

Clinical practice guidelines in primary treatment for temporomandibular disorders: The Japanese Society for the Temporomandibular Joint, 2023 edition

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Abstract

Purpose: This guideline aimed to make evidence-based clinical practice guidelines for the primary treatment of temporomandibular disorders (TMDs) for general practitioners who do not specialize in TMD.

Review process: Following the principles of evidence-based medicine, a systematic review and network meta-analysis (NMA) of multiple treatments was conducted, assessing the certainty of evidence using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach. Randomized controlled trials published between January 2000 and December 2020 were included. Patients diagnosed with TMD according to the Diagnostic Criteria for Temporomandibular Disorders were considered. Myalgia, arthralgia, and maximal mouth opening were selected as outcomes, and 12 treatments were included in the NMA. The modified Delphi method was used to reach a consensus on recommendations during clinical guideline panel meetings of the Japanese Society for the Temporomandibular Joint.

Results: Self-administered mouth opening exercises, stabilization-type oral appliances, and low-level laser therapy (LLLT) were recognized as effective primary treatments, although the evidence level was graded as “very low” (Grade 2D). During the clinical guideline panel meetings, decisions were developed based on the NMA results, and recommendations for clinical practice guidelines were finalized following consensus.

Conclusions: This guideline recommends mouth opening exercises and the use of stabilization-type oral appliances as primary treatments for TMD. Additionally, it suggests that LLLT be a conditional recommendation, supplemented with additional considerations.

Keywords: Clinical practice guidelines; Grading of recommendations, assessment, development, and evaluation approach; Network meta-analysis; Primary treatment; Temporomandibular disorder

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Abbreviations in this article: TMD: Temporomandibular Disorder; TMJ: Temporomandibular Joint; NMA: Network Meta-Analysis; GRADE: Grading of Recommendations, Assessment, Development, and Evaluations; LLLT: Low-Level Laser Therapy; QOL: Quality of Life; OA: Oral Appliance; RDC/TMD: Research Diagnostic Criteria for Temporomandibular Disorders; DC/TMD: Diagnostic Criteria for Temporomandibular Disorders; SR: Systematic Review; JTS: Japanese Society for the Temporomandibular Joint; PRO: Patient-Report

WHAT IS ALREADY KNOWN ABOUT THE TOPIC?

» *Maxillary stabilization splint therapy is recommended for patients with masticatory muscle pain. Manual and mouth opening exercises are suggested for managing mouth opening disturbances caused by disc displacement without reduction. Occlusal adjustment is recommended as a primary treatment for patients with TMD.*

WHAT THIS GUIDELINE ADDS?

» *Mouth-opening exercise therapy and stabilization-type oral appliances are recommended as primary treatments for TMD. Laser therapy is a conditional recommendation, with supplements and additional considerations incorporated.*

ed Outcomes; **TOMs**: Therapy Outcome Measures; **MMO**: Maximum Mouth Opening; **VAS**: Visual Analog Scale, **TENS**: Transcutaneous Electrical Nerve Stimulation; **SMD**: Standardized Mean Difference; **EtD**: Evidence to Decision.

1. Introduction

Temporomandibular disorders (TMDs) cause acute, recurrent, and chronic pain, as well as dysfunction of the jaw joint, associated muscles, and supporting tissues. TMD is a significant public health issue, affecting approximately 5%–12% of the global population[1]. It encompasses a wide range of conditions, including pain in the temporomandibular joints (TMJs) and masticatory muscles, joint noise, limited mouth opening, and restricted jaw movements.

The variability in TMD symptoms, including cases presenting only joint sounds or mouth-opening limitations without pain, should also be considered. Pathological TMDs are classified into myalgia, arthralgia, TMJ disc displacement, and TMJ osteoarthritis. Recent studies have reported that TMD symptoms often improve organically over time[2]. The American Academy of Dental Research recommends patient education as the initial step in TMD treatment[3]. The primary objectives of TMD treatment are pain relief, recovery of jaw function, and improvement in quality of life (QOL)[4]. Conservative treatments, including counseling, exercise, oral appliance (OA) therapy, massage, and manual therapies, should be considered the first choice to treat TMD symptoms owing to the low risk of side effects.

Since its publication in 1992, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) has been the most widely employed diagnostic protocol for TMD[5]. Although the validity of individual RDC/TMD diagnoses has been extensively studied, an assessment of the criterion validity for the complete spectrum of RDC/TMD diagnoses was absent until recently[6]. In 2014, the new Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) protocol was introduced for both clinical and research applications based on extensive experience with the RDC/TMD[7]. A bibliographic search of databases identified various systematic reviews (SRs) and original research articles on the treatment of TMDs. However, the existing literature provides limited qualitative clinical guidelines[8].

