Improvement and care seeking for temporomandibular-pain complaints: The complexity of chronic pain
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Chapter 6


Annemiek Rollman, Corine M. Visscher, Ronald C. Gorter, Machiel Naeije
Abstract

Even though chronic TMD pain tends to persist in most patients, some chronic patients show improvement. It is largely unknown which factors contribute to the improvement of chronic pain. The aim of this study is to investigate which factors, from a biopsychosocial perspective, help to predict improvement in patients with a report of TMD pain. Methods: Subjects with a report of TMD pain were recruited in seven TMD-clinics. They received a baseline questionnaire which included a wide range of possible predictors for improvement. After 6 months they received a follow-up questionnaire which included a measure to determine which participants were “improved” or “not improved”. To study which predictive variables were associated with improvement, multiple regression models were built. Results: From the 129 patients that responded to the baseline questionnaire, 100 patients also filled in the follow-up questionnaire (85% female, mean age (years) ±SD = 46.0 ±13.8). Fifty percent of these subjects had improved at the 6-month follow-up. Pain duration was the strongest (negative) predictor for 6-month improvement (p=0.009). Also the number of care providers (p=0.017) and the degree of hindrance on function (p=0.045) helped to predict improvement. Conclusions: The duration of the TMD-pain complaint, the number of care practitioners attended and the degree of hindrance on function (negatively) helped to predict 6-month improvement. No evidence is found to support the role of psychological or social factors on the improvement in patients with a report of TMD pain.

Key words: TMD pain, follow-up, improvement, biopsychosocial factors

Introduction

Orofacial pain refers to pain in the region of the head, face and mouth. Depending on the definition used, its population prevalence ranges from 1% (current cheek pain) to 48% (current oral or facial pain) [1]. The most common type of acute orofacial pain is toothache [2], whereas chronic orofacial pain is mostly associated with a temporomandibular disorder (TMD) [3]. Chronic TMD pain seldom appears as an isolated complaint. More than half of the patients presenting at a TMD clinic also reported pain in the neck [4], and also widespread pain is commonly reported by these patients [4, 5]. In addition, TMD patients often present with psychological complaints like depression and anxiety [6, 7].

Even though chronic pain tends to persist in most patients, some chronic pain patients show improvement. For example, in a group of chronic musculoskeletal pain patients (including patients with neck pain or back pain) about one-third improved over an 8-10 year period [8]. Comparable rates of long-term improvement have been reported in chronic TMD patients [9]. However, it is largely unknown which factors contribute to the improvement of chronic pain. To name a few considerations: is the way patients cope with their pain an important factor, or are psychological factors involved? In a systematic review on back pain patients, depression, psychological distress, passive coping
strategies and fear-avoidance beliefs were inconsistently found to be associated with poor outcome (on sick leave and functional improvement), whereas most social and socio-occupational factors were not predictive for improvement [10]. For TMD pain, only a few prospective studies on predictors for improvement have been published, with inconsistent results [9, 11 - 14]. For example, one study on acute TMD patients reported that baseline pain intensity and a diagnosis of myofascial pain were predictive for poor outcome at 6-month follow-up [13]. In another study, where a group of chronic TMD patients were followed over a 5-year period, these predictors were not confirmed. Instead, baseline pain frequency, somatization, widespread pain and a diagnosis of arthralgia were found to be associated with poor outcome [9].

As for back pain, where the Cochrane Back Review Group stated that highlighting factors that influence the improvement of low back pain is a major challenge to improve prognosis [15], prospective studies on the improvement of TMD pain are warranted. Therefore, the aim of this study is to investigate which factors, from a biopsychosocial perspective, help to predict improvement in patients with a TMD-pain report.
Material and Methods

Study population

This study is part of a larger project on care seeking behavior in patients with a report of TMD pain, and details about the study have been described extensively elsewhere [16]. In short, inclusion criteria for adults to be eligible for participation were a referral for a TMD-pain complaint to one of 7 participating centers for Temporomandibular Disorders (located in Amsterdam [two centers], Alkmaar, Arnhem, Breda, Den Haag, and Zwolle - all in The Netherlands), a self-report of OFP within the last month; and a good understanding of the Dutch language. To exclude patients with dental pain or with rare causes of orofacial pain (like neuralgias), exclusion criteria were: any report of toothache, burning sensations in the orofacial region, shooting pain that is provoked by touch, a diagnosis of a systemic disease, or cancer. This enlarges the likeliness that the pain complaint of most (if not all) of the participants was related to a temporomandibular disorder. At baseline, all patients signed an informed consent form in which they stated that they allowed the principal investigator to contact them for a follow-up measurement.

