Tailored Treatments in Temporomandibular Disorders: Where Are We Now? A Systematic Qualitative Literature Review

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Aims: To conduct a systematic review to evaluate the evidence of possible benefits of tailored treatments for temporomandibular disorders (TMD) based on randomized controlled trials (RCTs). **Methods:** Reports of RCTs investigating treatments tailored to TMD patients' psychosocial characteristics were systematically searched for through March 2013 in the following databases: Cochrane Central Register of Controlled Trials, PubMed, and Web of Science. The methodological quality of the RCTs was assessed using the Cochrane Collaboration's tool for assessing risk of bias. **Results:** Seven reports met the inclusion criteria. In all studies a subgroup of TMD patients, mainly identified by multidimensional diagnostic systems such as the Research Diagnostic Criteria for TMD Axis II or Multidimensional Pain Inventory, were offered a treatment intervention hypothesized to be suitable for that particular patient group. The quality of the trials was compromised in all cases. Two studies focused on well-functioning TMD patients. In both studies, self-care gave results equal to or better than usual conservative TMD treatment. The treatments were targeted for patients with compromised psychosocial adaptation in five studies, and typically included a cognitive behavioral treatment component. In all trials the results supported the efficacy of tailored treatment, albeit in one trial only in the short-term. **Conclusion:** The identified studies offer cautious support to the notion that treatment targeted to different psychosocial subgroups of TMD pain patients may be beneficial. *J Oral Facial Pain Headache 2014;28:28–37*
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Temporomandibular disorders (TMD) refer to a cluster of signs and symptoms involving the masticatory muscles, temporomandibular joints, and associated structures. Pain is the most prominent feature of TMD and the most important reason for seeking care. TMD is recognized as the most common persistent orofacial pain, with prevalence figures ranging from 3% to 12%.[1] The etiology and mechanisms of TMD are poorly understood, but existing evidence suggests an interplay of numerous factors, such as genetic susceptibility to higher pain sensitivity, environmental factors, increased psychological distress, and psychosocial dysfunction.[2–4] Currently, there is considerable variation in the treatment of TMD.[5] Interventions can range from oral appliances or physiotherapeutic or psychological methods to occlusal reconstruction or temporomandibular joint surgery, although generally only conservative, reversible strategies are recommended. A common finding is that TMD-related pain tends to improve to some extent regardless of the treatment modality used, but despite the reported initial high success rates, a considerable number of patients seem to progress to chronicity or report persistent symptoms.[6–10]

As for other chronic pain conditions, TMD is also conceptualized from a biopsychosocial perspective, which views pain and disability as a result of dynamic interactions among physical, psychological, behavioral, and social factors.[2,11–13] TMD patients differ significantly with regard to

levels of pain and pain-related disability and distress; psychosocial factors are considered important in explaining these differences.[14–18] There is also much research evidence suggesting that psychosocial factors have an import role in treatment response and in the transition to chronicity.[8,10,19–21] Accordingly, pain and TMD specialists have emphasized the need to identify subgroups of patients based on specific psychosocial characteristics and then to use this information in designing treatments to best match patients' needs.[20,22–25]

Early approaches to identify TMD patient subgroups based on psychological characteristics and psychopathology focused on categorizing different patients by using standard psychiatric assessment instruments.[26–28] An important step towards a more multidimensional assessment of TMD pain was the incorporation of the Multidimensional Pain Inventory (MPI) to identify psychosocial, cognitive, and behavioral characteristics of TMD patients.[14,29] An empiric approach based on cluster analysis yielded three profiles for patients with chronic TMD pain: dysfunctional, interpersonally distressed, and adaptive copers. These same three subgroups of patients have been identified in patient samples with different persistent pain conditions.[30] Around the same time, consistent with the biopsychosocial model of chronic pain, Dworkin and LeResche[31] developed a dual-axis approach to more specifically classify TMD, the Research Diagnostic Criteria for TMD (RDC/TMD). In this diagnostic system, Axis I involves the physical diagnosis and Axis II the impact and severity of pain, the graded chronic pain (GCP) scale. The GCP scale has been shown to have a significant correlation with, eg, symptoms of depression and somatization, pain-related functional limitations, and treatment-seeking behavior.[15,32] In the clinical and TMD treatment context, the RDC/TMD Axis II GCP scale has also been used to divide TMD patients into psychologically functional and dysfunctional patients.[16,33]

