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## Patients' experiences of supervised jaw-neck exercise among patients with localized TMD pain or TMD pain associated with generalized pain

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### ABSTRACT

**Objective:** To evaluate temporomandibular disorder (TMD) patients' experiences of a supervised jaw-neck exercise programme.

**Materials and methods:** The study used a mixed method design. All patients were diagnosed with myalgia according to the Research Diagnostic Criteria for TMD and divided into local myalgia ( $n = 50$ ; 38 women, mean age 43 yrs, SD 14), and myalgia with generalized pain ( $n = 28$ ; 27 women, mean age 43 yrs, SD 13). Patients participated in a ten-session supervised exercise programme that included relaxation, coordination and resistance training of the jaw, neck and shoulders. After the 10 sessions an evaluation form was filled out including both open- and closed-ended questions. The quantitative analysis was based on closed-ended questions concerned experience, adaptation and side-effects from the exercise programme. The qualitative analysis was employing inductive content analysis of open-ended questions.

**Results:** Patients reported similar positive overall experiences of exercise regardless of diagnosis, although more individuals in the general pain group experienced pain during training (57%) compared to the local pain group (26%;  $p = .015$ ). Patients in both groups shared similar experiences and acknowledged the possibility to participate in an individualized and demanding exercise programme. They expressed feelings of being noticed, taken seriously and respectful care management to be key factors for successful treatment outcome. The exercise programme was acknowledged as a valuable part of treatment.

**Conclusion:** The hypothesis generated was that individualized and gradually demanding exercise in the rehabilitation process of TMD stimulates self-efficacy and confidence in chronic TMD patients regardless of whether the pain was localized or combined with wide-spread pain.

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Exercise therapy; orofacial pain; pain; qualitative; temporomandibular disorders

### Introduction

Temporomandibular disorders (TMD) is a generic term for a group of musculoskeletal conditions in the jaw-face-temple region, which among others include pain in the jaw muscles and temporomandibular joint (TMJ) [1]. TMD is the most common cause of chronic pain in the orofacial area with a reported prevalence of 10–15%, with the highest prevalence observed in women and in ages 35–44 years [2–4].

The aetiology of TMD is multifactorial and embedded in the biopsychosocial model [1]. A proposed biomechanical hypothesis related to development of TMD points to the relationship between functional load and the capacity of the masticatory system [5]. Longstanding strain, from for example tooth clenching, may induce pain and dysfunction in individuals with reduced capacity of the musculoskeletal system, but not in those with sufficient capacity. This notion is supported by an observed lower resistance to functional load in patients with TMD pain compared to healthy controls [6]. Exercise programmes with the aim to improve capacity may thus be

utilized for treatment of TMD pain. Such programmes may be based on endurance/strength-, relaxation- or coordination-exercises. Reviews have indicated that such programmes may have positive effects on TMD symptoms [7]. Strength training for muscles can increase the capillary supply, strength and endurance of the muscles. Stretch exercise can help to increase the range of jaw movements [8] and reduce pain [9]. A conservative approach with an exercise programme combined with counselling has been found to decrease pain and increase global wellbeing in patients with TMD [10]. In the Swedish National guidelines for management of TMD, exercise programmes together with behaviour oriented treatment modalities and splint therapy are advocated as the first line of therapies [11]. There is however still a lack of evidence with regard to factors that may influence patients' adherence to such exercise programmes as well as on the actual patient compliance with provided instructions.

Patients with TMD pain have a higher prevalence of pain in the neck and back region [12–14] and a reciprocal

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relationship has been demonstrated between TMD and pain in these regions [15]. Patients with TMD pain may also present with comorbid widespread pain conditions [16]. Mechanisms related to central sensitization may thus be involved in these cases and affect the capacity of the musculoskeletal system. Treatment of chronic pain conditions, TMD pain included, is a challenging task since chronic pain is often related to spread of pain and central sensitization which may affect the prognosis of any chosen treatment. Chronic pain, may also induce negative thinking such as catastrophizing, which can lead to fear of movement, avoidance behaviour and increased pain and disability [17]. Thus, patients with generalized pain commonly develop behaviour characterized by fear and avoidance of movement [18].

