported by the subject in response to palpation of 3 or more muscle sites, with at least 1 of the sites on the same side as the complaint of pain.[2] For this analysis, the RDC/TMD criteria were applied to existing reliable examination data gathered prior to the development of the RDC/TMD. The examination specifications for collecting these data closely approximate those of the RDC/TMD, with the exception that the middle temporalis was not palpated in this examination. At baseline, 165 from a total of 235 individuals met the criteria of a muscle disorder, with 111 classified as RDC/TMD Group 1a MFP without limitation and 54 as RDC/TMD Group 1b MFP with limitation. Seventy individuals did not meet the criteria for a muscle disorder because the number of muscle sites painful to palpation was less than 3. For the longitudinal outcome analyses reported here, the subjects were subdivided into 5 different outcome groups on the basis of the presence or absence of a muscle disorder at follow-ups. Beginning with subjects without a diagnosis of muscle disorder at baseline, individuals could either *(1)* stay without MFP at any of the follow-ups (NOMFP); or *(2)* develop a new MFP (NEWMFP). Outcomes for subjects with a diagnosis of a muscular disorder at baseline were summarized by the following patterns: *(3)* subjects with MFP at all follow-ups were defined as having persistent myofascial pain (PER); *(4)* subjects without a diagnosis of MFP after 3 and after 5 years (with or without MFP at 1-year follow-up) were defined as remitted (REM); and *(5)* subjects who had at least 1 follow-up without MFP, but who had a diagnosis of MFP at 3 or 5 years, were classified as recurrent cases (REC).

Statistical Methods

Sociodemographic, physical, and psychological variables as well as the other Axis-I diagnoses at baseline were regarded as independent variables and were analyzed separately for each of the previously defined outcome groups. Distributions are displayed in box- and whisker-plots, with the box representing the 25th and 75th percentiles. Whiskers are drawn to 1.5 × interquartile range beyond the 25th and 75th percentiles. Values outside 1.5 widths or outside 3 widths of the box are marked as outsiders (o) or as extremes (x), respectively. Differences between groups were assessed by Kruskal-Wallis tests or Mann-Whitney U-tests. Pearson Chi-square tests were used for categorical variables (eg, gender, Axis I Group 2, Axis I Group 3 diagnosis). Changes between baseline and follow-ups were assessed by the paired Wilcoxon Sign Rank test for dependent variables. Logistic regression analyses were performed separately for subjects with MFP and subjects without MFP at baseline in order to isolate predictive variables for the longitudinal outcome. Three different outcome groups (PER, REC, and REM) for subjects presenting with MFP at baseline were compared pairwise. Subjects presenting without MFP at baseline formed the fourth pair (NOMFP vs NEWMFP). Variables significant in any of the bivariate analyses were used in stepwise logistic regression models for each comparison.

Results

Distribution of Gender- and Case-Type in the Outcome Groups

According to the previously defined outcome categories, 50 from a total of 165 individuals with a muscle disorder at baseline showed PER through all follow-ups, 55 subjects were REM, and 60 subjects

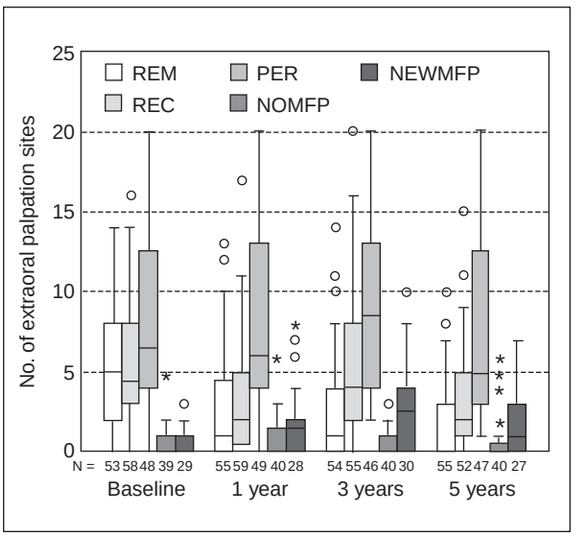

Fig 1a Number of painful extraoral palpation sites from baseline to 5-year follow-up. The dark horizontal lines represent the medians, the boxes represent the 25th and 75th percentiles. Whiskers are drawn to 1.5 × interquartile range beyond the 25th and 75th percentiles. Values outside 1.5 widths or outside 3 widths of the box are marked as outsiders ("o") or as extremes ("*"), respectively. REM = remitted cases, REC = recurrent cases, PER = subjects with MFP at all follow-ups, NOMFP = subjects without MFP at any of the follow-ups, and NEWMFP = subjects who develop a new MFP. These descriptions apply also to Figs 1b and 3 to 5.