Clinical practice guidelines have been developed worldwide based on the principles of evidence-based medicine, using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach proposed by the GRADE working group[9,10]. The creation of clinical guidelines for the treatment of TMDs is a mission of the Japanese Society for the Temporomandibular Joint (JTS). The JTS began developing clinical practice guidelines in 2018 and has been conducting questionnaire surveys on clinical questions

since then. The first edition of the Society's Evidence-Based Clinical Practice Guidelines, published in 2009[11–13], was the first set of clinical practice guidelines in Japan to follow the GRADE approach. The second edition, published in 2013[14], was also based on the GRADE approach. This edition recommended maxillary stabilization splint therapy for patients with masticatory muscle pain (Grade 2C). It also suggested the optimal use of manual therapy and self-assisted mouth-opening exercises for managing mouth-opening disturbances caused by disc displacement without reduction (Grade 2B). However, occlusal adjustment was not recommended for primary TMD treatment (Grade 1D). New versions of clinical practice guidelines are needed following the publication of the second edition. The diagnostic tools for TMD have transitioned from RDC/TMD to DC/TMD, and treatment outcomes and methods have evolved over time. Additionally, patient-reported outcomes (PRO) play a crucial role in the development of clinical guidelines. Key indicators of treatment effectiveness include pain, mandibular movement, TMJ noise, difficulty eating, and QOL. However, there are significant variations in the measurement tools and criteria used to determine efficacy[15].

Although high-quality SRs on this topic are limited, these reviews highlight the importance of using PRO measures in research and clinical practice[16]. However, therapeutic outcome measures (TOMs) for TMDs have not been systematically evaluated. To address this gap, a scoping review was conducted to identify primary TMD TOMs before conducting a SR to revise clinical practice guidelines. The study's findings indicate that major outcome measures included pain, maximum mouth opening (MMO), jaw function, and jaw movement, with most pain outcomes being evaluated using changes in visual analog scale (VAS) scores[17].

This review process aimed to develop evidence-based clinical practice guidelines for the primary treatment of TMDs by general practitioners who do not specialize in TMD management.

2. Review Process

2.1. Clinical question

Which treatment method is effective for the primary treatment of TMD?

2.2. Patients

Patients diagnosed with myalgia or arthralgia related to TMD, regardless of TMJ disc displacement, were included based on the RDC/TMD or DC/TMD criteria.

2.3. Intervention

The clinical practice guidelines included only studies describing the primary treatment with conservative monotherapy in adult patients. The following interventions were considered in the SR: stabilization-type oral appliances, anterior repositioning-type oral appliances, manipulation, self-assisted mouth-opening exercise therapy, massage, low-level laser therapy (LLLT), cognitive behavioral therapy, transcutaneous electrical nerve stimulation (TENS), cold and hot compresses, occlusal adjustment, analgesics, and muscle relaxants.

2.4. Comparator

Each treatment method/placebo (including no treatment) was selected as a reference treatment.

2.5. Outcome

Pain, experienced during functional activities such as opening the mouth or biting, including any myalgia or arthralgia of the TMD, excluding pain at rest, was considered the primary outcome. MMO was included as the secondary outcome, irrespective of pain. Pain was evaluated using the visual analog scale (VAS). The standardized mean difference (SMD) was used for statistical analysis of treatment effectiveness. In addition, the threshold of the effect size by Cohen's *d* was used based on the standardized mean difference, according to the Cochrane Handbook (section-15-5-3-1), with an SMD of 0.2 indicating a small effect, 0.5 a moderate effect, and 0.8 a large effect.

2.6. Timing for evaluation of outcome

Following a discussion by the panel committee, the maximum period for determining efficacy by a non-specialist physician was set at three months. However, for reference, the longest time point within one month, considered the initial reference for non-specialists to decide on referral to a specialist—was also listed.

2.7. Setting of target and treatment

These clinical practice guidelines cover conservative, reversible, or nonsurgical treatments provided by general practitioners or clinicians in general hospitals who do not specialize in TMDs. Home care (self-management) performed by patients is also included.

2.8. Side effects and risks of treatment

Only a limited number of studies have examined the side effects and risks (harm) of TMD treatments. Therefore, the summary of potential harms was based on manual searches and the experience of committee specialists, as listed in the evidence-to-decision (EtD) table.

2.9. Systematic search for evidence

Randomized controlled trials published between January 2000 and December 2020 were included in the clinical practice guidelines. NMA was performed with a random-effects model with Netmeta statistical software (R Foundation for Statistical Computing, Vienna, Austria). The details of this NMA are scheduled for publication in a SR. This NMA adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines, and the protocol was registered with PROSPERO (CRD42021239965).