In patients with generalized pain related to fibromyalgia, strength training has been proven to increase their global impression of wellbeing while a mixed exercise programme including both strength training and/or aerobics and flexibility training had a positive effect on both pain and physical function [19–21]. The programme also improved the patient's management of their everyday activities as a result of avoiding inactivity and changing habits [20,21]. Relaxation was reported as an important element for relief in pain and stress [21]. Some women reported a feeling of not being taken seriously or not being noticed before the treatment. This changed during the therapy and afterwards they reported an increased feeling of being respected as well as an improvement in their psychological health. They also reported an increase in their own awareness of their condition, which helped them in coping with their pain situation [20].

Exercise programmes may thus have beneficial effects on both mental and physical functioning for patients with local and general chronic pain conditions [22]. Although training is a conservative form of treatment, it may be important to individualize the training programme, and start from a level that the patient can manage. Overestimation of the patient's capacity increases the risk of failure and that the task is discontinued [19]. In any evaluation of exercise programmes it is, therefore, important to capture the patients experience of the programme, and given the vulnerability in patients with possible central sensitization, to also include patients with such widespread generalized pain.

The objective of the present study was to evaluate patients' experiences of a supervised exercise programme for the jaw-neck system among TMD patients with local myalgia of the jaw muscles and generalized pain, respectively.

## Materials and methods

### Study population

The participants were consecutive patients that were referred by TMD specialists at the Department of Clinical Oral Physiology, Umeå for a supervised jaw-neck exercise programme.

Inclusion criteria was a diagnosis of myalgia according to the Research Diagnostic Criteria for TMD [1]. One group comprised patients with a primary diagnosis of localized myalgia only and the other group included patients with a myalgia

diagnosis associated with generalized pain (i.e. patients with fibromyalgia and other wide-spread pain conditions). The local myalgia group could include patients with pain also in the neck/shoulder areas but with no pattern of widespread pain and with absence of signs of generalized hyperalgesia (i.e. no pain response to palpation of shoulders, lower arm, thumb and calf muscles); the generalized pain group included patients with widespread pain and significant palpation pain response in shoulder, lower arm, thumb and calf muscles. Patients with primary TMJ pain, TMJ arthrosis, TMJ locking, generalized inflammatory disease, tinnitus and neuromuscular diseases were excluded. Patients that had completed the exercise programme and filled out evaluation forms were contacted by mail after completed treatment and asked for informed consent for their data to be used for research purposes. In total, 50 patients with local myalgia (38 women and 12 men, mean age 43 yrs, SD 14) and 28 patients with myalgia in combination with generalized pain (27 women, and 1 man, mean age 43 yrs, SD 13) filled out the evaluation form and provided consent for the data to be used in the analysis. These formed the basis for both the quantitative part of the study and the qualitative text analysis (Figure 1).

### Initial capacity test and exercise program

The supervised exercise programme was tailored to each patient by carrying out an initial capacity test. The aim of the initial test was to assess the patient's individual capacity and to determine the initial load of the exercises. The capacity test consisted of five endurance tests; an isometric and isotonic shoulder dumbbell lifting task, isotonic jaw opening and protrusion against a defined resistance, and a dynamic chewing task. For all exercises the patients were instructed to continue the exercise as long as possible with a maximum