One-hundred-twenty-nine patients with a report of TMD pain who met the inclusion criteria filled in the baseline questionnaire [16]. Six months later, they were contacted by mail to fill in a short follow-up questionnaire. When participants did not respond within 3 weeks, a reminder was sent. If necessary, a second reminder was given after 6 weeks. Participants who did not reply to any of the reminders were contacted by phone in order to gather information regarding the main outcome measure (improved/not improved), and whether they had received treatment in the past 6 months. In total, 100 subjects responded to the follow-up questionnaire (responders) and 29 did not (non-responders).

Baseline questionnaire

The baseline questionnaire consisted of a wide variety of variables that could (help) predict which patients are likely to improve from their TMD-pain complaints within the upcoming 6 months. All variables were measured by use of standardized self-report scales. Where available, previously validated measures were chosen.

*Pain duration:* classified as 0-3 months, 3-6 months, 6-12 months, 1-3 years, 3-10 years, or >10 years.

*Pain intensity:* measured by the ‘Characteristic Pain Intensity’ (CPI) which is part of the graded chronic pain scale [17, 18]. For the CPI, the 0 to 10 ratings of questions regarding ‘current pain’, ‘worst pain in the past 6 months’, and ‘average pain in the past 6 months’, are averaged and multiplied by 10 (range: 0-100; higher scores denote more pain).
**Pain-related disability:** rated by the ‘Disability Score’ (DS) which is part of the graded chronic pain scale [17, 18]. For the DS, 0 to 10 ratings of interferences of the TMD-pain complaints with ‘daily activities’, ‘social activities’, and ‘work/housework in the past 6 months’ are averaged and multiplied by 10 (0-100; higher scores denote more disability).

**Hindrance on Function:** measured by the ‘Patient Specific Approach’ (PSA) [19]. For the PSA, participants report the activity they regard most important and difficult to perform because of their TMD-pain complaints. The amount of hindrance experienced during this activity is then measured on a 100-mm Visual Analogue Scale (0-100; higher scores denote more hindrance on function).

**Widespread pain:** sites that were painful within the past 6 months were marked on the body drawing of the McGill Pain Questionnaire [20, 21]. The number of painful body sites outside the orofacial region were counted according to the method proposed by Lobbezoo et al. [22]; neck, shoulders, arms, chest, abdomen, back, and legs (0-7; higher scores denote more widespread pain).

**Number of care practitioners:** the total number of healthcare practitioners the participant previously visited for their pain complaint.

**Use of pain killers:** current use of pain killers for their pain complaint. (yes/no).

**Fear of movement:** measured by a 4-point score (ranging from ‘strongly disagree’ (1) to ‘strongly agree’ (4)) on the statement “I’m afraid that I might injure myself if I move my jaw”. This item was derived from the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (1-4; higher scores denote more fear of movement) [23]. To control the length of the questionnaire, only 1 item of the original TSK-TMD was included. This item was chosen because of its simple and clear formulation, and because its scores relate well with the score of the activity avoidance subscale of the TSK-TMD [23].

**Coping strategies:** catastrophizing (1-6; higher scores denote more catastrophic thoughts about pain), pain coping (1-6; higher scores denote the use of more different strategies to cope with pain), internal pain control (1-6; higher scores denote more positive expectancies about personal control over pain), and external pain control (1-6; higher scores denote more positive expectancies about control over pain by others) were measured by the Pain Coping and Cognition List (PCCL) [24].

**Psychological distress:** depression, somatization and anxiety were measured by the Dutch version of the Symptom Check List 90 (SCL-90 DV) [25, 26]. In this checklist, depression represents symptoms of low mood and aversion to activity, (range: 16-76; higher scores denote more depression within the last month), somatization represents bodily symptoms, such as faintness and stomach upset, associated with a general feeling of physical complaints (range: 12-60; higher scores denote more somatization within the last month) and anxiety represents symptoms of nervousness, tension, panic and
restlessness) (range: 10-50; higher scores denote more anxiety within the last month). The depression, somatisation and anxiety scores were then classified as “normal”, “moderate” or “severe” using the thresholds for the Dutch population [27]: very low-above average = “normal”, high = “moderate” and very high = “severe”.

Dental anxiety: measured by the Dental Anxiety Scale (DAS) [28, 29]. This scale measures fear of a visit to the dentist and anxiety over dental procedures (4-20; higher scores denote more anxiousness).