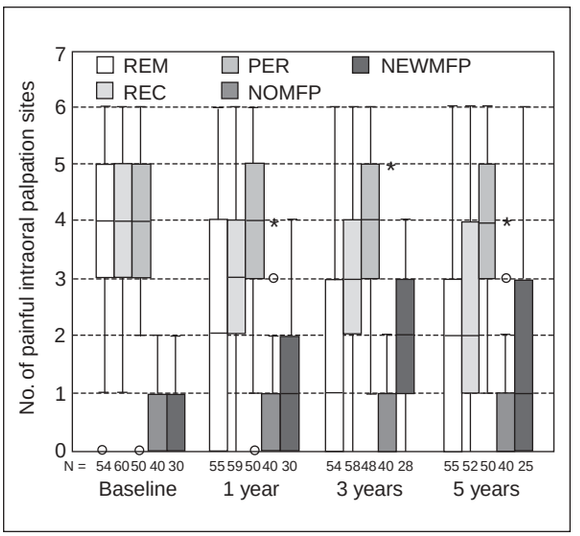

Fig 1b Number of painful intraoral palpation sites from baseline to 5-year follow-up.

were REC. From a total of 70 subjects without MFP at baseline, 30 developed MFP at 1 or more of the follow-ups. These individuals were assigned to the NEWMFP group, whereas the remaining 40 subjects were assigned to the NOMFP group. The assignment to all these outcome groups showed no statistically significant differences for males vs females (P = .32) or clinical cases vs community cases (P = .36).

Palpation Sites

Extraoral palpation sites included the palpation sites outlined in the RDC/TMD[2], plus 4 additional sites in the head and neck region. The number of painful extraoral palpation sites at baseline differed significantly among the outcome groups (Kruskal-Wallis test, $P < .001$), with the PER group having the highest number of painful sites (median = 6.5, Fig 1a). As would be expected of persons not meeting criteria for MFP at baseline, NOMFP (median = 0) and NEWMFP (median = 0) groups had significantly fewer painful sites, whereas REC and REM groups (median = 5) showed only minimal but nevertheless statistically significant differences compared to the PER group. During the follow-ups the median number of painful extraoral palpation sites remained consistently low for the NOMFP group (median = 0) and decreased consistently for the REM group from 5 to 0. The NEWMFP group demonstrated a slight increase of the median from 0 at baseline to 2.5 after 3 years to 1 after 5 years, whereas the REC and PER groups showed a fluctuation of the median number of sites over the years (2 to 4.5 and 5 to 8.5, respectively).

At baseline the number of painful intra-oral palpation sites was significantly higher for the PER, REM, and REC groups (median = 4), compared to the NEWMFP and NOMFP groups (median = 0, Kruskal-Wallis, $P < .001$). During the follow-ups the REM and the REC groups demonstrated a decrease of intraoral palpation sites, whereas the number in the PER group remained high. Only the NEWMFP group had an increase of painful intraoral sites after 1 and 3 years (Fig 1b).

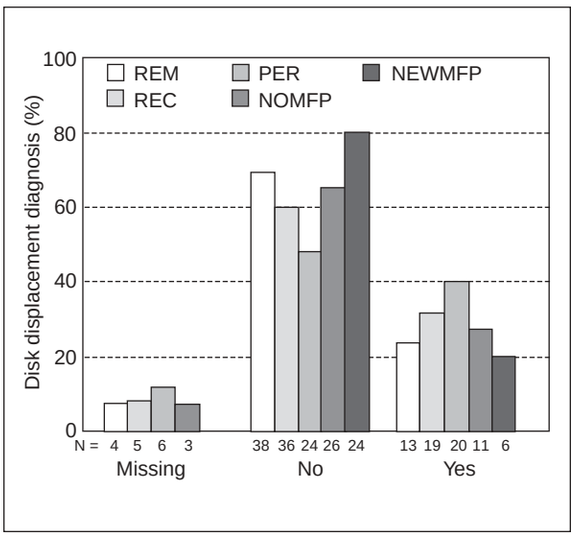

Fig 2a Percentage of disc displacements (Axis I Group 2 diagnoses) within the outcome groups at baseline.

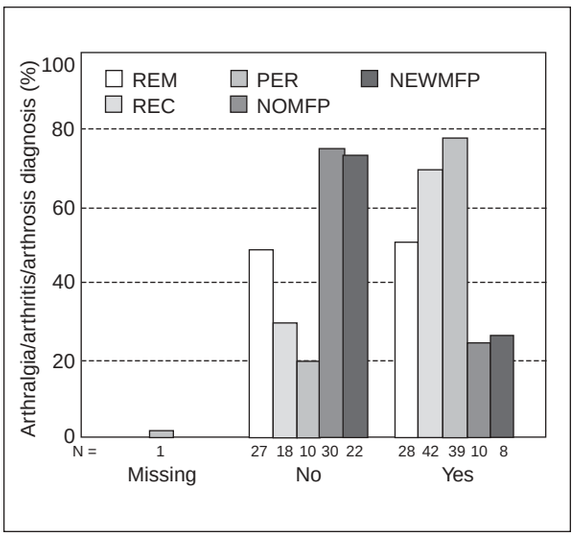

Fig 2b Percentage of arthralgia/arthritis/arthrosis (Axis I Group 3 diagnoses) within the outcome groups at baseline.