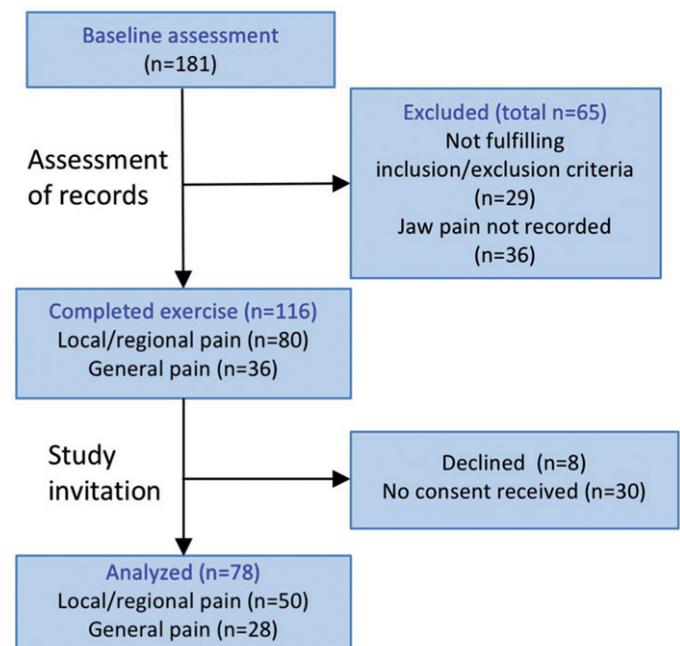


Figure 1. Flowchart of patients included in the study.

**Table 1.** Illustrating an example of the condensation from written comment to theme during the text analysis.

Citations	Meaning unit	Code	Category	Theme
<i>The right type of training for the first time. I dare to push myself and increase my performance.</i>	Right type of training. Increase performance.	Individually designed, demanding exercises, improvements	<i>Tailored to gradually challenge the ability</i>	Tailored challenge –patient's benefit
<i>Good, unusual type of training that is needed. (Instructions that are) easy to understand, but I had to ask about the strength exercise the first time, but other than that, very good. I've done my best and when I felt stronger more load could be put on so I can improve even more. I feel much stronger in the jaw after the training/treatment.</i>	Instructions easy to understand. When stronger more load. Can improve more. Feel much stronger.			

time limit set to 5 minutes [6,23]. The participants were free to stop at any time.

Thereafter the structured programme of ten supervised one-hour individualized training sessions were performed. The exercise programme comprised of strength, endurance and coordination exercises for the jaw-neck-shoulder region followed by a relaxation period.

The programme started with paced jaw 'jogging' (small jaw opening-closing movements) as a warm-up for 6 min. This was followed by jaw opening movements against resistance (3 min) and jaw protrusion against resistance (3 min). Both these jaw exercises against resistance were carried out with the aid of a custom made hydraulic system with an adjustable load up to 1.6 kg. Shoulder lifts were carried out holding 1–3 kg dumb bells (16 min). The neck coordination exercises were carried out with target patterns on the wall tracked with a laser pointer attached to head frame (14 min). The final part was a seated relaxation exercise (12 min). All these exercises were individualized with different loads depending on the outcome of the initial capacity test and the load was gradually increased over the sessions in the exercise programme. A detailed description of the programme is presented elsewhere [6,23]. After the exercise programme an evaluation was carried out with the aid of a questionnaire.

### Evaluation form

The evaluation form was constructed with both open-ended and closed-ended questions related to how well the exercise programme was adjusted to the patients' individual capacity, whether the patients thought the programme had had a beneficial or detrimental effect on their symptoms and other experiences of the programme that the patients wanted to share or comment on. The evaluation form included 11 questions in total, of which 7 questions were included in the quantitative analyses and five questions in the qualitative text analysis.

### Statistical methods

The quantitative data were entered into Excel-files and statistical analysis was carried out in GraphPad Prism version 7.0 for Mac, GraphPad Software, La Jolla California USA, [www.graphpad.com](http://www.graphpad.com) and SPSS version 23. The Chi squared test

was used for comparison between the two groups and a  $p$ -value of  $<.05$  was considered statistically significant.