2.10. Strength and limitations of evidence

These clinical practice guidelines were developed following the GRADE approach developed by the Cochrane Handbook and the GRADE Working Group. A modified Delphi method was used to reach a consensus on recommendations during panel meetings. In STEP 1, each panel member was asked to assign a score from 1 to 9 (1 point: disagree; 9 points: agree) pertaining to the draft of the clinical practice guidelines as a preliminary vote. Members who scored less than 7 points provided a reason for their decision. Voting

was conducted anonymously online. In STEP 2, a panel meeting was held to discuss the aggregated results and establish a consensus. If no agreement was reached (median < 6.5 or disagreement index ≥ 1) after discussion, the EtD framework (**Table 1**) was adopted. The recommendations were revised, and members participated in a second round of voting. The strengths of the recommendations were based on the GRADE EtD criteria. The EtD framework comprises constructed questions (population, intervention, comparison, main outcomes, and settings), an assessment (policy importance, desirable and undesirable effects, evidence certainty, sense of values, balance of effects, acceptability, and feasibility), and a conclusion (recommendations, justification, considerations, monitoring and evaluation, and research priorities).

2.11. Stakeholder participation and users

Specialists from JTS, prosthodontics, as well as oral and maxillofacial surgery participated as clinical guideline committee members and panel participants. These clinical practice guidelines are intended for use by TMD specialists and non-specialists, such as general practitioners or hospital doctors. The clinical guideline committee was comprised of members from university hospitals (two from TMD departments, three from prosthodontic departments, two from oral and maxillofacial surgery departments of a dental school, and three from oral and maxillofacial surgery departments of a medical school), one from a general oral and maxillofacial surgery hospital, three general dental practitioners, two patients with TMD and a medical journalist. They participated in a panel meeting to reach an agreement on the recommendations.

2.12. External evaluation and update plan

Public comments were solicited, and external evaluations were conducted by an external evaluation committee (non-members, free of charge). These clinical practice guidelines are updated sequentially when significant relevant research is reported, with a revised version published every five years.

3. Results

3.1. Systematic review and network meta-analysis

Details are provided in the NMA for publication[18]. Twenty-four randomized clinical trials involving 1,336 patients assessed pain outcomes, while 12 randomized clinical trials on MMO involving 614 patients were included in the NMA. LLLT, mouth-opening self-exercise, and stabilization splints were highly effective in reducing pain. Mouth-opening exercises, stabilization splints, and LLLT were moderately effective in increasing MMO. However, the quality of evidence was low. Treatments for pain relief related to TMDs in the SR include LLLT, mouth-opening exercises, stabilization splints, cognitive-behavioral therapy, TENS, massage, and analgesics. Treatments aimed at improving MMO outcomes included LLLT, mouth-opening exercises, stabilization splints, TENS, massage, and analgesics.

3.2. Assessment of the EtD framework (**Table 1**)

The clinical guidelines panel provided evidence for EtD based on the results of the NMA, which will be prepared in a systematic review. The panel reached a consensus during clinical guideline meetings and formulated clinical practice recommendations for the primary treatment of TMDs.

