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Effectiveness of Manual Therapy, Exercise, Low-Level Laser Therapy, Ultrasound, and Transcutaneous Electrical Nerve Stimulation in Reducing Pain and Improving Mouth Opening in Temporomandibular Joint Disorders: A Protocol for A Network Meta-Analysis of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION

Support - Taiwan Society of Ultrasound in Medicine.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202520007

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 2 February 2025 and was last updated on 2 February 2025.

INTRODUCTION

Review question / Objective To evaluate and rank the efficacy of Temporomandibular joint (TMJ) manual therapy, TMJ exercises, and physical modalities, as previously described, in reducing pain intensity and improving maximal mouth opening (MMO), with a focus on their individual effects.

Rationale TMJ disorders affect 10–36 million U.S. adults, ranging from mild discomfort to severe pain and functional limitations. These disorders are classified as articular (e.g., disc displacement) or non-articular (e.g., myofascial pain), with the Research Diagnostic Criteria system widely used for diagnosis. Physical therapy serves as a key conservative treatment, with TMJ manual therapy and exercises effectively reducing pain and improving function, while modalities like low-level laser therapy, transcutaneous electric nerve stimulation (TENS), and ultrasound provide analgesic and anti-inflammatory effects. However,

no network meta-analyses have ranked individual physical therapy interventions.

Condition being studied The PICO (population, intervention, comparison, outcome) setting of the current meta-analysis included: (1) P: TMJ disorder; (2) I: TMJ manual therapy, TMJ exercise, low-level laser therapy, therapeutic ultrasound, and TENS; (3) C: no intervention or sham therapy; and (4) O: pain intensity and maximal mouth opening.

METHODS

Search strategy Two authors made independent electronic searches in the PubMed, Cochrane library, and ClinicalTrials.gov with keyword of ("therapeutic ultrasound" OR "laser therapy" OR "transcutaneous electrical nerve stimulation" OR "manual therapy" OR "exercise") AND ("temporomandibular joint disorders" OR "temporomandibular joint dysfunction") through the earliest record to January 2025.

Participant or population TMJ disorders.

Intervention TMJ manual therapy, TMJ exercise, low-level laser therapy, therapeutic ultrasound, and TENS.

Comparator No intervention or sham therapy.

Study designs to be included Randomized controlled trials.

Eligibility criteria (1) randomized controlled trials investigating pain intensity and/or maximal mouth opening (MMO); (2) studies involving adults diagnosed with TMD based on medical imaging or the Research Diagnostic Criteria for TMD classification system; and (3) intervention groups receiving a single treatment.

Information sources Two authors made independent electronic searches in the PubMed, Cochrane library, Physiotherapy Evidence Database (PEDro) and ClinicalTrials.gov with keyword of ("therapeutic ultrasound" OR "laser therapy" OR "transcutaneous electrical nerve stimulation" OR "manual therapy" OR "exercise") AND ("temporomandibular joint disorders" OR "temporomandibular joint dysfunction") through the earliest record to January 2025.

Main outcome(s) The primary outcome was pain intensity using the Numeric Rating Scale (NRS) and Visual Analog Scale (VAS) pre- and post-intervention.

Additional outcome(s) The secondary outcome was maximal mouth opening before and after treatment, measured as the distance between the maxillary and mandibular central incisors using a ruler or vernier caliper.

Data management Two independent authors extracted data from the recruited studies, encompassing demographic data, study design, details of treatment regimens, and values of the outcomes. The evaluators paid special attention to the effect direction of the scale used in each trial to avoid mis-interpretation.

Quality assessment / Risk of bias analysis The PEDro scale was used to assess RCT quality based on 11 criteria, including randomization, blinding, and outcome reporting, with scores ranging from 0 to 10 (excluding eligibility). Studies scoring ≥ 6 were classified as high quality, 4–5 as medium, and ≤ 3 as low quality.

Strategy of data synthesis Treatments were ranked using the Surface Under the Cumulative Ranking Curve (SUCRA) to quantify their relative efficacy. Inconsistencies between direct and indirect evidence were evaluated with the node-splitting method and the design-by-treatment interaction model.

Subgroup analysis N/A.

Sensitivity analysis Sensitivity analysis assessed the impact of the pre-post correlation coefficient, using 0.8 as recommended by the Cochrane Handbook. To test result robustness, a coefficient of 0.5 was also applied, as commonly used in the literature.

Language restriction Nil.

Country(ies) involved Taiwan.

Keywords Temporomandibular joint disorder, manual therapy, low-level laser therapy, transcutaneous electrical nerve stimulation, rehabilitation.

Contributions of each author

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