The identification of different subgroups of patients based on their psychosocial characteristics provides a theoretical framework to develop differentiated, optimal treatments to address the specific needs of these particular patient subgroups and to study whether treatments so targeted do improve patient outcomes. For many years, the potential of customizing treatment for chronic pain patients has been emphasized,[22] and the utility of tailoring therapeutic interventions to patient characteristics has received increasing attention in the treatment of different chronic pain conditions, including TMD.[8,17,20,30,33] Further assessments of randomized controlled trials (RCTs) suggest that treatment responses differ across different psychosocial subgroups of TMD patients.[19,20,33] The present authors were interested in finding out whether the usefulness of tailoring treatments to patients' psychosocial characteristics has been tested in prospective, rigorous scientific studies. Thus, the aim of this study was to evaluate the evidence of possible benefits of tailored treatments for TMD based on a systematic review of RCTs.

Materials and Methods

Search Strategy and Inclusion Criteria

Reports of RCTs for TMD with treatments tailored to patients' psychosocial characteristics were systematically searched for through March 2013. There were no language restrictions. Electronic databases including the Cochrane Central Register of Controlled Trials (2011, Issue 4), PubMed (NCBI), and Web of Science were searched by an expert librarian together with two of the researchers. The search strategy used a combination of controlled vocabulary and free-text words. The detailed search strategies developed for each database are presented in Figs 1 to 3. To identify further studies, the reference lists of identified articles and reviews of tailored treatments for TMD and other relevant articles were screened. Unpublished reports or abstracts were not considered. The titles and abstracts of all identified studies were scanned independently by two authors. Full texts of all studies that appeared to meet the inclusion criteria were independently read by three authors to confirm eligibility.

Quality Assessment

The investigators independently evaluated the methodological quality of each identified article by using the Cochrane Collaboration's tool for assessing risk of bias.[34] This includes the following quality criteria: sequence generation; allocation concealment; blinding of participants, personnel, and outcome assessors; incomplete outcome data; selective outcome reporting; and other possible sources of bias. A summary assessment of the risk of bias for the outcome of studies was undertaken[34]: Within a study, a summary assessment of low risk of bias was considered when there was a low risk of bias for all key domains, unclear risk of bias when there was an unclear risk of bias for one or more key domains, and high risk of bias when there was a high risk of bias for one or more key domains. After the assessments, the results were compared and disagreement was resolved by discussion among the investigators.

Assessment of Heterogeneity

Heterogeneity was assessed by reviewing the clinical and methodological characteristics of the included studies. No meta-analysis was conducted due to lack of homogeneity across the studies.

Free text search
#1 individuali* OR personaliz* OR personalis* OR customiz* OR customis* OR tailored OR tailoring OR targeted OR targeting OR "research diagnostic criteria" OR RDC OR "adapted treatment" OR "adapted treatments" OR "adapted therapy" OR "adapted therapies" OR "adjusted treatment" OR "adjusted treatments" OR "adjusted therapy" OR " adjusted therapies"
#2 temporomandibular or craniomandibular
#1 AND #2

Fig 1 Search in the Cochrane Central Register of Controlled Trials. * Indicates search for sequence of letters that may not be a complete word.