Other Axis I Diagnoses

The other Axis I diagnoses for the outcome groups are shown in Figs 2a and 2b. At baseline 69 subjects showed RDC/TMD Group 2 uni- or bilateral disc displacement according to RDC/TMD criteria. One hundred forty-eight subjects had no disc displacement, and 18 had missing data for this diagnosis. The distribution of disc displacements at baseline among the outcome subgroups ranging between 20% and 40% showed no significant differences ($P = .14$). The vast majority of the disc displacements (64 or 91%) were specified as disc displacement with reduction.

RDC/TMD Axis I Group 3 diagnoses (see Fig 2b) were dominated by Group 3a (uni- or bilateral arthralgia, 118 or 90%) whereas Group 3b (arthritis, 9 or 7%) and Group 3c (arthrosis, 4 or 3%) were rare conditions. The Group 3 diagnoses were not evenly distributed among the outcome groups ($P < .001$). Approximately one third of individuals without MFP at baseline (NEWMFP and NOMFP) had a Group 3 diagnosis at baseline. However, additional Group 3 diagnoses were found in about three fourths of the PER group (78%) and REC group (70%), and in about half of those in the REM group (51%).

Pain Characteristics and Other Pain Conditions

TMD-related orofacial pain was characterized by items assessing several dimensions of TMD-related pain included in the questionnaire: intensity, interference, duration, frequency, disability days, and pain-related dysfunction (Graded Chronic Pain).[11] At baseline, facial pain intensity ratings showed only small differences across the outcome groups with medians ranging between 4 and 6 on a 10-point scale (Kruskal-Wallis test, $P = .16$). For REC ($P = .03$), PER ($P = .002$), and NEWMFP ($P = .03$) groups, orofacial pain intensity dropped significantly after 1 year. The level for all groups was between 3 and 5 (Fig 3a). At 3 and 5 years, pain intensity ratings showed significant differences across outcome groups (Kruskal-Wallis test, $P < .001$).

At baseline, facial pain frequency demonstrated the biggest differences among the outcome groups (Fig 3b). The PER group showed a median frequency of 5 ("almost every day"), when the other groups had a median of 3 ("less than half the days"). The differences were statistically significant (Kruskal-Wallis test, $P < .004$) at all follow-ups.

Many subjects from the sample also reported pain at other body sites (Fig 3c). Besides facial pain, the questionnaire included questions on headache, chest pain, back pain, and abdominal pain. The total number of pain sites was not evenly distributed among the outcome groups. At baseline the PER group had the highest number of pain sites (median = 3) compared to the other groups (median = 2). At follow-ups the NOMFP and REM groups showed a decrease of the median to 1, whereas the median remained at 2 for the REC, NEWMFP, and PER groups.

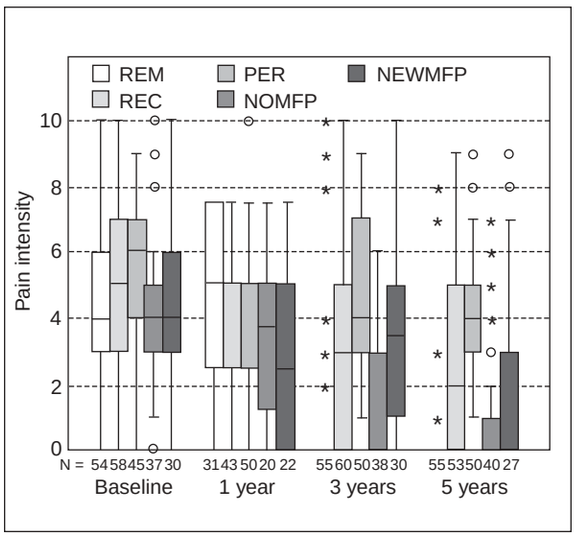

Fig 3a Facial pain intensity from baseline to 5-year follow-up (VAS 0 to 10).