### Text analysis

The procedure of the text analysis was based on the concept of inductive qualitative content analysis described by Graneheim & Lundman 2004 [24]. The answers from the open-ended questions in the evaluation forms were transcribed verbatim to a Word-file. The whole data corpus was analyzed as one unit. The texts files were read line by line multiple times to achieve an overview of the whole material. Central parts from the answers were extracted and formed meaning units. A meaning unit is constituted of words, sentences or paragraphs which relate to each other through their content, their central meaning. These meaning units, which represented the essential content of the answers, were then further shortened while still preserving the core, thus keeping the original meaning intact. These condensed meaning units were then abstracted, i.e. interpreted on higher logical levels, and labelled with codes. The codes were compared and further abstracted into categories based on similarities which describe the manifest content of the texts. The underlying meaning of the categories were summoned into one theme which express the latent content, that formed the basis for the generating of a hypothesis related to the effect of supervised exercise in patients with local and generalized myalgia, respectively (Table 1). The text analysis was carried out by four of the authors (LG, MM, AI, AW) who first analyzed the text individually and independently. The interpretations were then discussed all together until consensus was achieved. The patient's group affiliation was not known during the text analysis. The emerged codes and categories were constantly compared with the original data, going back and forward between the original text and the interpretative levels. This was done before and after the group affiliation was known to the analysts.

The study was approved by the Regional Ethical Review Board in Umeå Dnr 2016/47-31 and followed the ethical principles stated in the Declaration of Helsinki.

### Results

We found no gender difference between the group of patients with local myalgia compared to those with

generalized pain. There was no statistically significant difference between the two groups in the distribution of answers to questions regarding the overall impression of the supervised training programme, quality of instructions, possibility of individual adjustment and how the exercise programme contributed in their rehabilitation (Figures 2 and 3).

Fifty-six percent of the patients with generalized pain reported that they experienced significant pain during the exercise programme compared to 26% among patients with local myalgia ( $p = .015$ ) (Figure 4).

### Qualitative analysis

The patients' experiences were similar in the two groups. The results of the qualitative part are thus presented together for the groups, showing the group affiliation in the citations, instead of repeating the same categories for each group.

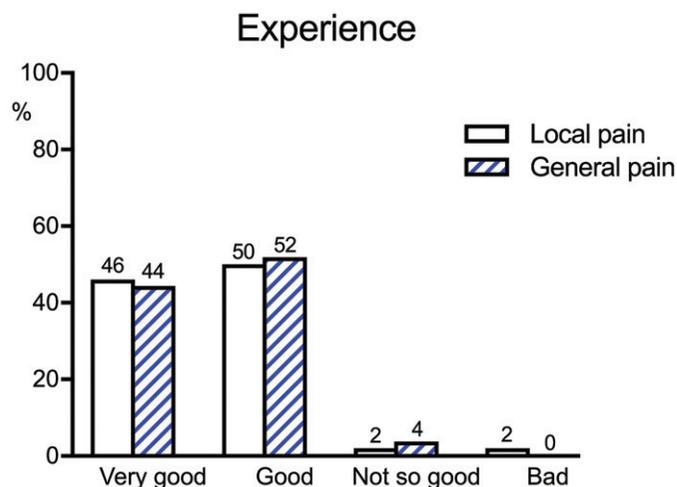


Figure 2. Percentage distribution of answers to the question: 'How did you experience the exercise program?' among patients with local myalgia ( $n = 50$ ) and patients with myalgia associated with generalized pain ( $n = 28$ ).

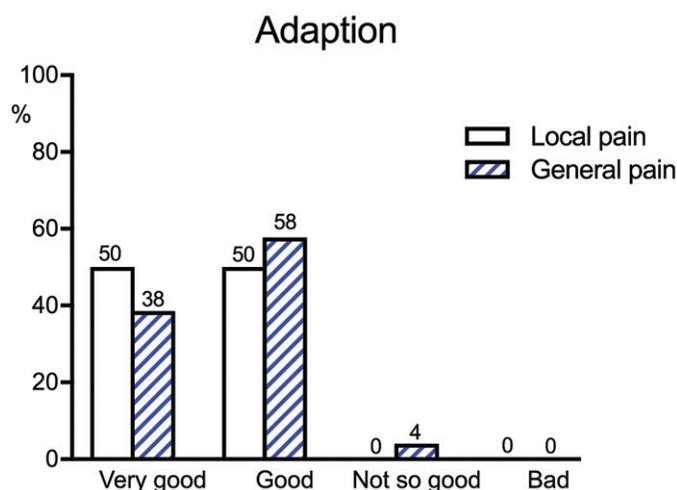


Figure 3. Percentage distribution of answers to the question: 'How well was the exercise program adapted to you?' among patients with local myalgia ( $n = 50$ ) and patients with myalgia associated with generalized pain ( $n = 28$ ).