#1
"Randomized Controlled Trial"[pt] OR "Randomized Controlled Trials as Topic"[MeSH] OR (random*[ti] AND controlled[ti]) OR "randomized controlled"[tw] OR "randomised controlled"[tw] OR randomly[tiab] OR randomization[tiab] OR randomisation[tiab]
#2
"adapted therapy"[tw] OR "adapted treatment" [tiab] OR "therapy adjustments"[tw] OR "therapy adjustment"[tw] OR "treatment adjustments"[tw] OR "treatment adjustment"[tw] OR individualised[tiab] OR individualized[tiab] OR personalized[tiab] OR personalised[tiab] OR customized[tiab] OR customised[tiab] OR tailored[tiab] OR tailoring[tiab] OR targeted[tiab] OR targeting[tiab] OR "research diagnostic criteria"[tiab] OR RDC[tiab] OR individualising[tiab] OR individualizing[tiab] OR personalizing[tiab] OR personalising[tiab] OR customizing[tiab] OR customising[tiab]
#3
("Therapeutics"[MeSH] OR "prevention and control"[sh] OR "drug therapy"[sh] OR "therapy"[sh] OR "nursing"[sh] OR "diet therapy"[sh] OR "radiotherapy"[sh] OR "psychology"[sh] OR "rehabilitation"[sh] OR "surgery"[sh] OR treatment*[tiab] OR therapy[tiab] OR therapies[tiab] OR intervention*[tiab] OR cognitive therap*[tiab] OR cognitive behavio*[tiab] OR cognition behavio*[tiab] OR "Occlusal Splints"[MeSH] OR occlusal splint*[tiab] OR ("Splints"[Mesh] AND "Dental Occlusion") OR biofeedback[tiab] OR "Biofeedback (Psychology)"[MeSH] OR "Cognitive Therapy"[MeSH] OR "Psychology"[MeSH] OR "Mental Disorders"[Mesh] OR "Adjustment Disorders"[Mesh] OR "Anxiety Disorders"[Mesh] OR "Anxiety"[MeSH:NoExp] OR "Dental Anxiety"[MeSH] OR "Mood Disorders"[MeSH] OR "Personality Disorders"[MeSH] OR "Sleep Disorders"[MeSH] OR "Somatoform Disorders"[MeSH] OR "Affective Symptoms"[MeSH] OR "Depression"[MeSH] OR "Stress, Psychological"[MeSH] OR "Depressive Disorder"[MeSH] OR "Psychophysiologic Disorders"[MeSH] OR "Adaptation, Psychological"[Mesh] OR "Facial Pain"[MeSH] OR dysfunctional patient*[tiab] OR (dysfunctional[ti] AND patient*[ti]) OR biopsychosocial OR psychosocial)
#4
("Craniomandibular Disorders"[MeSH]OR temporomandibular[tw])
#1 AND #2 AND #3 AND #4

Fig 2 Search in PubMed. MeSH, Medical Subject Heading; pt, publication type; ti, title; tw, text word; tiab, title/abstract. *Indicates search for sequence of letters that may not be complete word.

Topic=(individuali* OR personaliz* OR personalis* OR customiz* OR customis* OR tailored OR tailoring OR targeted OR targeting OR "research diagnostic criteria" OR RDC OR “adapted treatment” OR “adapted therapy” OR “adjusted treatment” OR “adjusted therapy”)
AND Topic=(temporomandibular or craniomandibular) AND Topic=(random*)

Fig 3 Search in Web of Science. * Indicates search for sequence of letters that may not be a complete word.

Results

Identified Articles

The search results yielded 48 references from the Cochrane Central Register of Controlled Trials, 46 references from PubMed, and 91 from Web of Science. Hand searching yielded three additional articles from the reference lists of the identified publications. Based on the assessment of the titles and abstracts or the whole text, these were reduced to 10 potentially relevant articles, all published in English. The main reasons for exclusion from the analysis were that the studies identified were not RCTs or that the treatments were not tailored to patients' psychosocial characteristics. Two reports[35,36] presented further analysis of one relevant RCT,[37] and one report[38] presented a cost-effectiveness analysis of another relevant RCT.[39] Thus, the number of studies included in the final analysis was reduced to seven trials.

Studies Included in the Analysis

No studies were identified in which targeted treatments were compared to non-targeted treatments in a TMD patient population. All included reports were based on studies in which a subgroup of TMD patients, identified by a multidimensional diagnostic system taking patient characteristics into account, were offered a treatment intervention hypothesized to be suitable for that particular patient group. As for the tailoring method, four studies used RDC/TMD Axis II criteria[37,40–42] and one study used MPI criteria.[43] Furthermore, one study used the predictive algorithm by Epker et al[7] to identify subjects considered to have a high risk of progressing from acute to chronic TMD,[39] and one study used the Hamilton Rating Scale for Depression (HRSD) with psychiatric evaluation to classify patients.[44] Two studies focused on functional TMD patients,[40,42] while in five studies the treatments were targeted for patients with compromised psychosocial adaptation, ie, dysfunctional, high-risk, or depressed patients.[37,39,41,43,44] Studies focusing on functional TMD patients contrasted usual treatment to self-care[40] or compared the effectiveness of dentist-prescribed self-care to that of self-care plus a hard splint or a soft splint.[42] The more impaired or dysfunctional patients were usually offered cognitive behavioral therapy (CBT) in addition to the usual conservative TMD treatment, and the outcomes were contrasted to those received by the usual treatment,[41,43] or to non-intervention control,[39] or to an education/attention control.[37] The study by Tversky et al[44] compared treatment results received by the use of antidepressants to those received by splint therapy or by a combination of antidepressant use and splint therapy. The characteristics of the studies are summarized in Table 1.