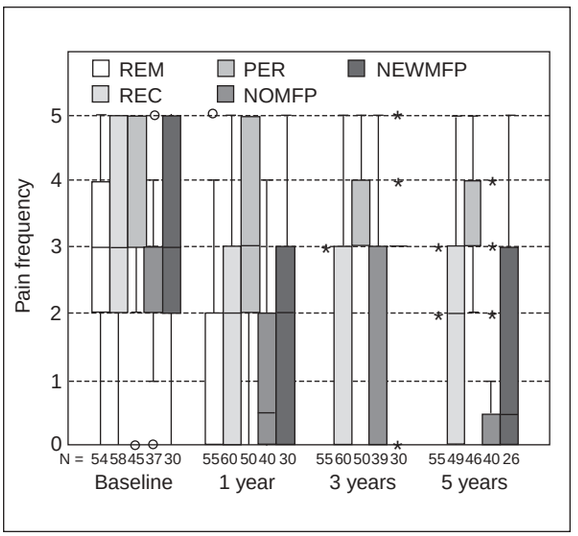

Fig 3b Facial pain frequency from baseline to 5-year follow-up (0 = no pain, 1 = only once, 2 = several brief episodes, 3 = less than half the days, 4 = more than half the days, 5 = every or almost every day).

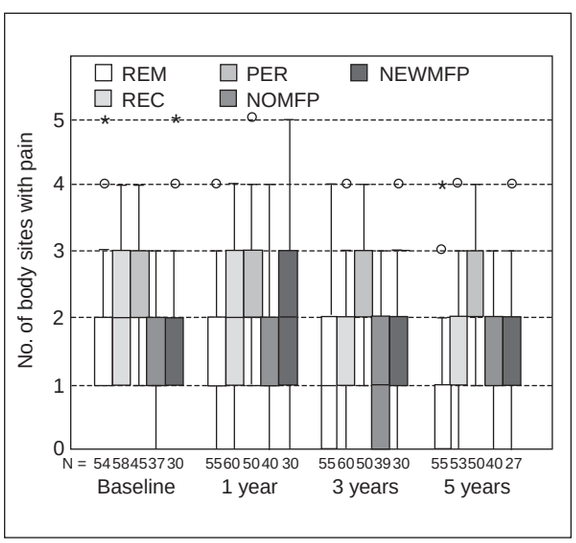

Fig 3c Total number of body sites with pain (abdominal pain, back pain, chest pain, headache, facial pain) from baseline to 5-year follow-up.

Axis II Variables

At baseline and all follow-ups, values for the depression scale were generally evenly distributed among the outcome groups (Fig 4a, Kruskal-Wallis test, P = .17 to .83). However, the REM group included the highest proportion of depressed subjects at baseline, but demonstrated a significant decrease in depression at follow-ups (Wilcoxon test, P = .001 to .028). In contrast, all the other groups did not show significant changes in depression between baseline and any of the follow-ups.

Two approaches were undertaken for analysis of somatization, and involved analysis of somatization scales with and without the 5 scale items related to pain. Both sets of analyses demonstrated similar results. To avoid confounding with other items assessing pain throughout the body, further analysis was restricted to the somatization scale excluding the 5 pain-related items. At baseline, the PER group had higher levels of somatization (Fig 4b). The median standardized score for the NOMFP group was below –0.5, and the REC, REM, and NEWMFP groups had medians around zero. With the exception of the 1-year follow-up, the differences between the outcome groups were significant (Kruskal-Wallis test, P = .001 to .048). Furthermore, Wilcoxon tests revealed a significant decrease of somatization between baseline and 1-year follow-up (P = .003) and after 5 years (P = .012) for the REM group. The REC group demonstrated a significant decrease only between baseline and 1 year (P = .007), whereas the PER group showed significantly lower somatization after 1 year (P = .006) and after 5 years (P = .005) compared to baseline. For the NEWMFP and NOMFP groups, there were no significant changes in somatization between baseline and any of the follow-ups.

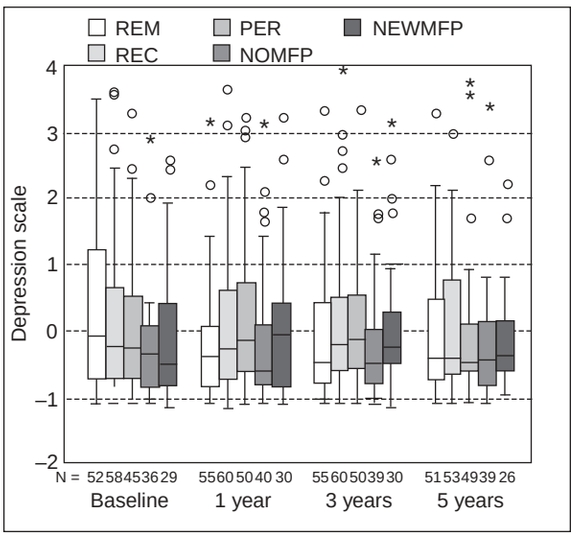

Fig 4a Depression scale from baseline to 5-year follow-up.