Table 1. Evidence to Decision (EtD) framework

Questions		Which treatment method is most effective as a primary treatment for temporomandibular disorder?	
Population		TMD based on RDC/TMD) or DC/TMD.	
Intervention		Primary treatment as conservative mono-therapy.	
Comparison		Each treatment method/placebo (including no treatment).	
Main outcomes		Pain in any functional situation was used as primary outcomes, while maximum mouth opening was used as the secondary outcome.	
Setting		General practitioners or clinicians in general hospitals who are not specialists in temporomandibular disorders.	
Conflict of interests		There are no conflict of interests.	
Assessment			
Criteria		Judgement	Summary of evidence
Policy importance	Is the policy a priority	☐ No ☐ Probably no ☐ Probably yes ☒ Yes ☐ Varies ☐ Don't know	Temporomandibular disorder can be considered a common disease in clinical dentistry, highlighting the need for clinical practice guidelines for its initial treatment. However, although there are various methods for this initial treatment, no consensus has been obtained as to which treatment should be started. Therefore, in this clinical practice guideline, problems with initial treatment (when performed alone) would be prioritized.
Desirable effects	How substantial are the desirable anticipated effects?	☐ Trivial ☐ Small ☒ Moderate ☐ Large ☐ Varies ☒ Don't know	Desirable effects were moderate in self-mouth opening exercise therapy, stabilization type oral appliance, and low-level laser therapy (LLLT). Desirable effects were not discovered in other treatments. The evidence level was very low and effectiveness was unknown in Cognitive behavior therapy, TENS, Massage, as well as Analgesic. No randomized controlled trials were available for anterior repositioning type oral appliances, muscle relaxants, manipulation, cold and hot compresses, or occlusal adjustment.
Undesirable effects	How substantial are the undesirable anticipated effects?	☒ Trivial ☐ Small ☐ Moderate ☐ Large ☐ Varies ☐ Don't know	Undesirable effects were trivial. No harms were reported within each of the included interventions. Complications such as burns, infections, prolonged erythema, and contact dermatitis are common concerns in LLLT. Excessive self-opening exercise without proper guidance can increase pain. Stabilization type oral appliances may cause increased pain and abnormal tooth position if they are not created or used properly. Additionally, it may slightly worsen respiratory conditions (apnea/hypopnea) during sleep, and the effect is more pronounced with devices with a large amount of elevation and devices with an extended floor on the palate side (Michigan type).
Evidence certainty	What is the overall certainty of the evidence of effects?	☒ Very low ☐ Low ☐ Moderate ☐ High ☐ Very high ☐ Don't know	Evidence certainty was very low. More than 50% of studies were at high risk of bias for any outcome, with small sample sizes and very serious imprecision.
Sense of values	Are there important uncertainties about how much people value the primary outcome?	☐ Significant uncertainty or variability ☒ Possible significant uncertainty or variability ☐ Probably no significant uncertainty or variability ☐ No significant uncertainty or variability	Sense of values were probably yes. A hypothetical value of outcome was considered to be maximal opening range (0.7-0.8) for pain attributed to temporomandibular disorders (1.0) (1). Although the degree of disability in daily life and QOL are important outcomes for patients, no studies have been compiled. For patients, there are variations such as cases with less pain than at the first visit as well as limited mouth opening, and cases with no restricted mouth opening but severe pain.
Balance effects	Does the balance between desirable and undesirable effects favour the policy or the comparison?	☐ Favour comparator ☐ Probably favours comparator ☒ Probably favours policy ☐ Favour the policy ☐ Varies ☐ Don't know	The balance of effects likely favours the policy. Temporomandibular disorder is considered to be a disease whose symptoms may naturally decrease over time. Low-power laser therapy, self-opening training, and stabilizing oral appliances improved more than placebo, suggesting an intervention advantage. However, the certainty of the evidence is 'very low'.

Table 1. Continued

Questions		Which treatment method is most effective as a primary treatment for temporomandibular disorder?	
Acceptability	Is the policy acceptable to government authorities, patients and community?	☐ No ☐ Probably no ☐ Probably yes ☒ Yes ☐ Varies ☐ Don't know	Acceptability was yes. This time, interventions other than occlusal adjustment of natural teeth, for which there were no research papers, were considered to be reversible treatments and acceptable.
Feasibility	How feasible is the policy to implement in low- and middle- income countries?	☐ No ☒ Probably no ☒ Probably yes ☐ Yes ☐ Varies ☐ Don't know	The feasibility of self-mouth opening exercise therapy and stabilization type oral appliance was likely high, while feasibility of LLLT was likely low. Self-mouth opening exercise therapy requires no initial cost because it does not require special tools or equipment. Stabilization type oral appliances are covered by national insurance, and established treatment protocols exist. In contrast, LLLT requires specialized equipment, which is unavailable in many facilities and is not covered by national insurance.

3.3. Policy importance

The importance of this policy was confirmed. Therefore, primary treatment with monotherapy is prioritized in clinical practice guidelines.

3.4. Desirable effects

The desirable effects were moderate for mouth-opening self-exercise therapy, stabilization-type oral appliances, and LLLT. Desirable effects were not established for other treatments, as the evidence level was low and the effectiveness of cognitive behavior therapy, TENS, massage, and analgesics was unknown. There have been no randomized controlled trials on anterior repositioning-type oral appliances, muscle relaxants, manipulation, cold and hot compression, or occlusal adjustment.

3.5. Undesirable effects

These undesirable effects are negligible, and no harm was reported during the intervention. Complications, such as burns, infections, prolonged erythema, and contact dermatitis, are common concerns associated with LLLT. Excessive self-opening exercises without proper guidance may increase pain. Stabilization-type oral appliances may cause increased pain and abnormal tooth positioning if not properly created or used. In addition, it may slightly worsen respiratory conditions (apnea/hypopnea) during sleep, and the effect is more pronounced with devices at large elevations and with an extended floor on the palatal side (Michigan-type).

3.6. Evidence certainty

The certainty of the evidence is low. More than 50% of the studies had a high risk of bias for any outcome, with small sample sizes and significant imprecision.

3.7. Sense of values

Their sense of value was acknowledged. A hypothetical value of outcome was considered a maximal opening range (0.7–0.8) compared to pain attributed to TMDs (1.0) (1). Although the degree of

disability in daily life and QOL are important patient outcomes, no studies have been conducted to date. Patients exhibited variations, with some cases reporting less pain than at the first visit, others limited mouth opening, or severe pain despite unrestricted mouth opening.