The separate and blinded text analyses of the two patient groups derived into same categories, their common experiences and attitudes were thus presented together and encompassed under one overall theme: *tailored challenge - patient's benefit* summarizing the patients' experiences from the supervised training programme.

The theme was based on two emerged categories, 'Tailored to gradually challenge the ability' and 'Reinforced self-efficacy and empowerment'. The categories were derived from a number of codes from the extracted meaning units, as representative parts from the text. Quotes are presented as examples of an informant's expressions. The quotes are marked LM for informants with local TMD myalgia and GM for those with generalized pain.

### Tailored to gradually challenge the ability

The codes ordered under the category 'Tailored to gradually challenge the ability' were: individually designed, demanding exercises, accessibility, improvements, and importance of relaxation. The informants expressed that the individual adjustment of the exercise programme to their capacity and ability, and with gradually increasing demands, was a positive and important part of the setup of the training programme.

'... individually based. Adapted for every new event.' (LM)

'Good the first time, when they test how much I can manage, and then of course the training is adapted to suit me and what I'm capable of.' (GM)

The gradually increasing resistance load during the programme, which was both described as a challenging task but also as an important feed-back of improved strength and endurance, encouraged and stimulated the patient's efforts to their limits.

'The right training for the first time. I can dare to push myself and improve my performance.' (LM)

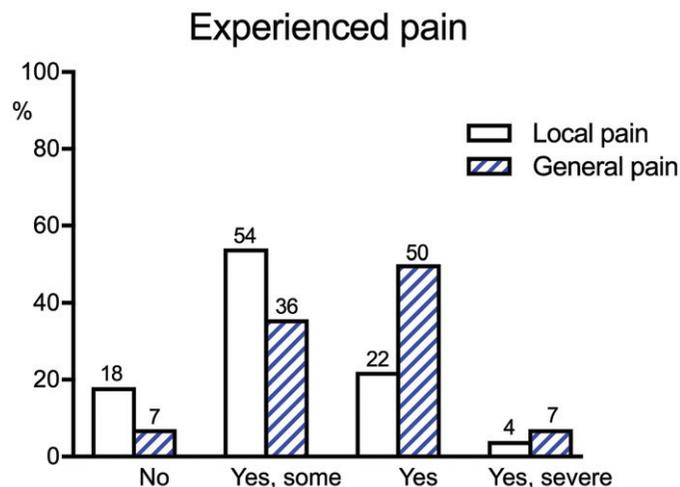


Figure 4. Percentage distribution of answers to the question: 'Have you experienced increased pain/symptoms during the exercises?' among patients with local myalgia ( $n = 50$ ) and patients with myalgia associated with generalized pain ( $n = 28$ ).

*'I've done as well as I can and when I've done better, heavier weights are put on so that I can get even better.'* (GM)

The opportunity for continuity, attending at regular intervals, the structure of the programme and the easy access to the training sessions were expressed to be an important component for successful implementation of the programme and treatment.

*'Having access to training when the pain is worse, possibly at regular intervals, otherwise it's easy for training at home to become routine (a reminder, quite simply).'* (LM)

*'Difficult to train at home, so it was good to get out and train.'* (GM)

The informants experienced different improvements of their symptoms after they completed the supervised exercise programme. Positive effects, such as, increased muscle strength and decreased feeling of fatigue in jaw muscles were described along with functional improvements that included an improved ability to eat without any pain.

*'Have become significantly better in my jaw and jaw joint, less discomfort chewing on both sides.'* (GM)

*'The "tingling" in my scalp/head has practically disappeared and I have absolutely no aching tiredness in my jaw.'* (LM)

The possibility to practice relaxation was mentioned as a very important component of the exercise sessions, as patients do not take their time to relax at home even though it would be beneficial for them.