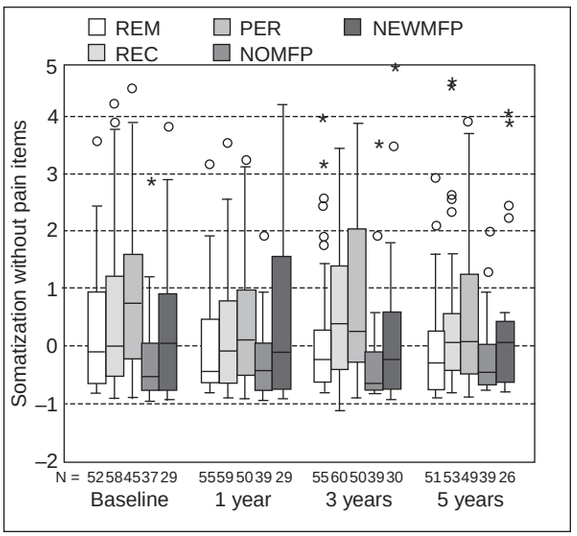

Fig 4b Somatization scores without pain items from baseline to 5-year follow-up.

Number of Treatment Visits

Figure 5 shows the number of self-reported treatment visits related to the facial pain problem. At baseline, all prior visits were recorded; at follow-ups the number of visits since the last interview were counted. At baseline, the median number of visits ranged between 5 and 7 with no significant differences among the outcome groups (Kruskal-Wallis test, $P = .21$). However, the differences between the groups became significant at 1 year ($P = .043$), 3 years ($P < .001$), and 5 years ($P = .014$), because the decrease was not equal for all groups. The PER group had the highest number of visits for all follow-ups, with approximately 50% still seeking treatment after 5 years. In the other outcome groups, only a few cases were still receiving treatment after 5 years.

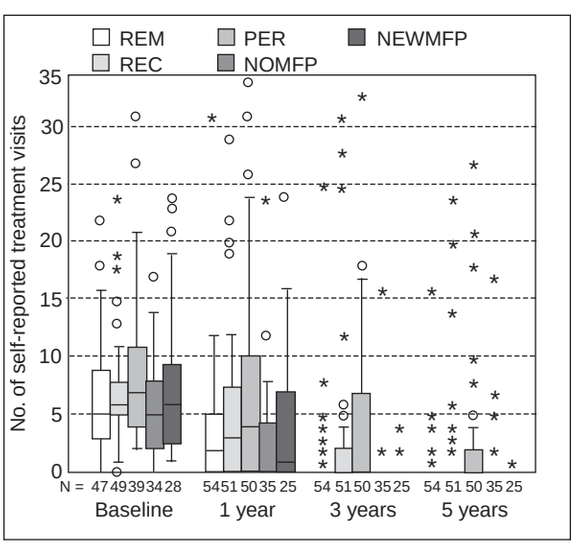

Fig 5 Number of self-reported treatment visits.

Logistic Regression Analyses

To identify relevant prognostic factors at baseline, the different outcome groups were compared by pairwise logistic regression. Subjects with muscle disorders at baseline could end up as PER, REC, or REM. These 3 groups resulted in 3 pairs (REM vs PER, REM vs REC, REC vs PER). Subjects without muscle disorders at baseline could end up as NEWMFP or as NOMFP, forming the fourth pair for logistic regression analysis.

Remitted vs Persistent Outcomes. Table 1 summarizes the results of stepwise regression analysis and the final model including estimates for odds ratios (OR) and their 95% confidence intervals (CI). Values greater than 1 for OR indicated a higher risk to end up as PER vs REM. After entering age and gender, higher values on the somatization scale (without pain items) were associated with

Table 1 Results of Logistic Regression Analysis Predicting the Outcome for Muscle Disorder by Comparing Remitted (REM) and Persistent (PER) Myofascial Pain

				95%CI	
Step	Variable	OR	*P* value	Lower	Upper
1	Age	0.99	.66	0.96	1.03
	Sex	1.64	.38	0.54	5.00
2	Depression	0.64	.05	0.41	1.01
	Somatization without pain	1.57	.03	1.05	2.35
3	Pain intensity	1.01	.96	0.79	1.28
	Pain frequency	1.50	.02	1.04	2.17
4	RDC Group 2	3.32	.04	1.08	10.26
	RDC Group 3	2.54	.08	0.90	7.18
5	No. of intraoral sites	0.97	.89	0.63	1.49
	No. of extraoral sites	1.16	.04	1.01	1.34
6	No. of body pain sites	1.81	.05	1.00	3.29
Final model	Age	1.00	.97	0.96	1.04
	Sex	1.23	.78	0.29	5.24
	Depression	0.70	.18	0.41	1.19
	Somatization without pain	1.08	.76	0.66	1.77
	Pain intensity	0.90	.50	0.67	1.21
	Pain frequency	1.79	.01	1.12	2.87
	RDC Group 2	2.88	.08	0.88	9.43
	RDC Group 3	1.72	.36	0.54	5.47
	No. of intraoral sites	1.09	.70	0.69	1.73
	No. of extraoral sites	1.13	.10	0.97	1.32
	No. of body pain sites	1.81	.05	1.00	3.29