Level of education: classified as no education, low (primary school), middle (junior vocational education/secondary vocational education), or high (vocational colleges/university) [30].

Employment: current employment (yes/no).

Household situation: currently living alone (yes/no).

Besides information on the above-described putative predictors for improvement, also information regarding age (in years), gender, and city of recruitment was noted.

Six-month follow-up questionnaire

Improved/not improved. At the follow-up measurement, improvement was measured based on the following question: “Did the pain in your face that you reported half a year ago…”: “completely disappear”,” largely decrease”, “slightly decrease”, “remain the same”, “increase slightly” or “increase a lot”. In line with previous studies on low-back pain [31-33], patients who reported that their TMD-pain complaints had “completely disappeared” or “largely decreased” were classified as “improved”, and the other patients were classified as “not-improved”.

Treatment: Participants were asked to indicate whether or not they were treated for their pain complaint in the past 6 months. The choice of treatment (e.g. dentist, physiotherapy or psychologist), nor the implementation of that treatment was standardized. Participants who reported that they had not seen a specialist were categorized as “not treated”, all others were considered to have undergone “treatment”.

The study was approved by the medical ethical committee of the VU University of Amsterdam (file number 2004/166).
Data analyses

T-tests and χ²-tests were used to analyze whether any baseline differences were present between responders (i.e. the participants who filled in the follow-up questionnaire; N=100) and non-responders (N=29) of the follow-up measurement.

A multiple logistic regression model was built to evaluate which baseline variables best predict improvement of the TMD-pain complaints at the 6-month follow-up. First, single regression analyses were performed to determine which variables univariately predicted improvement. For ordinal variables, linearity of their effect on improvement was checked by analysis of dummy variables. When the regression coefficients of the dummy variables did consistently increase (or decrease), linearity was considered present. In case of a non-linear association, either a log-transformation or dichotomization of the variable was conducted (depending on the variable).

Predictors that showed at least a moderate association with ‘improvement’ (i.e., p-value ≤0.10) were entered in the multiple regression analysis. Then, the variable with the weakest association with ‘improvement’ was removed from the multiple regression model. This was repeated in a backward stepwise manner, until all variables that were retained in the model showed a p-value ≤ 0.05. For the variables that were retained in the multiple regression model, it was checked whether any significant interactions were present between these variables. As a final step, age, gender, place of recruitment and treatment in the past 6 months were entered in the multiple regression model to determine whether there were any confounding effects. Confounding was considered present when adding one of these variables to the multiple regression model would change the regression coefficient of any of the predictors by more than 10% [16].

The Statistical Package for Social Sciences (SPSS 17.0) was used to analyze the data and α<0.05.

Results

Seventy-eight participants returned the 6-month follow-up questionnaire. Information regarding the main outcome measure (improved/not improved) of 22 additional participants could be collected by the phone call. This resulted in a total follow-up study sample consisting of 100 participants (Response Rate = 78%). Persons who did not respond to the follow-up questionnaire (N=29, 76% female, mean age (years) ±SD = 43.4 ±13.3) did not differ from the responders (85% female, mean age (years) ±SD = 46.0 ±13.8) with respect to any of the putative predictive variables measured on baseline (t= -1.79-0.18, p=0.34-0.55; χ²=4.01-2.17, p=0.07-0.86).

At the 6-month follow-up measurement, 50 of the 100 patients (50%) had improved on their TMD-pain complaints (i.e., their pain complaint completely disappeared or largely decreased, see Fig. 1). In Table 1 the descriptives of the putative predictors for
improvement are presented for the group of participants that had improved, and for the group that had not improved.

Baseline predictors for 6-month improvement of orofacial pain.

The inspection of the regression coefficients of the dummy variables for pain duration showed that the effect of pain duration on improvement TMD-pain complaints was not linear. Since a log-transformation of pain duration did not result in a linear association with improvement, the variable pain duration was dichotomized into a group of patients with ‘short-pain duration’ and a group of patients with ‘long-pain duration’. Based on the distribution of pain duration in the study sample (Table 1), the cut-off to separate short-pain duration from long-pain duration was set at 1 year (≤1 year, N=43; >1 year, N=57).