*'The best thing for me has been the relaxation, and it's a shame that I have to go to a gym in order to have the time to relax.'* (LM)

*'The relaxation exercise has been very beneficial.'* (GM)

### **Reinforced self-efficacy and empowerment**

The codes ordered under the category 'Reinforced self-efficacy and empowerment' were: hopefulness, increased awareness, supported and noticed. The informants expressed that the supervised exercise programme increased their hope for recovery as well as their empowerment. Some of the patients have experienced an overall increase in quality of life and their expressions were imbued with optimism and hopefulness regarding their condition.

*'It feels like a major benefit to have this training. It has helped me a lot at several levels, goal-orientation, relaxation, I feel I've been given a chance to take care of myself as a result of this.'* (LM)

*'Trained not just the musculature and relaxation, but also the important awareness'* (LM)

*'Finally something that has helped me to feel better and a chance to get better.'* (GM)

*'It has become more of a whole for precisely my concerns.'* (GM)

Many of the patients expressed a feeling of enhanced self-efficacy during and after the exercise programme. The ability to manage training on their own after the supervised

programme and an improved knowledge of their diagnosis and capabilities as well as exploring new limitations were expressed. An increased awareness and feelings that they were provided tools for handling their condition on their own after the exercise programme were mentioned.

*'You recover from pain more quickly if you train regularly ... I've learnt a lot about how I work.'* (GM)

*'Thought-provoking movements/exercises that I take away and can do in my day-to-day life, also ordering my own relaxation CD ... The training at the jaw gym has given me ideas and tools for what I can do myself to make a difference to my stiffness and tension in my jaw and neck.'* (LM)

Regardless of the outcome of the treatment, a supportive and nice reception were described by the patients to be of outermost importance. A positive treatment outcome was closely related to the patients' experience of being taken seriously, noticed and respectfully treated.

*'Good and friendly reception, gentle and respectful.'* (LM)

*'Very pleasant reception, displaying a lot of patience and understanding.'* (GM)

*'You're believed about your pains'* (GM)

*'Good caring, understanding for the pain I have.'* (LM)

### **Discussion**

The main finding was that patients expressed a positive and fairly unified experience of an exercise programme regardless of whether they had a localized or generalized pain condition. The results show that the therapy model was of value for the patient and most likely an essential part of their overall rehabilitation process.

Although there was a tendency for more experienced pain during exercise among patients with generalized pain, there were no significant differences between patients with local or generalized pain regarding their general experience, how well the exercise programme was adapted to them or their experience of the exercise programme as a part of the treatment. As the patients described an overall positive experience the text analysis was directed to identify possible central and common opinions that the patients expressed as important components of the exercise programme.

Patients with chronic pain conditions often have associated emotional distress, meaning that emotional function is an important outcome measure [25]. Our results emphasize the importance from the patient's perspective to be recognized and taken seriously regarding their pain condition as opposed to being marginalized and rejected. Patients with fibromyalgia commonly report psychological impact [26] and feelings of not being taken seriously [20]. Patients with chronic orofacial pain expressed feelings of anger, being abandoned, and insulted [27], as well as distrust from the care-givers [27,28]. Positive attitude and expectations, from the patient and the therapist, are important components of a rehabilitation process in order to achieve both specific and

unspecific treatment effects. Several participants in our study reported an understanding that they would not be completely cured from their pain after the exercise therapy, but that their feelings of improvement and enhanced quality of life were equally important.

Exercise therapy has shown encouraging results when used as part of treatment of chronic pain conditions [10,19]. An initial capacity test to define a baseline can guide the patient and set intermediate milestones, interpreted as important for the participant's self-efficacy and essential for any trial aimed at a behavioural change [29]. The capacity test thus seems helpful to individualize the exercise programme based on each patient's capacity and is regarded by patients as an important component. To start with lower weights and gradually use heavier and more demanding weights can contribute to the participant's feeling of improvement, recovery and trust in their self-efficacy. The sustained and long-term effect of the supervised exercise programme is, however, not known.