OR = odds ratio; CI = confidence interval.

a significantly higher risk (OR = 1.6) to end up as PER, whereas high values on the depression scale had a risk-reducing effect (OR = 0.6). Entering pain items in a third step revealed no effect for pain intensity. Higher ratings of pain frequency were associated with a significantly higher risk (OR = 1.5) for a poor outcome. Axis I Group 2 and Group 3 diagnoses were also associated with increased risk. However, additional Axis I Group 3 diagnoses were not significant at the .05 level. The number of painful intraoral palpation sites forced into the model in a fifth step was not significant (*P* = .89), whereas the number of painful extraoral palpation sites were a significant predictive factor (*P* = .04; OR = 1.2). A higher number of total body pain sites was also associated with a higher risk to end up in the PER group (*P* = .05; OR = 1.8).

After forcing all variables into the model, pain frequency (*P* = .01) and the total number of body sites with pain (*P* = .05) were significant risk factors. The *P* value for Axis I Group 2 diagnosis was marginal (*P* = .08). However, somatization without pain items, RDC Group 3 diagnosis, and the number of painful extraoral palpation sites were no longer significant, indicating that these variables were "captured" by other variables in the model.

Remitted vs Recurrent Outcomes. Stepwise regression analysis, comparing the REM and REC groups, was also performed. However, none of the variables forced into the model contributed significantly to the prediction of the outcome (REM or REC). Only the presence of an RDC Group 3 diagnosis at baseline was associated with increased risk, with a marginal *P* value of .06 in the final model.

Recurrent vs Persistent Outcomes. Comparing REC and PER groups (Table 2), pain frequency (*P* = .01), number of painful extraoral palpation sites (*P*= .02), and total number of body pain sites (*P* = .02) were significant risk factors in the final model. Higher values for these variables were significantly associated with an outcome of persistent pain (PER), with ORs ranging between 1.2 and 1.97.

No Myofascial Pain vs New Myofascial Pain. Table 3 summarizes the results of regression analysis comparing the NOMFP and NEWMFP groups. Values for OR greater than 1 indicated a risk increasing effect to develop a new muscle disorder

Table 2 Results of Logistic Regression Analysis Predicting the Outcome for Muscle Disorder by Comparing Recurrent (REC) and Persistent (PER) Myofascial Pain

				95%CI	
Step	Variable	OR	*P* value	Lower	Upper
1	Age	1.01	.53	0.98	1.05
	Sex	1.05	.93	0.33	3.32
2	Depression	0.78	.27	0.50	1.21
	Somatization without pain	1.36	.12	0.92	2.01
3	Pain intensity	0.91	.42	0.74	1.14
	Pain frequency	1.54	.01	1.09	2.18
4	RDC Group 2	1.48	.40	0.59	3.72
	RDC Group 3	0.87	.81	0.29	2.69
5	No. of intraoral sites	0.83	.37	0.57	1.23
	No. of extraoral sites	1.20	.01	1.05	1.37
6	No. of body pain sites	1.97	.02	1.11	3.50
Final model	Age	1.00	.98	0.96	1.04
	Sex	0.87	.85	0.20	3.77
	Depression	0.97	.90	0.58	1.62
	Somatization without pain	0.86	.56	0.52	1.42
	Pain intensity	0.80	.09	0.62	1.04
	Pain frequency	1.72	.01	1.15	2.59
	RDC Group 2	2.01	.19	0.71	5.70
	RDC Group 3	0.97	.95	0.28	3.31
	No. of intraoral sites	0.92	.68	0.61	1.38
	No. of extraoral sites	1.18	.02	1.03	1.35
	No. of body pain sites	1.97	.02	1.11	3.50

OR = odds ratio; CI = confidence interval.