In Table 2 the results of the single logistic regression analyses (with pain duration dichotomized) and the subsequent multiple logistic regression analysis are presented. Pain duration was, by far, the strongest predictor for 6-month improvement (p=0.009): patients with pain complaints for more than 1 year were four times less likely (OR: 0.25) to improve than patients with a shorter duration of pain. In addition, also the number of care providers (p=0.017) and the degree of hindrance on function (p=0.045) helped to predict improvement: the more care practitioners attended, and the more the oral function was hindered by the pain complaint, the poorer the prognosis. There were no interaction effects (p=0.07-0.73) and there was no confounding by age, gender, or treatment (change in regression coefficients (b)=0.0-10.0%). Confounding by city of recruitment could only be determined when Zwolle was omitted from the analysis (because only 1 participant from that city was included in the follow-up study), and also resulted in no confounding effects (change in regression coefficients (b)=0.0-9.1%) on the three predictors for improvement of TMD-pain complaints.
Fig. 1. Descriptives of the main outcome measure.

Answer to the question: "Did the pain in your face that you reported half a year ago...?"
### Table 1: Descriptives of the putative predictive variables and confounders for 6-month improvement of orofacial pain

<table>
<thead>
<tr>
<th>Predictive variables</th>
<th>Improved (N=50)</th>
<th>Not Improved (N=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain duration (1-6) (n=100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 months - 3 months</td>
<td>16%</td>
<td>2%</td>
</tr>
<tr>
<td>≥3 months &lt; 6 months</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>≥6 months &lt; 1 year</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>≥1 year &lt; 3 years</td>
<td>26%</td>
<td>24%</td>
</tr>
<tr>
<td>≥3 years &lt; 10 years</td>
<td>10%</td>
<td>20%</td>
</tr>
<tr>
<td>≥10 years</td>
<td>4%</td>
<td>30%</td>
</tr>
<tr>
<td>Pain intensity (0-100) (n=98)</td>
<td>52.4 (19.3)</td>
<td>54.8 (18.6)</td>
</tr>
<tr>
<td>Pain-related disability (0-100) (n=98)</td>
<td>24.3 (28.4)</td>
<td>33.9 (29.1)</td>
</tr>
<tr>
<td>Hindrance on function (0-100) (n=84)</td>
<td>36.9 (29.1)</td>
<td>44.7 (28.7)</td>
</tr>
<tr>
<td>Widespread Pain (1-7) (n=98)</td>
<td>2.0 (0.2-3.5)</td>
<td>2.0 (1.0-3.0)</td>
</tr>
<tr>
<td>Number of care practitioners for TMD-pain complaints (n=97)</td>
<td>0.5 (1.3-2.2)</td>
<td>1.0 (0.2-5)</td>
</tr>
<tr>
<td>Use of pain killers (yes): (n=98)</td>
<td>50%</td>
<td>52%</td>
</tr>
<tr>
<td>Fear of movement (1-4) (n=100)</td>
<td>1.0 (1.0-3.0)</td>
<td>1.5 (1.0-3.0)</td>
</tr>
<tr>
<td>Catastrophizing (1-6) (n=97)</td>
<td>1.7 (1.3-2.3)</td>
<td>2.0 (1.3-2.0)</td>
</tr>
<tr>
<td>Pain Coping (1-6) (n=97)</td>
<td>3.2 (2.5-3.8)</td>
<td>2.8 (2.0-3.6)</td>
</tr>
<tr>
<td>Internal pain control (1-6) (n=97)</td>
<td>3.4 (2.6-4.3)</td>
<td>2.8 (2.2-3.9)</td>
</tr>
<tr>
<td>External pain control (1-6) (n=97)</td>
<td>2.8 (2.0-3.3)</td>
<td>2.6 (1.8-3.3)</td>
</tr>
<tr>
<td>Depression (n=99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>80%</td>
<td>72%</td>
</tr>
<tr>
<td>Moderate</td>
<td>11%</td>
<td>20%</td>
</tr>
<tr>
<td>Severe</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>Somatic complaints (n=99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>68%</td>
<td>60%</td>
</tr>
<tr>
<td>Moderate</td>
<td>20%</td>
<td>22%</td>
</tr>
<tr>
<td>Severe</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Anxiety (n=99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>82%</td>
<td>70%</td>
</tr>
<tr>
<td>Moderate</td>
<td>12%</td>
<td>22%</td>
</tr>
<tr>
<td>Severe</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Dental Anxiety Scale (4-20) (n=81)</td>
<td>7.6 (2.6)</td>
<td>8.1 (3.9)</td>
</tr>
<tr>
<td>Level of education (n=92)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td>Low</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>Middle</td>
<td>61%</td>
<td>57%</td>
</tr>
<tr>
<td>High</td>
<td>39%</td>
<td>34%</td>
</tr>
</tbody>
</table>
Note. Continuous variables are presented as mean values (and standard deviation); for ordinal data the median (and 25th-75th percentiles) are given; categorical variables are presented as percentages. If N<100, scores were not filled in (correctly) and therefore missing. The following items missed more than 10 scores: Hindrance on function (13 missing values; 3 outliers, see discussion); DAS: was the last item of the survey, which might have led to a lack of attention to this scale by some subjects.
Table 2. Predictive variables for 6-month improvement of TMD-pain complaints