Fear of movement is common among patients with chronic pain. Pain can lead to catastrophizing and negative thoughts, thereby worsening the condition as one consequence of avoidance behaviour is decreased muscle activity that over time may result in decreased muscle capacity. Avoidance and escape from a potentially painful situation are considered important factors related to the maintenance of pain conditions. Chronic pain and avoidance behaviour may thus interfere with daily life tasks [17]. The exercise programme can be regarded as a guide through recovery that helps the patients change their way of thinking and to confront their fear of movement. The patients expressed that the exercise programme had contributed to increased muscle capacity and enhanced self-efficacy. The fear that pain is a symptom of a more severe disease has also been expressed by patients [30]. Accurate information about cause, character and prognosis are important for patient adherence and treatment outcome. This can successfully be assured with a supervised exercise programme as described in the present study.

### **Methodological considerations**

One study limitation was the characteristics of the study groups. Since the patient sample was based on a clinical sample of consecutive patients who carried out the exercise programme as part of their treatment at a specialized orofacial pain clinic, the group with localized pain also included individuals with regional pain. The widespread pain group had diagnoses related to chronic pain from physicians (fibromyalgia, whiplash associated disorders, post-traumatic stress syndrome) and was categorized as generalized pain based on pain in several locations and signs of hyperalgesia over a limited number of points (shoulder, arm, hand and leg). It would have been preferable with more standardized criteria, such as the 18 points of palpation in line with the 1990 The American College of Rheumatology's Criteria for the classification of fibromyalgia [31] but such procedure was judged difficult to incorporate at the dental chairside.

Whereas quantitative studies tries to prove or disprove a hypothesis, the aim of qualitative studies is to develop deeper knowledge and understandings of the individual's experiences, thoughts, attitudes and often to generate new hypothesis. In the present study a combination of qualitative and quantitative methods was used and prioritized equally to provide a richer and broader picture of TMD patient's experiences of a supervised exercise programme.

Qualitative content analysis can be deductive or inductive in nature. The deductive method tests a predefined hypothesis while the inductive method is used when there is a lack of previous studies or knowledge regarding the phenomena in question [32]. Since few previous studies exist in this field, an inductive approach was used, that enabled formulation of a hypothesis. The quantitative analysis revealed that the majority of cases in both groups reported finding the exercise programme positive. Thus, the qualitative content analysis focussed on cues related to the informant's perspective of why they considered the programme beneficial. The text analysis started with data on the individual level and then moved on to group level. Based on that, further abstraction in the analysis process attempted to generate a hypothesis that represents the general opinion of the informants. To enhance the trustworthiness, triangulation in the data analysis was performed, where different authors initially analyzed the text files separately, followed by consultation until consensus was reached. To further increase the trustworthiness of the text analysis, the procedure should be described from the subjects own words to the final results, this can be demonstrated with, for example, tables, as done in the present study. If there are any interpretations of the content, this is displayed in the table(s) illustrating the analysis procedure. The trustworthiness can be further improved by citations from the participants [32]. Another quality assurance measure for trustworthiness is the presence of citations from the analyzed text, contributing to the *credibility*, i.e. that valuable data have been presented, taken in account and not neglected while irrelevant data have been excluded [24]. The text analysis should not be considered as imprecise; it should always strive to give a true perspective of the subjects' expressions. In the present study, we used strategies for enhancing the trustworthiness in the qualitative part, the results as in other qualitative studies cannot be generalized, but in similar contexts, a treatment strategy with supervised tailored challenging exercises should be considered for the benefit of the patient. This hypothesis is further strengthened because of the mixed method used.

### **Conclusions**

Patients' experiences of a supervised exercise programme were expressed as positive and fairly unified regardless of whether they had a local or generalized pain condition. The hypothesis generated was that individualized and gradually demanding exercise tasks improve self-efficacy and confidence in chronic pain patients. These are essential components in a rehabilitation process aimed at recovery from pain and related disability. More qualitative studies in this field

can provide a wider understanding of patients' experiences of exercise to optimize the treatment of chronic pain conditions in the orofacial region.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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