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Effectiveness of Therapeutic Ultrasound for Pain and Disability in Patients with Rotator Cuff Tendinopathy: An Updated Systematic Review, Meta-Analysis, and Exploratory Meta-Regression of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Data extraction.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 3 June 2026 and was last updated on 18 June 2026.

INTRODUCTION

Review question / Objective An updated systematic review and meta-analysis to evaluate the efficacy of therapeutic ultrasound in reducing both pain and functional impairment in individuals with rotator cuff tendinopathy.

Rationale Rotator cuff tendinopathy encompasses a spectrum of subacromial disorders, including tendinopathy, bursitis, and impingement syndrome. Therapeutic ultrasound is commonly used for its proposed analgesic and tissue-healing effects. However, previous reviews have not comprehensively evaluated the influence of treatment parameters and co-interventions. Therefore, this updated systematic review and meta-analysis examined the effects of therapeutic ultrasound on pain and functional outcomes in individuals with rotator cuff tendinopathy.

Condition being studied The population, intervention, comparison, and outcome (PICO) framework. Eligible studies enrolled adults diagnosed with rotator cuff tendinopathy through clinical assessment and/or imaging techniques (P). The intervention of interest was therapeutic ultrasound (I), while comparator groups received treatments without ultrasound (C). The primary outcomes were changes in pain intensity and functional disability (O).

METHODS

Search strategy Two reviewers independently searched PubMed, MEDLINE, Scopus, PEDro, and the Cochrane Library from inception to May 2026 using the following keywords: ("shoulder impingement syndrome" OR "rotator cuff tendinopathy" OR "rotator cuff tendinitis" OR "rotator cuff tendinosis" OR "subacromial bursitis") AND ("therapeutic ultrasound" OR "ultrasound therapy").

Participant or population Rotator cuff tendinopathy.

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Intervention Therapeutic ultrasound.

Comparator Other treatment.

Study designs to be included Randomized controlled trials.

Eligibility criteria Studies were included if they were randomized controlled trials involving adults with rotator cuff tendinopathy confirmed by clinical assessment and/or imaging. Eligible trials compared therapeutic ultrasound, delivered either as a standalone intervention or combined with other physical therapy approaches, against at least one non-ultrasound control group and reported pre- and post-intervention measures of pain or disability.

Information sources A comprehensive literature search was conducted independently by two reviewers in PubMed, MEDLINE, Scopus, PEDro, and the Cochrane Library from database inception to May 2026. The search strategy combined terms related to rotator cuff disorders ("shoulder impingement syndrome," "rotator cuff tendinopathy," "rotator cuff tendinitis," "rotator cuff tendinosis," and "subacromial bursitis") with terms related to ultrasound therapy ("therapeutic ultrasound" and "ultrasound therapy").

Main outcome(s) Pain intensity served as the primary outcome and was quantified using validated pain measures, including the Numeric Rating Scale, Visual Analog Scale, and 4-point Likert scale. Treatment effects were determined by comparing scores before and after the intervention.

Additional outcome(s) Functional disability was considered a secondary outcome and was evaluated using validated shoulder-specific instruments, including the Constant–Murley Score, Shoulder Pain and Disability Index, Disabilities of the Arm, Shoulder and Hand, and Shoulder Disability Questionnaire.

Data management When outcomes were reported at multiple follow-up points, only the measurements obtained immediately after the intervention were included. For multi-arm trials, shared groups were proportionally split across relevant comparisons to prevent participant duplication, with sample sizes allocated equally among the corresponding intervention and control groups.

Quality assessment / Risk of bias analysis Risk of bias was assessed using the Cochrane Risk of Bias 2 (RoB 2) tool. This instrument evaluates five domains: bias arising from the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selection of the reported result. Each domain was rated as "low risk of bias," "some concerns," or "high risk of bias," and an overall risk-of-bias judgment was assigned accordingly. The certainty of evidence was assessed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach and classified as high, moderate, low, or very low based on risk of bias, inconsistency, indirectness, imprecision, and publication bias.

Strategy of data synthesis Given the expected clinical and methodological diversity across studies, pooled analyses were performed using a random-effects model in Comprehensive Meta-Analysis software (version 4; Biostat, Englewood, NJ, USA). Statistical significance was defined as $p < 0.05$. Treatment effects were expressed as Standardized Mean Difference (SMD), with values of 0.2, 0.5, and 0.8 indicating small, moderate, and large effects, respectively. Heterogeneity was evaluated using Cochran's Q test and the I^2 statistic, where values of 25%, 50%, and 75% were interpreted as low, moderate, and substantial heterogeneity.

Subgroup analysis Subgroup analyses were performed according to comparator type: (1) therapeutic ultrasound versus exercise, (2) therapeutic ultrasound versus another physical agent, and (3) therapeutic ultrasound plus conventional physiotherapies versus conventional physiotherapies alone.

Sensitivity analysis The stability of the pooled estimates was examined through leave-one-out sensitivity analyses, in which each study was omitted in turn and the overall effect size was recalculated.

Language restriction No language limit.

Country(ies) involved Taiwan (R.O.C.)

Keywords Ultrasonic Therapy, Rotator Cuff Injuries, Shoulder Impingement Syndrome, Physical therapy.

Contributions of each author

Author 1 - Yu-Jhen Chen - Conceptualization; Methodology; Formal analysis; Data curation Writing – Original Draft; Visualization.

Author 2 - Long-Huei Lin - Conceptualization; Methodology; Formal analysis; Data curation;

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Author 4 - Jong-Shyan Wang - Writing – Review & Editing; Supervision.
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