3.8. Balance of effect

The balance of effects was considered favorable. Symptoms of TMD naturally decrease over time. Low-power laser therapy, self-opening training, and stabilizing oral appliances improved symptoms more than the placebo, suggesting an intervention advantage. However, the certainty of the evidence is “very low.”

3.9. Acceptability

Acceptability was also a significant factor. In this review process, interventions other than the occlusal adjustment of natural teeth, for which there are no published research, were considered reversible and acceptable.

3.10. Feasibility

Self-mouth-opening and stabilization-type oral appliances are considered feasible. Feasibility was limited with LLLT. Mouth-opening self-exercise therapy incurs no initial cost, because it does not require special tools or equipment. Stabilization-type oral appliances are covered by national insurance and recommended methods have been established. LLLT requires specialized equipment that several facilities lack and is not covered by national insurance.

3.11. Consensus for recommendations by panel meeting

Based on this evidence, we created and voted on the first draft of the clinical guidelines (**Table 2**). A consensus on the recommendations was reached after voting in panel meetings based on a modified Delphi method (**Table 3**). The final recommendations were revised during the discussion and the number of remarks within the recommended sentences increased.

Table 2. Primary treatments for temporomandibular disorders

We suggest self-mouth opening exercise therapy, low-level laser therapy and stabilization type oral appliances as primary treatments (conservative, reversible, non-invasive) performed by general practitioners for adult temporomandibular disorders (muscle or joint pain). However, the evidence level was very low (Grade 2D).

Table 3. Results of voting in the panel meeting using the Modified Delphi Method

Panel member	Score: 1 to 9 points (1 point: disagree; 9 points: agree)	Opinions on clinical practice guidelines.
1	9	Thank you.
2	9	Non.
3	9	Non.
4	9	Non.
5	9	The revision process took a long time, but I believe it was conducted using the correct procedure and the latest network meta-analysis methods. The low level of evidence may be attributed to the fact that clinical studies for temporomandibular disorder treatment, including differences in the selection of clinical outcomes among the project members. I believe it would be necessary for Japan to advocate clinical research with a high level of evidence in order to revise clinical practice guidelines in 5 or 10 years.
6	9	Non.
7	9	Non.
8	9	We believe it is necessary to devise additional sentences to supplement the recommended sentences.
9	9	Non.
10	9	Non.
11	8	Non.
12	8	I thought it would be nice to not include the phrase “general practitioner”. Additionally, the phrase “if one treatment is cheap”, is ambiguous regarding how cheap the treatment was. I felt that it was uncomfortable to use as a guideline to comment on the price instead of the treatment’s effectiveness and the number of irradiations.
13	8	At the last meeting, there was a discussion about attaching reference materials such as the form of a stabilization sprint. I think that there are many general dentists who use the guidelines, and put the specific number of days (1 month or 3 months?). I thought it would be better to keep it.
14	7	
15	7	I agree that it is an irreversible treatment that should be stopped if all three points are not met. While there is no clear evidence and it is difficult to tally, but cognitive behavioral therapy and a whole body approach from the neck down should be considered. I would appreciate it if you could also take up the effects of raising the bite for patients who have been shaved and the occlusion is low. Thank you.
16	5	If recommendations are not made for each target symptom (part, duration, degree of complaint, subjective symptoms leading to onset), it may lead to disregard for medical interviews and easy use of stabilization splints. Even if the recommended medical intervention is reversible and has few side effects, if it results in recommending treatment “for the time being” rather than listening to the patient, a valuable guideline is it won’t work. Guidelines that were meaningful when cutting interventions (occlusal adjustment of natural teeth) to give an ideal occlusion were common, do not continue to have the same value when splinting becomes common “for the time being”. I believe that it is necessary to fully consider the background of the disease (including the tendencies of medical providers and iatrogenic defects) in the development of clinical practice guidelines, particularly for chronic QOL-related diseases. Shouldn’t we reconsider the method of making clinical practice guidelines for diseases related to chronic QOL?
17	4	We felt that the quality of the evidence was very low, and that the number of articles and samples included were insufficient to make recommendations.

3.12. Recommendation (Table 4)

A panel meeting and e-mail solicitation were conducted, and consensus building for these clinical practice guidelines was conducted by 17 individuals, including three patient representatives, using the modified Delphi method (anonymous questionnaire). Responses were obtained from all participants, and agreement was reached. The treatment recommendations were self-mouth opening exercises and stabilization splints. LLLT is recognized as an effective primary treatment; however, the level of evidence is low (Grade 2D). Grade 2 represents weak or conditional evidence, and Grade D represents a low evidence level. Additionally, four supplementary recommendations and five statements were suggested.