Table 3 Results of Logistic Regression Analysis Predicting the Outcome for Muscle Disorder by Comparing No Myofascial Pain (NOMFP) and New (NEWMFP) Myofascial Pain

				95%CI	
Step	Variable	OR	*P* value	Lower	Upper
1	Age	1.00	.83	0.96	1.05
	Sex	1.57	.43	0.52	4.72
2	Depression	0.64	.14	0.35	1.16
	Somatization without pain	2.34	.02	1.18	4.63
3	Pain intensity	0.94	.61	0.76	1.18
	Pain frequency	1.24	.28	0.84	1.84
4	RDC Group 2	0.60	.44	0.16	2.22
	RDC Group 3	0.57	.43	0.14	2.34
5	No. of intraoral sites	1.07	.85	0.54	2.13
	No. of extraoral sites	0.86	.58	0.50	1.47
6	No. of body pain sites	1.07	.85	0.52	2.20
Final model	Age	0.99	.83	0.95	1.05
	Sex	1.56	.49	0.44	5.53
	Depression	0.64	.17	0.34	1.12
	Somatization without pain	2.38	.03	1.07	5.53
	Pain intensity	0.92	.46	0.73	1.16
	Pain frequency	1.39	.16	0.88	2.18
	RDC Group 2	0.58	.44	0.15	0.15
	RDC Group 3	0.57	.45	0.13	0.13
	No. of intraoral sites	1.06	.88	0.52	2.13
	No. of extraoral sites	0.86	.57	0.50	1.47
	No. of body pain sites	1.07	.85	0.52	2.20

OR = odds ratio; CI = confidence interval.

if the subject had no MFP at baseline. The only variable with a significant influence was somatization (P = .03). Elevated values on the somatization scale at baseline were associated with a higher risk to develop a new MFP (OR = 2.3).

Discussion

Limitations

The longitudinal outcome of 235 subjects reporting pain in the TMJ or masticatory muscles at baseline was investigated in the present study. The reduction in sample size of 135 from an original sample of 370 represented a 12% loss for each follow-up (1 year, 3 years, 5 years). Based on the RDC/TMD criteria,[2] the final sample consisted of 70 subjects without MFP and 165 subjects with MFP at baseline. The final sample consisted of 155 consecutive patients and 80 community cases identified from an age-stratified representative sample. In most baseline characteristics, drop-outs did not differ from the final sample. Because no statistically significant or systematic differences between clinic and community cases were found, data were combined from these 2 groups. It is possible that the groups differed in ways that were not measured. However, it should be noted that about half the community cases in this sample had received treatment for their conditions in the past, so these groups do not represent pure "treated" and "untreated" cases.

A comparison of these data with other studies is difficult because many previous epidemiologic studies on TMD used a cross-sectional design. A survey on this literature was given by LeResche.[12] Most of the longitudinal studies were mainly conducted on adolescents. Only a few longitudinal studies with a broader age distribution could be found. Another difficulty in making comparisons is that these studies either used anamnestic indices based exclusively on questionnaires or focused on the change of isolated symptoms (eg, clicking and pain in the TMJ or the masticatory muscles).[13,14]

Descriptive Outcome for MFP and Painful Palpation Sites

Remission (loss of the MFP diagnosis) could be caused by a decrease in the number of painful muscles, by a lack of a facial pain report in the questionnaire, or by both. Data on pain report and on the number of painful intra- and extraoral palpation sites revealed that both phenomena had contributed to the improvement of the remitted group. After 5 years, a considerable proportion of the REM group still had some sites painful to palpation. However, these included palpation sites in the head and neck region not encompassed by the RDC/TMD criteria.

The number of painful intraoral palpation sites did not differ across the different outcome groups presenting MFP at baseline or between the outcome groups without MFP at baseline. Multivariate analysis revealed that this variable was not a significant predictor for any pairwise comparison, whereas the number of extraoral palpation sites was a significant predictor for the outcome comparing the PER and REC groups and PER and REM groups.

About one third (55/165) of those with a diagnosis of MFP at baseline were remitted, presenting no MFP at 3 years or 5 years, whereas 50 subjects (31%) presented persistent MFP and 60 subjects (36%) showed fluctuating diagnoses of MFP during the follow-ups. These numbers are in contrast to previous reports of treatment success rates of approximately 75% for standard physical medicine treatment.[15] However, most treatment outcome studies have had shorter follow-up periods, and the definition of success in most previous studies has been based on patient reports of improvement. It is certainly possible that subjects could experience their conditions as improved, even though they still met diagnostic criteria at 1 or more follow-up examinations. This remains an issue for further investigation.

Other Axis I Diagnoses

Additional diagnoses of joint-related disorders were quite frequent in this sample. Disc displacements with reduction dominated the Axis I Group 2 (64/69) diagnoses, which were found in 27% of the sample. Arthralgia was the most frequent Axis I Group 3 diagnosis (118/131) and was present in 50% of the sample. Comparisons of the REM with the REC and PER groups revealed that an additional baseline diagnosis of arthralgia was significantly more frequent in those subjects who would go on to become PER and REC cases. The logistic regression model also revealed that a Group 3 diagnosis was a risk factor for a persistent outcome with a marginal P value during stepwise procedures. After adjusting for the variables "number of painful extraoral palpation sites" and "total number of body pain sites," the final model showed an increased P value of .36 (comparing REM and PER). Therefore, the increased risk of

persistent MFP associated with a diagnosis of arthralgia appears to be part of a more generalized finding of widespread pain, rather than the specific finding of a joint condition. Using bivariate analysis, Garofalo et al found that a diagnosis of arthralgia was associated with a higher risk to develop chronic TMD.[16] That study assessed chronicity of pain 6 months after presenting with acute TMD.