<table>
<thead>
<tr>
<th>Predictive variables</th>
<th>Single regression</th>
<th>Step 1 Multiple regression (n = 78)</th>
<th>Step 2 Multiple regression (n = 79)</th>
<th>Step 3 Multiple regression (n = 81)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>b</td>
<td>P</td>
<td>OR (95%-CI)</td>
</tr>
<tr>
<td>Pain duration (0–1)</td>
<td>100</td>
<td>−1.45</td>
<td>0.001</td>
<td>0.51 (0.10–0.55)</td>
</tr>
<tr>
<td>Number of care practitioners for TMD-pain complaints</td>
<td>97</td>
<td>−0.49</td>
<td>0.007</td>
<td>0.61 (0.43–0.88)</td>
</tr>
<tr>
<td>Hindrance on function (0–100)</td>
<td>84</td>
<td>−0.02</td>
<td>0.040</td>
<td>0.98 (0.97–0.99)</td>
</tr>
<tr>
<td>Pain coping (1–6)</td>
<td>97</td>
<td>0.38</td>
<td>0.077</td>
<td>1.46 (0.96–2.21)</td>
</tr>
<tr>
<td>Pain-related disability (0–100)</td>
<td>97</td>
<td>−0.01</td>
<td>0.055</td>
<td>0.99 (0.97–1.00)</td>
</tr>
</tbody>
</table>

b, regression coefficient; OR, odds ratio; CI, confidence interval. The number of patients included in the various steps of the multiple regression analysis varied slightly as related to some missing values on the predictive variables.
Discussion

The results of this study show that pain duration is the strongest, negative predictor for 6-month improvement of TMD-pain complaints. Additional variables that contribute to the prediction of improvement are the number of care practitioners previously attended for the pain complaints and the amount of hindrance on the specific oral function that was selected by the patient as most important and hampered by the pain.

There are some strengths and weaknesses in this study. Strengths of the study include the high response rate (78%), the lack of baseline differences between responders and non-responders, and the wide range of putative predictors (covering physical, psychological and social aspects) studied. Weaknesses of the study include the fact that treatment was not controlled for, the relatively small sample size, and the number of missing values for some variables. Since this study was not designed as a randomized clinical trial, treatment type and implementation of that treatment were not controlled for. Earlier studies have however consistently shown that even though patients benefit from conservative treatments (like oral appliance or home exercises) for TMD pain, it is less important what type of treatment is provided [34, 35]. Bearing this in mind, the decision to check for possible confounding effects of treatment (yes/no) on the results presented in this paper seems sufficient. This analysis of confounding showed that irrespective of whether a patient was treated or not, patients with less pain duration, who had attended less care practitioners and who reported less hindrance on function are more likely to show improvement within the upcoming 6 months.

The sample size of the follow-up study was 100 participants. In prospective studies, it is difficult to predict the number of ‘cases’ (in this study, the patients who showed improvement at the 6-month follow-up) and ‘controls’ (patients who did not improve). Coincidentally, the number of cases and controls was equally distributed (for both groups N=50) which allowed for building a multiple regression model for improvement of TMD-like pain with up to 5 predictors, applying the rule of thumb to the multiple logistic regression analysis: ‘10 cases of data for each predictor in the model’ [36]. Since only 5 predictors were selected from the single regression analysis, and only 3 predictors were retained in the final regression model, the sample size was adequate for the regression analysis.

For one of the predictors for improvement of TMD-pain complaints (i.e., hindrance on function as measured with the patient specific approach) 16 missing values were present. Thirteen patients did not report a specific activity which was difficult to perform because of their TMD-pain complaints, and therefore no VAS scores were available. In addition, 3 patients rated their activity (i.e. yawning, opening the mouth, and doing sports) as impossible to perform because of their TMD-pain complaints (VAS score=100). However, the outcomes of the clinical examination (including maximal mouth opening, data not presented) of these patients contradicted the scores of the patient specific approach (PSA), suggesting that these patients probably did not understand the intent of the patient-specific approach. Therefore, their scores were skipped from the analysis.
For future studies, to prevent missing values on this measure, we recommend to provide verbal instructions on the use of the patient specific approach at the initial visit [19].