3.13. Justifications

The Clinical Practice Guidelines Committee (the Committee) developed conditional recommendations to address TMD classification. Few studies on conservative treatment have classified myalgia or arthralgia as the targets. Recommendations regarding pathology could not be made, although the committee believed that recommendations regarding pathology were desirable. In addition, it was impossible to integrate evidence from numerous combination treatments in the SR.

Regarding cognitive behavioral therapy, massage, myomoni-tors, and analgesics, the certainty of the evidence was judged to be extremely low, and the size of the effect was unknown. No recom-mendations were made, as there were no randomized controlled

Table 4. Primary treatment guideline for temporomandibular disorders

Recommendation	
We suggest that self-mouth opening exercise therapy, and stabilization type oral appliance, are effective primary treatments (conservative treatment, reversible treatment, non-surgical treatment) for adult patients of temporomandibular disorders (muscle or joint pain) although the evidence level was very low (Grade 2D). Low-level laser therapy (LLLT), which is not supported by Japanese national insurance, can also be an effective primary treatments for adult patients of temporomandibular disorders if the treatment cost is not expensive.	
supplementals	
1	Do not start treatment without correctly diagnosing temporomandibular disorder.
2	Properly diagnosing temporomandibular disorder and classifying the TMJ pathology is desirable when providing medical treatment although this recommendation does not classify the pathology. (The Japanese Society of Temporomandibular Joint, Recommendation for treatment of temporomandibular disorders 2020.)
3	If the patient's symptoms do not improve after continuing the same treatment for about 3 months, referring the patient to a specialized facility or specialist doctor as soon as possible is desirable.
4	The stabilization oral appliance is assumed to be the maxillary type.
Additional statements	
1	Self-mouth opening exercise therapy: In the case of self-mouth opening exercise only, national insurance cannot be calculated even if the training takes time.
2	Stabilization type oral appliance: This was mainly used during sleep, it is important to provide even occlusal contact and may cause harm if not properly constructed, adjusted and used. It should also be considered that even with proper use, it may worsen respiratory conditions during sleep.
3	Low-level laser therapy (not high-power laser treatment used for incisions, etc.): At the time of March 2023, all medical examinations for temporomandibular disorders, including re-examination fees, will be self-financed if LLLT is performed. Members of the TMD clinical practice guideline panel expressed strong concerns about the facile LLLT indication.
4	Occlusal adjustment of natural teeth: Please refer to the Japanese Society of Temporomandibular Joint "Primary treatment practice guideline for patients with temporomandibular disorder 3".
5	Precautions in preparing this clinical practice guideline: This clinical practice guideline was prepared by a systematic review of single treatment methods, and was not prepared considering the combination of multiple treatments (e.g., combination therapy such as self-mouth opening exercise therapy and analgesics). The originally planned ranking of treatments was not used as a reference.

trials of drugs, exercise therapy, cold and hot compresses, or occlusal adjustment for natural teeth. Additionally, the study selection was limited to those published after 2000, when the RDC/TMD was widely used. In addition, an adviser to the clinical practice guideline methodology commented that the data were restricted to a single measure of pain outcome reduction, which may lead to imprecision in the certainty of the evidence in the clinical practice guidelines and bias in the direction and strength of the recommendations.

3.14. Research priorities for the future

This clinical guideline review identified several studies with no diagnoses or pathophysiology of myalgia or arthralgia. Future research should focus on the following aspects. First, several pathological studies are required to elucidate the differences in treatment methods based on pathology. The outcomes were diverse, and the unification of core outcomes was desirable. Secondly, standardizing the evaluation regarding the rate of improvement in TMD, as well as QOL and disability-related outcomes, is desirable.

4. Discussion

The JTS clinical guidelines are the only clinical guidelines for TMD developed utilizing a standardized method, such as the GRADE approach. Mouth-opening exercises, stabilization splints, and LLLT are recognized as effective primary treatments for TMD.

Al-Moraissi *et al.* conducted a series of network meta-analyses[19–21]. Several studies have included cases with insufficient diagnosis of TMD and TMJ acupuncture therapy, which is challenging for general practitioners who are not specialists in TMD. However, these studies were not intended for the development of clinical practice