Risk of Bias in Included Studies

A summary of the risk of bias is presented in Table 2. Only two studies clearly reported allocation concealment and sequence generation.[37,42] One study used an outcome measure blinded assessor,[41] whereas in another study it was stated that a non-blinded member of the research team conducted the outcome evaluations.[39] No description of blinding was clearly given in the rest of the reports. Attrition was not adequately addressed in the study by Turk et al,[43] and outcome reporting was incomplete and selective in one report.[44] The overall assessment of bias disclosed that the quality of the trials was compromised in all cases; the overall risk of bias was unclear in five trials,[37,40–43] and high in two trials.[39,44]

Outcome of Trials

Functional TMD patients allocated to a self-care treatment program showed significantly decreased TMD pain, pain-related activity interference, reduced number of painful masticatory muscles, and fewer further visits for TMD treatments compared to patients in the usual TMD treatment group.[40] In another study on 200 patients with no or minimal pain-related psychosocial interference, no significant differences were detected in any of the outcomes among the three treatment groups: the self-care, or self-care combined with hard acrylic splint or with soft splint.[42]

A six-session CBT intervention delivered in conjunction with the usual TMD treatment for patients with pain-related disability according to the RDC/TMD Axis II criteria, despite producing some early gains, was no more effective than usual treatment in improving pain-related variables over the 1-year follow-up time.[41] In another study in which patients were selected using the same criteria, a four-session CBT yielded superior results compared to an education/attention control condition.[37] In the study by Turk et al,[43] in which dysfunctional patients (according to MPI criteria) received a combination of splint, biofeedback and supportive counseling, or the same treatment package plus a standardized cognitive therapy (CT) for depression, the intervention including CT demonstrated significantly greater reductions in pain, depression, and use of medication, with continued improvement at the 6-months follow-up. In the study by Gatchel et al[39] patients estimated to have high risk of progressing to chronic pain and receiving CBT combined with biofeedback reported significantly less pain, their coping styles were more adaptive, and they were less likely to have somatoform or affective disorders at one year compared to non-intervention controls. Furthermore, in the study by Tversky et al,[44] TMD patients diagnosed with depression received either splint therapy or antidepressant therapy, or a combination of these treatments.

Table 1 Summary of RCTs of Tailored Treatments for TMD

	Dworkin et al[40]	Truelove et al[42]	Dworkin et al[41]
Tailoring method	RDC/TMD Axis II	RDC/TMD Axis II	RDC/TMD Axis II
Study setting	Consecutive patients, Orofacial Pain Clinic, University of Washington, Seattle, USA	Consecutive patients, Orofacial Pain Clinic, University of Washington, Seattle, USA	Referral patients, Orofacial Pain Clinic, University of Washington, Seattle, USA
Sex	85% female	86% female	85% female
Mean age (SE)	37.5 y (1.09 y)	36 y (12 y)	38.8 y (10 y)
No. eligible patients	196	262	186
Randomized	63%	76%	63%
Inclusion criteria	Facial pain or other TMD symptoms RDC/TMD Axis I diagnosis **RDC/TMD Axis II: Grade 0, I, or II low** Age 18–70 y	RDC/TMD Axis I Myofascial pain with or without arthralgia or disc displacement with reduction **RDC/TMD Axis II: Grade I–II** Age 18–60 y	Facial pain RDC/TMD Axis I diagnosis **RDC/TMD Axis II: Grade II high, III, or IV** Age 18–70 y
Exclusion criteria	Migraine Acute infection or other orofacial disease Emergency treatment need Debilitating physical or mental illness	Other Axis I dgs, eg, disc displacement without reduction Any systemic arthritis Serious medical or psychological condition Full dentures Current splint use	Migraine Acute infection or other orofacial disease Emergency treatment need Debilitating physical or mental illness
Therapeutic groups	Usual treatment (UT), n = 63 Self-care (SC), n = 61	SC, n = 64 SC + hard splint (HS), n = 68 SC + soft splint (SS), n = 68	UT, n = 58 Comprehensive care (CC) = cognitive behavioral therapy (CBT) + UT, n = 59
Treatment duration	About 2.5 mo	2.5 mo	About 4 mo
Number of visits	UT: ? SC: 3	2	UT: ? CC: 6
Follow-up	3 mo, 6 mo, 12 mo	3 mo, 6 mo, 12 mo	6 mo, 12 mo
Dropouts	SC: 10%, UT: 3%	SC: 25%, SC + HS: 4%, SC + SS: 19%	UT: 12%, CC: 5%
Outcomes	**CPI**, SC > UT Activity interference, SC > UT Vertical jaw motion, S = UT Painful muscles, SC > UT Depression, SC = UT Somatization, SC = UT Helpfulness, SC > UT Satisfaction, SC = UT TMD knowledge, SC > UT No. of further visits, SC < UT	**CPI**, SC = HS Self-reported symptoms, SC = HS = SS Changes in clinical findings, SC = HS = SS Changes in diagnosis, SC = HS = SS Pain duration, SC = HS = SS Compliance, HS > SS	**CPI**, CC = UT **Activity interference**, CC = UT Ability to control pain, CC = UT Vertical jaw motion, CC = UT Painful muscles, CC = UT Axis I dg, CC = UT Depression, CC = UT Somatization, CC = UT Satisfaction, CC = UT Helpfulness, CC = UT
Reviewers' conclusion on efficacy	SC better than UT	Equal effectiveness with SC and HS/SS	Equal effectiveness with CC and UT