Pain Characteristics and Other Pain Conditions

The predictive value of pain intensity was not significant in bivariate or multivariate comparisons of the outcome groups. The outcome groups REC, PER, and NEWMFP demonstrated a significant decrease of between 1 and 2 points on the 10-point scale after 1 year. However, pain intensity remained at moderate levels of 3 points for the REC group and 4 for the PER group after 3 years. These changes in pain intensity indicate that a 1-year follow-up may be too short to evaluate the success for a TMD therapy. A longer observation period will probably result in lower success rates. In contrast to our results, Garofalo et al identified pain intensity as a significant risk factor for developing chronicity in subjects presenting with acute TMD.[16] In our study, pain frequency was the strongest predictor comparing the PER vs REM, and PER vs REC groups. In the final model, somatization was not a significant predictor any more after controlling for pain frequency. Thus, a high pain frequency appears to be associated with a high degree of somatization.

Axis II Scales

At baseline, depression was almost evenly distributed among the outcome groups. With the exception of the REM group, no significant changes were observed over the observation period. The REM group showed a slightly higher proportion of depressed subjects at baseline compared with other groups, but REM subjects showed significantly reduced depression scores at the follow-ups. Possibly, within the REM group, depression was related to the pain condition and thus disappeared after or along with "healing" of the muscle disorder. The role of depression and the development of chronic pain appears to be reciprocal. Magni et al found that chronic musculoskeletal pain predicted the development of depression and vice versa.[17] Von Korff et al observed that depression was a marginally significant risk factor for onset of TMD-related pain.[18] However, the persistence of chronic musculoskeletal pain could be predicted only by a combination of sociodemographic variables. Ohrbach and Dworkin found a significant decrease of depression and somatization in subjects with highly improved pain after 5 years, whereas the other outcome groups (remitted, low improved, same, worse pain) demonstrated no differences between baseline and 5 years.[7] In our study, depression score at baseline was not a significant predictor for the outcome of MFP.

Somatization (without pain items) at baseline was significantly higher in the PER group compared to the other outcome groups. However, after controlling for pain frequency, number of painful extraoral palpation sites, and total number of body sites with pain, somatization was no longer a significant predictor for the PER group. However, painful extraoral palpation sites and total number of body sites with pain may be surrogates for the somatization process because both number of palpation sites and number of body sites with pain are known to be significantly related to somatization. A previous study underscores the significant association between somatization and the report of more widely dispersed TMD pain. Wilson et al showed that elevated somatization score was a significant predictor for both the number of muscle palpation sites and the number of painful placebo sites.[19] Another study revealed that somatization predicted follow-up pain levels in treated patients.[20] Parallel to the decrease of pain intensity and pain frequency, the REM, REC, and PER groups showed a significant decrease of somatization score after 1 year compared to baseline. Although the PER group demonstrated a further decrease of the median somatization score at the follow-ups, the PER group had the highest proportion of subjects with severe somatization scores after 5 years. For this group of PER subjects, sensitivity to bodily symptoms might be an explanation for the persistence of MFP. Comparing the NOMFP and NEWMFP groups, a high somatization score at baseline was the only significant predictor for NEWMFP. Subjects without MFP at baseline presenting higher somatization scores had a significantly higher probability of developing a new MFP (OR = 2.38; 95% CI = 1.07–5.53). However, 23% (7/30) of the subjects in the NEWMFP group presented with severe or moderate somatization at baseline.

Treatment Seeking

The number of reported treatment visits at baseline did not differ between the outcome groups and decreased differentially during the follow-ups. From 1 year onward, the PER group presented significantly higher numbers of treatment visits. Thus the more favorable outcomes of remittance and recurrence compared to persistence were not related to amount of treatment received.

Clinical Implications

The results of this epidemiologic study demonstrated that a high frequency of facial pain (eg, "more than half the days" or "almost every day"), a high number of extraoral muscles painful to palpation, a high number of body sites with pain, high somatization scores, and additional RDC/TMD Group 3 diagnoses (mostly arthralgia) were associated with poorer outcomes for persistent and recurrent muscle disorders. Therefore, extended diagnostic and therapeutic approaches that incorporate psychological and behavioral interventions as well as physical/medical interventions should be considered in planning treatment for patients presenting with 1 or more of these risk factors.

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