guidelines. Additionally, cases of mixed myalgia and arthralgia were excluded from the SR (currently being prepared for publication)[22]. Furthermore, a US report stated that there are no current clinical practice guidelines[23]. Unfortunately, the English versions of the JTS clinical practice guidelines were not included in that report, probably because they were not indexed in PubMed. Clinical practice guidelines published in South Korea[24] follow the GRADE approach; however, while the certainty of the evidence follows the GRADE approach, the strength of the recommendations follows a unique criterion and cannot be considered a strict GRADE approach. In 2008, JTS developed clinical practice guidelines and conducted surveys that included clinical questions. The first clinical practice guidelines were published in 2010, making them the first in Japan to follow the GRADE approach. These guidelines were further developed to provide additional recommendations to address the two clinical questions. Subsequently, a pamphlet was created for patients[11–13]. In 2013, an updated version in English was published[14]. In addition, although not a clinical practice guideline, the JTS has published the "Treatment Guidelines for Temporomandibular Joint Disorders 2020," which outlines a system from diagnosis to treatment[25]. As described above, several project members believe that there are no clinical practice guidelines for TMDs, and the Japanese clinical practice guidelines have not been updated. Therefore, clinical practice guidelines were developed for general practitioners, as several of them are involved in TMJ treatment. These guidelines are intended to enable general physicians to quickly improve the QOL of patients with TMD by providing appropriate initial treatments. In prior reports, there have been no standard treatments for TMDs, and there is little evidence to support this. Even with these clinical practice guidelines, the certainty of the evidence is low. In addition, the wide range of outcomes makes planning SRs challenging. Therefore, a scoping review of outcomes was conducted[17]. During this period,

Table 5. Treatment details of 29 studies included in the network meta-analysis of randomized clinical trials on initial conservative treatment options for temporomandibular disorders

Self-exercise (n=8)*				Stabilization splints (n=14)				LLLT (n=15)		
Duration		Device		Material		Duration		Power	Duration	Times
Times/day	Repetition	No use	Use	Hard	Soft	Sleep	24 hours	(J/cm ²)	(sec)	(days/week)
3 (2-6) [†]	10 (10-20) [†]	7 ⁺	1 ⁺	14 ⁺	0 ⁺	12 ⁺	2 ⁺	5 (1.5-8) [†]	24 (10-420) [†]	2 (1-4) [†]

[†]These studies include mouth opening range of “passive”, “gentle”, “light resistance”, “resisted”, and “pain occurrence” for the self-exercise.

⁺Median (range); *Number of study

several consecutive studies on new methodologies for GRADE and NMA were published. Consequently, a new clinical question was formulated, and the authors undertook an SR. Procedures for assessing the certainty and limitations of the evidence were developed according to The Cochrane Handbook[26] and the GRADE approach[27,28] developed by the GRADE Working Group.

To develop clinical practice guidelines, the clinical questions for each treatment method were initially considered in accordance with prior clinical practice guidelines. However, with this method, general practitioners cannot easily decide which treatment should be the primary treatment for TMD as the number of clinical questions is increasing. Therefore, this guideline recommends ranking recommendations based on the NMA. To perform an NMA, a uniform pathophysiological classification of TMD is required for all treatment methods. In addition, making the outcomes more patient-centered is an issue for consideration. Pain, mandibular movement, TMJ noise, difficulty eating, and QOL are useful indicators of treatment effects; however, there is a large variation in measurement tools and criteria for determining efficacy[15]. Although high-quality SRs on this topic are limited, these reviews recognize the importance of using PRO measures in research and clinical practice[16]. Treatment ranking was not possible in the present review process because the evidence level was low. A scoping review was conducted to investigate the major outcomes of TMD treatment and their assessment criteria prior to selecting clinical outcomes from the clinical guidelines. A scoping review of outcomes revealed that pain and MMO were the primary outcomes in most studies of any pathophysiological classification. The evaluation period was three to six months. Additionally, few studies have diagnosed disc displacement in patients with TMD. There has been much discussion on whether an NMA should be used, because the level of certainty regarding the evidence may be low. If combination therapies were included, such as mouth opening self-exercise therapy with medication or stabilization sprint with mouth opening self-exercise therapy, the treatments would be too large, the number of studies on each combination therapy would be small, and the evidence level would be low. Therefore, it was decided that only monotherapy would be included. However, studies on monotherapies are limited. Finally, NMA was used to provide the most definitive recommendations for general practitioners when making treatment choices. Therefore, this clinical practice guideline comprehensively answers the question, “which treatment method is preferable for the initial treatment of temporomandibular disorder?” This was different from prior clinical practice guidelines.

For pain outcomes, the standardized mean was used instead of the mean difference (MD) because of differences in pain measurements, such as pain during mastication, pain during movement, and pain alone, although the same VAS score (0–100) was used. Differential SMD was adopted. For the MMO outcome, SMD was used instead of MD because differences between painless, painful, and unstated

measures of pain were observed. Although the degree of disability in daily life and QOL are significant patient outcomes, no studies have been conducted to date.