Primary outcomes of RTCs noted in bold type.

RDC, Research Diagnostic Criteria; TMD, temporomandibular disorders; HRSD, Hamilton Rating Scale for Depression; MPI, Multidimensional Pain Inventory; TMJ, temporomandibular joint; CPI, characteristic pain intensity.

Combined treatment yielded significantly better pain intensity reduction compared to single treatments in the 20-week follow-up period.

A summary of the outcomes of the studies, together with the present authors' estimate of the overall treatment result, are presented in Table 1.

Discussion

Although research to identify subgroups of TMD pain patients based on their psychosocial characteristics has been conducted for a long time, surprisingly there has been little application of this knowledge to

Turner et al[37]	Turk et al[43]	Gatchel et al[39]	Tversky et al[44]
RDC/TMD Axis II	MPI	Predictive algorithm by Epker et al[7]	HRSD + psychiatric evaluation
Patients seeking care, Orofacial Pain Clinic, University of Washington, Seattle, USA	Consecutive referral patients, TMD Clinic, Medical Center, Pittsburgh, PA, USA	Consecutive patients, TMD research program, University Medical Center, Dallas, TX, USA	Referral patients, Oral Medicine Clinic, Melbourne, Australia
86% female	90% female	80% female	89% female
37 y (11.4 y)	33.6 y (9.4 y)	37.7 y (?)	? (?)
366	48	101	48
43%	100%	100%	100%
> 3 mo facial pain RDC/TMD Axis I diagnosis **RDC/TMD Axis II: Grade II high, III, or IV** Age >18 y	> 3 mo muscle or TMJ pain Restricted opening **MPI: dysfunctional** Age ≥ 18 y	< 6 mo acute jaw or facial pain **High risk acute jaw pain** Age 18–70 y	Facial pain and at least two of the following: TMJ noises and discomfort, functional limitation, muscle tenderness **Depression** Age 12–70 y
Need for further diagnostics Current or previous CBT for pain CBT for pain Major medical or psychological condition Pending litigation	Major psychopathology Previous TMJ surgery	Comorbid pain/exacerbating condition (cancer, fibromyalgia) History of jaw pain	Psychiatric disorders other than depression or mild anxiety
CBT, n = 79 Education/Attention control =E/A, n = 79	Standardized treatment (ST) (splint therapy + stress management–biofeedback + supportive counseling), n = 24 Cognitive therapy (CT) + ST, n = 24	Early intervention (EI) (biofeedback + CBT), n = 56 Nonintervention (NI), n = 45	Splint (S), n = 16 Antidepressant therapy (A), n = 16 S + A, n = 16
2 mo	1.5 mo	EI: ?	5 mo max
4	6	6	5
3 mo, 6 mo, 12 mo	6 mo	12 mo	1 mo, 2 mo, 3 mo, 4 mo, 5 mo
CBT: 12%, E/A: 11%	ST: 16%, CT: 2%	EI: 3%	S: 6%, A: 6%, S + A, 6%
CPI, CBT > E/A **Activity interference**, CBT > E/A Jaw use limitation, CBT > E/A Depression, CBT > E/A Pain beliefs, CBT > E/A Pain catastrophizing, CBT > E/A Pain coping, CBT = E/A TMD knowledge, CBT = E/A Helpfulness, CBT > E/A	Pain intensity, CT > ST Muscle pain, CT > ST Joint pain, CT = ST Max opening, CT = ST Depression, CT > ST Pain catastrophizing, CT = ST Interference scale, CT = ST Oral behavior, CT = ST Medication use, CT > ST Health care use, CT = ST Credibility ratings, CT = ST	CPI, EI > NI Risk status change (HR to LR), EI > NI Coping measures, EI > NI Mood and personality measures, EI > NI No. of health care visits, ?	Pain intensity, S + A > S or A
CBT better than E/A	Intervention including CBT better than ST	EI better than NI	Combined A and S better than single therapy

