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ORIGINAL ARTICLE

Does early motion lead to a higher failure rate or better outcomes after arthroscopic rotator cuff repair? A systematic review of overlapping meta-analyses

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Background: The aims of the study were as follows: to perform a systematic review of meta-analyses comparing "early motion" and "delayed motion" after arthroscopic rotator cuff repair; to provide a framework to analyze the best available evidence to develop recommendations; and to identify gaps where suggestions could be made for future investigations.
Methods: Literature searches were performed to identify meta-analyses examining arthroscopic rotator cuff repair with early-motion vs. delayed-motion rehabilitation protocols. Clinical data were extracted, and meta-analysis quality was assessed using the Quality of Reporting of Meta-analyses and Oxman-Guyatt scales.
Results: Nine meta-analyses met inclusion criteria. No clear superiority was noted in clinical outcome scores for early-motion or delayed-motion rehabilitation. Results of tendon healing were found to be either no different or in favor of delayed motion, but no differences were noted in rotator cuff tear recurrence rates postoperatively. The majority of meta-analyses found significantly better range of motion with early motion up to a year postoperatively for forward elevation and up to 6 months for external rotation, but significant differences were not reported for functional improvements and strength at 12 months postoperatively. Subgroup analyses suggested that larger preoperative tear sizes have significantly greater retear rates with early-motion rehabilitation.
Conclusions: The current highest level of evidence suggests that early-motion rehabilitation after rotator cuff repair results in superior postoperative range of motion up to 1 year. Whereas early motion and delayed motion after cuff repair may lead to comparable functional outcomes and retear rates, concern exists that early motion may result in greater retear rates, particularly with larger tear sizes.
Level of evidence: Level IV; Systematic Review

Keywords: Rotator cuff repair; rehabilitation; early motion; delayed motion; shoulder; arthroscopy; outcomes; meta-analysis

Institutional Review Board approval is not required for a review.

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More than 270,000 rotator cuff repair operations are performed annually in the United States.[31] Postoperative clinical and functional outcomes are affected by a plethora of patient (age, tissue quality, activity level, medical comorbidities) and surgical (tear size, repair technique, rehabilitation protocol) variables.[38] In recent years, a more critical evaluation of rehabilitation protocols has been under way to determine what practices lead to superior clinical outcomes and tissue healing with minimal stress on repair. The question of timing of shoulder range of motion postoperatively has been a source of great discussion, with proponents of early range of motion suggesting the potential for increased shoulder range of motion and decreased postoperative stiffness, muscle atrophy, and fatty infiltration.[65] Advocates of delayed range of motion submit that it more adequately protects the repair by minimizing micromotion and allows tendon-to-bone healing, which could reduce retear rates. There has been discordance in the results of recent meta-analyses that have compared early-motion with delayed-motion rehabilitation, and an exact understanding of which postoperative protocol is best is yet to be determined. This is additionally highlighted by the fact that comparative studies and meta-analyses on this topic continue to be performed and published. Thus, a more comprehensive review and analysis of this pertinent topic are valuable to provide a more definitive statement and conclusion as the available data allow on this topic by critically evaluating the highest-level evidence.

Overall, the objective of this review was to perform a systematic review of these overlapping meta-analyses comparing early-motion with delayed-motion rehabilitation protocols after arthroscopic rotator cuff repair to determine the comparative efficacy on patient outcomes. Traditionally, "early motion" after rotator cuff repair refers to shoulder range of motion that begins as early as postoperative day 1, whereas "delayed motion" refers to strict sling immobilization during the first 4-6 (or sometimes 6-8) weeks after surgery. We analyzed these meta-analyses to provide the most comprehensive evidence from the available literature on the topic. Specifically, the aims of the study were as follows: to perform a systematic review of meta-analyses comparing early and delayed motion after arthroscopic rotator cuff repair; to provide a framework for the analysis and interpretation of the presently discordant best available evidence with the goal of developing recommendations for treatment; and to identify gaps within the literature where suggestions could be made for continued investigation in the future. Clinical outcomes included subjective patient-reported outcome scores, objective findings (tendon healing rate by magnetic resonance imaging [MRI], ultrasound [US], or computed tomography [CT]), complications (retear rate and overall complications), and range of motion.

We hypothesized that there would be no significant differences in these outcome variables in comparing early-motion with delayed-motion rehabilitation protocols after arthroscopic rotator cuff repair, with the exception of improved postoperative range of motion in the patients enrolled in early-motion rehabilitation protocols after arthroscopic rotator cuff repair.

Materials and methods

A systematic review of the literature was performed using PubMed and Ovid MEDLINE, Embase, Scopus, SportDiscus, Cumulative Index to Nursing and Allied Health Literature, and HealthSource: Nursing. The search was performed on July 18, 2016. The search methodology was limited to articles written in English. The following broad search terms were used in an effort to identify all articles with potential relevancy: "Rotator Cuff"[All Fields] AND ("early"[All Fields] OR "motion"[All Fields] OR "immobilization"[All Fields] OR "delayed"[All Fields] OR "late"[All Fields] OR "aggressive"[All Fields] OR "passive"[All Fields] OR "active"[All Fields] OR "rehabilitation"[All Fields] OR "protocol"[All Fields]) AND (Meta-Analysis[ptyp] OR systematic[sb] OR "systematic"[All Fields] OR "systematic review"[All Fields] OR "meta-analysis"[All Fields] OR "meta analysis"[All Fields] OR "meta-analyses"[All Fields] OR "meta analyses"[All Fields] OR "meta"[All Fields]). All reviewed articles were manually cross-referenced to be certain that all potentially eligible studies were identified.

The resulting abstracts from the search were reviewed by 2 of the authors (R.M., W.A.Z.), with the inclusion criteria being any meta-analyses that compared the outcomes of arthroscopic rotator cuff repair with early postoperative motion vs. delayed postoperative motion rehabilitation protocols. Exclusion criteria comprised the following: nonclinical or nonhuman in vivo studies; studies that did not compare early with delayed postoperative motion rehabilitation protocols; studies that did not perform pooling of the data or a comprehensive meta-analysis; and narrative reviews. Full texts were obtained and evaluated from those studies that met the inclusion criteria without exclusionary criteria, and the same authors manually reviewed the reference lists from these studies to screen for any other studies that potentially could be included but were missed from this search. The tables of contents from *Journal of Bone and Joint Surgery (American Volume)*, *The American Journal of Sports Medicine*, *Arthroscopy*, *Clinical Orthopaedics and Related Research*, and *Journal of Shoulder and Elbow Surgery* from the last 2 years of publication dates were manually assessed to again identify any articles that could have been overlooked. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart depicting this study's search selection algorithm is shown in Figure 1.

Methodologic and study data were extracted from each of the included studies (Tables I-IV and Supplementary online Tables I-III). General study characteristics were extracted from the included studies. Standardized clinical indices, subjective measures (American Shoulder and Elbow Surgeons [ASES]; Constant; Disabilities of the Arm, Shoulder, and Hand [DASH]; Simple Shoulder Test; University of California–Los Angeles; Western Ontario Rotator Cuff; visual analog scale score for pain; Constant score for pain), objective findings, and complications reported in each study were evaluated. Pooled effect sizes, risk and odds ratios, and mean differences (MDs) of these data points were extracted. Subgroup analyses were recorded and included the following variables: rotator cuff tear size (qualitative and quantitative), study evidence level, and surgical technique.

The quality of the included meta-analyses was scored using the Quality of Reporting of Meta-analyses (QUOROM) system,[53] which evaluates meta-analyses on the basis of 18 categories, with a point awarded for each category when more than half of the criteria are