Only mouth-opening self-exercise therapy, stabilization-type oral appliances, and LLLT are recommended in this practice guideline; however, other anterior repositioning types of oral appliances, manipulation, cognitive behavior therapy, TENS, cold and hot compresses, occlusal adjustment, analgesics, and muscle relaxants are included in the SR. Regarding cognitive behavioral therapy, TENS, massage, and analgesics, the certainty of the evidence was judged to be extremely low, and the size of the effect was unknown. Studies focusing on mono- and combination therapies, which are often used in clinical practice, were excluded as the aim was to identify effective therapies. The authors believe that combination therapies, including recommended monotherapies, will be useful in clinical practice. The narrow focus of this review process may not reflect real-world treatment plans in which patients often receive multiple concurrent treatments. Further studies are required to evaluate the efficacy of these combination treatments. No randomized controlled trials have been conducted on other repositioning splints, muscle relaxants, manipulations, cold and hot compresses, or occlusal adjustments. Recommendations against occlusal adjustment in primary treatment for patients with TMD[14] remain active and have not been deleted in the Japanese Society for the Temporomandibular Joint, although this statement was not included in the 2023 edition because there were no randomized controlled trials in the SR.

Therapeutic exercise results in earlier recovery of jaw function than splinting[29]. Physical therapy is more effective in relieving the characteristic pain intensity[30]. Exercise therapy is an effective approach for treating TMDs[31]. LLLT improved the physical and emotional symptoms of TMD, with results similar to those of OS[32]. The treatment details of the 29 studies included in the network meta-analysis of randomized clinical trials for initial conservative treatment options for temporomandibular disorders are shown in **Table 5**. Self-exercise and LLLT were performed under various conditions. However, stabilization splints were almost identical in this condition owing to their hard material and use during sleep. No adverse effects were reported in any of the studies.

Key considerations include: (1) Mouth-opening self-exercise training: Excessive practice without following instructions can increase pain. (2) Stabilization-type oral appliances: Improper use and lack of preparation prior to use may increase pain and tooth positioning. Additionally, sleep-disordered breathing (apnea/hypopnea) may be aggravated, causing a more pronounced effect with devices that have a large lift and those that extend to the floor on the palatal side (Michigan type)[33–35]. (3) Low-power laser: This is a noninvasive treatment with few complications. The complications associated with cosmetic surgery include burns, infections, pro-

longed erythema, and contact dermatitis. In addition, it is necessary to focus on models that can increase the output and those with a high output, such as superizers (not strictly laser beams), because they may have a heating effect[36]. Schwartzberg *et al.*[37] included case photographs of complications. However, this review process did not include photographs of the cases of low-power laser-related harm. Therefore, the accessibility and cost-effectiveness of LLLT must be considered. Interventions other than the occlusal adjustment of natural teeth, for which there are no published research papers, are considered reversible and acceptable. In this SR, a follow-up was conducted within three months; therefore, the effects beyond three months remain unknown. At the time of planning the review process, the project members planned to analyze the effects observed within one month. However, the number of studies was small, and the certainty of the evidence was very low in the majority of cases; therefore, it was decided that the analysis would not be conducted within 1 month. Moreover, general practitioners may not be able to judge the effect of treatment in the early stages (within one month). The effect of the stabilization-type oral appliances was low, although not worse than that observed during the first visit[38].

Following the development of the EtD table, recommendations were formulated through committee discussions. LLLT, mouth-opening self-training, and stabilizing oral appliances improved symptoms more than placebo, suggesting an intervention advantage. However, the certainty of the evidence was “very low” and the intervention was probably effective. More than 50% of the studies had a high risk of bias for any outcome with small sample sizes and serious imprecision. It was deemed impossible to create recommendations for other treatments because of the lack of direct comparisons between the included interventions and the “very low” certainty of the evidence. In addition, although several studies have quantitatively analyzed pain caused by TMDs and MMO, the evaluation methods vary greatly in terms of the degree of difficulty in daily life, degree of functional impairment, QOL, and adverse events. The low level of evidence in the studies included in this review process can be attributed to the lack of uniformity between the studies. The authors propose the creation of a core outcome set for TMD clinical research and an international research framework that integrates the timing and evaluation methods of treatment effects to develop clinical guidelines for TMD. Additionally, future research should focus on higher-quality randomized controlled and multicenter trials to strengthen the evidence base.

Conclusions

The authors suggest that mouth-opening exercises, stabilization splints, and LLLT are effective primary treatments for TMDs. However, the evidence level was low (Grade 2D) according to the GRADE approach following the NMA. After discussion, these clinical guidelines were classified as conditional recommendations, with supplements information and additional statements incorporated.

Ethical approval

Not applicable

Conflict of interest

The authors declare no conflict of interest.

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Patient and public involvement

Patients and the public were not involved in the design of the review process, conduct, reporting, or dissemination.

Data availability statement

Data supporting the findings of this review process are available upon reasonable request from the corresponding author (KO).

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Conflicts of interest

The authors declare that there are no conflict of interests.

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