That those with short term TMD-like pain are more likely to improve on follow-up, while those with more chronic TMD-like pain do not improve, seems self-evident proof that chronic means tends to persist [9, 37]. Interestingly, also the number of care practitioners previously visited for the TMD-pain complaints negatively contributed to the chance of improvement at the 6-month follow-up. This confirms an earlier suggestion of Rammelsberg et al., who reported that about half of the patients with persistent TMD-pain still received treatment [9]. This can be interpreted as the result of a negative coping style: even though previous care providers were not successful in treating the patient, the patient still believes that someone else will be able to help. However, this interpretation is contradicted by the finding that the coping strategy ‘external pain control’ (which measures the degree of positive expectancies about control over pain by others) was not related to improvement of TMD-pain complaints. So possibly, the number of care practitioners previously visited for the TMD-pain complaints is more an indication of the complexity of the complaint (e.g., a complicated diagnosis), or, in some cases, a reflection of the lack of knowledge in the field of TMD pain.

The third predictor for improvement of TMD-pain complaints after a 6-month follow-up period was hindrance on function as measured with the patient specific approach (PSA). The PSA showed a much stronger association with improvement than the pain-related disability scale (see Table 2). Although both scales rate the degree of functional limitation, the PSA is tailored to the individual complaint, whereas the pain-related disability scale is more generic. Generic measures have been suggested to be less responsive to change and may also be less predictive for improvement of pain [38]. In a recent review on outcome measures for chronic low back pain, the use of specific measures that rate what is most important to the individual patient is strongly recommended [39]. Therefore, we suggest the use of the PSA in future research on TMD pain.

Even though this study revealed some predictors for the improvement of TMD-pain complaints, perhaps an even more interesting finding relates to the fact that most predictors included in the study are not associated with improvement. In such situations, the possibility of a too small sample size to detect associations should be considered. Since others have reported that baseline pain intensity, widespread pain and catastrophizing helped to predict outcome in TMD patients, the current results on these variables should be interpreted with caution. The finding that no association is found with depression and disability is however a confirmation of earlier studies [9, 11-14]. In the field of low back pain and neck pain, much more studies on predictors for improvement have been published [10, 40, 41]. However, also in that area, only few predictors (e.g., depression, history of previous attacks, passive coping strategies and fear-avoidance beliefs) were inconsistently reported to predict poor outcome, while other factors (e.g., anxiety, social factors and occupational factors) were not. Perhaps, the lack of reproducible predictors for poor outcome in musculoskeletal pain patients
merely illustrates that the assumption that certain baseline characteristics are related to improvement of musculoskeletal pain is an oversimplification of the truth. Associations between baseline characteristics and long-term outcomes probably are not simple cause-and-effect relationships. Instead, various patient characteristics probably act together, and perhaps even unknown factors (like genetics) may play a role in the perpetuation of musculoskeletal pain complaints.

The aspects found in this study only partly explain why some patients improve, while others do not. This suggests that other yet unknown aspects must be of influence, which is illustrated by the story of one of the participants of this study: a lady of 39 years old presented TMD-pain complaints which already lasted for more than 10 years. She had never attended a care practitioner for this complaint before, because she was not (made) aware of the possibility of treatment for her complaints. She was diagnosed with myofascial TMD pain and subsequently treated with physiotherapy. At the 6-month follow-up measurement she reported that her pain had “largely decreased”. This example not only shows that in patients with a long history of complaints, but without (extensive) prior treatment, prognosis for improvement may still be favorable, but also that referral to an appropriate care practitioner is sometimes hampered by lack of knowledge of both first-care providers and patients. To better understand the interdependence between factors that are related to the improvement, or even to detect new factors that are not commonly included in quantitative study designs, qualitative studies may be a suitable approach. For example, semi-structured interviews with patients who show poor outcome and patients with good outcome may provide new insights in the mechanisms involved in treatment success.

**Conclusions**

Within the limits of this study, the duration of the TMD-pain complaints, the number of care practitioners attended and the degree of hindrance on function (negatively) helped to predict 6-month improvement. No evidence is found to support the role of psychological or social factors on the improvement in patients with a report of TMD pain.
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