clinical patient care. The majority of TMD treatment studies have compared different treatments matching the study samples only for their physical diagnosis.[25] Because of the acknowledged importance of psychosocial factors for TMD treatment response the focus of the present systematic review was on studies in which treatments were tailored based on patients' psychosocial characteristics.

To obtain direct evidence of efficacy of tailoring treatments to patient characteristics would require RCTs comparing targeted treatment to non-targeted treatment in a TMD patient population. However, to

Table 2 Risk of Bias Summary: Review Authors' Judgments About Risk of Bias Items for Each Included Study

	Dworkin et al[40]	Truelove et al[42]	Dworkin et al[41]	Turner et al[37]	Turk et al[43]	Gatchel et al[39]	Tversky et al[44]
Adequate sequence generation	Unclear	Yes	Unclear	Yes	Unclear	Unclear	Unclear
Allocation concealment	Unclear	Yes	Unclear	Yes	Unclear	Unclear	Unclear
Blinding of participants, personnel, and outcome assessors	Unclear	Unclear	Yes	Unclear	Unclear	No	Unclear
Incomplete outcome data	Yes	Yes	Yes	Yes	Unclear	Yes	No
Selective outcome reporting	Yes	Yes	Yes	Yes	Yes	Yes	Unclear
Other source of bias	Yes	Yes	Unclear	Unclear	Unclear	Unclear	Unclear

the authors' knowledge, no such studies have been performed. In all studies found, a subgroup of TMD patients was offered a treatment intervention hypothesized to be suitable for that particular patient group. The results of the trials in which treatments were targeted for patients with compromised psychosocial adaptation[37,39,41,43,44] have given some support to the efficacy of tailored treatment, which typically included a CBT component. Studies on functional TMD patients[40,42] suggested that self-care in this patient population gives equal or better results than usual conservative TMD treatment. However, all RCTs identified suffered from methodological problems, and all studies had unclear to high risk of bias. Due to these methodological weaknesses, this systematic review indicates that there is currently only cautious support to the notion that targeting treatments to psychosocial subgroups of TMD pain patients is beneficial.

The methods used to tailor treatments to patient characteristics varied in identified RCTs and reflected the general trends in the development of the techniques to identify patient subgroups in chronic pain. The early attempts to empirically identify subgroups of pain patients were based on the use of standardized psychiatric instruments. Due to methodological concerns and the unidimensional nature of these instruments, the focus shifted to more multidimensional classification systems.[22,30] The oldest RCT included in the present review[44] focused on assessing the role of depression in the outcome of conservative TMD treatment. Patients in the study by Gatchel et al[39] were classified using a predictive algorithm estimating the risk of progressing from acute to chronic TMD pain. The algorithm was based on a combination of physical and psychosocial variables, and was derived from a previous study by the same research group demonstrating that self-reported pain intensity and the presence of muscle pain accurately classified 91% of the subjects who went on to develop chronic TMD pain.[7] The validity of this model has not been tested in further studies or by other research groups. The rest of the RCTs used either MPI or RDC/TMD classification systems, both of which have been shown to be valid and reliable and clinically useful in comprehensive patient assessment.[30,45,46] The RDC/TMD especially have been extensively applied to clinical studies. Compared to the MPI, the RDC/TMD seem to offer a simpler and more direct method for subtyping patients in clinical settings, and have received recognition as a standardized biopsychosocial assessment method for TMD worldwide (www.rdc-tmdinternational.org).

The rationale for testing the efficacy of minimal interventions emphasizing self-care in functional TMD patient populations was based on previous documentation of the efficacy of self-care strategies in diverse chronic pain conditions, and on economic considerations.[40,42] Indeed, given that the majority of TMD patients are categorized as functional,[15,47] the differences in costs between therapies, eg, conservative TMD treatment using occlusal splint vs self-care, are of considerable clinical interest. A recent high-quality RCT in which TMD treatment was targeted to hormonal fluctuations, gave further support for the long-term benefits of self-care strategies in TMD pain.[48]

Most studies focusing on more impaired or dysfunctional TMD pain patients have aimed to specifically address patients' psychosocial and behavioral problems by using CBT, which has demonstrated benefits on pain, disability, and mood in diverse chronic pain conditions such as back pain, neck and shoulder pain, and fibromyalgia.[49] While it has been shown that more psychologically distressed patients are especially best suited for CBT,[50] not all studies have confirmed this. In their further analysis of the results of their RCT testing the efficacy of brief CBT intervention,[37] Turner et al[36] were not able to identify baseline patient characteristics that predicted the treatment outcome. In another RCT on the use of CBT for TMD pain,[20] the most adaptive TMD patients seemed especially to benefit from the addition of CBT to standard treatment. Furthermore, those re-

ceiving the combination treatment tended to report continuing declines in pain for a year after treatment. It should be pointed out, however, that in all studies on the use of CBT in chronic pain, the reported effect sizes are only modest.[49,51]

The patients in the identified trials were recruited from secondary or tertiary TMD clinics and, except for the study by Gatchel et al,[39] all study populations consisted of patients with chronic TMD pain and may thus not present the average TMD patient populations. The preliminary results achieved in these studies may not be applicable for patients in primary health care. Further studies are needed to investigate the promise of being able to decrease the risk of TMD pain patients in primary health care from developing chronic pain problems by identifying patients at risk and tailoring specific treatments for them. Generally, early identification and treatment of patients who are at risk for chronic pain is considered important in the light of research findings suggesting that interventions delivered during the first few months after pain onset are more effective than those delivered later.[23] In the follow-up of the patients of the Gatchel et al[39] study, Stowell et al[38] demonstrated that early intervention was also a cost-effective method of treating TMD-related pain.

The interventions studied in the included RCTs were highly heterogeneous, and so were the control conditions; individual interventions varied regarding their content, number of sessions, and the personnel delivering them. Furthermore, in most RCTs, combinations of different interventions were delivered to the experimental and control patients. As it was not within the scope of the present review to analyze in detail the interventions used in the trials, the reader is referred to previous systematic reviews assessing the evidence concerning some of these interventions.[51,52] Due to the wide clinical heterogeneity, no pooling of data was possible in the present review.

Except for the RCT by Tversky et al,[44] all other trials used a set of outcome measures and domains, which is in accordance with the recent IMMPACT recommendations for chronic pain clinical trials.[53] The use of outcomes that are relevant to patients with different characteristics is considered especially important in studies in which treatments are tailored to specific patient subgroups.[43] In addition to the use of traditional retrospective outcome questionnaires, Turner's study group[37] used daily diary ratings of pain outcomes to assess day-to-day changes in these, and demonstrated the feasibility and utility of such methods in TMD treatment trials.[35]

To find all TMD pain RCTs with treatments tailored to patient characteristics for this review was challenging; tailoring or a corresponding term was only mentioned in the titles or abstracts of three of the included RCTs.[40,41,43] For example, in the study by Turner et al,[37] only patients with pain-related disability as defined by RDC/TMD Axis II criteria were included in the trial, but the authors did not address the treatment tailoring in any other way in their report. Many of the RCTs included in the present systematic review were identified through extensive hand searching of reference lists of articles and reviews dealing with the topic of patient classification and treatment matching.

Conclusions

This systematic review evaluated the evidence of possible benefits of tailoring therapeutic interventions to TMD patients' psychosocial characteristics. Only seven reports about RCTs studying targeted treatments were identified—two of these focusing on well-functioning TMD patients, and five on patients with compromised psychosocial adaptation. The identified studies have provided cautious support to the notion that targeting treatments in TMD may be beneficial. Considering that the idea of tailoring treatment to patient characteristics is intuitively and clinically highly appealing, and given the initial promising findings of the studies identified in this systematic review, further high-quality studies are warranted in this area of TMD research.

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