Delphi Consensus for Rotator Cuff Repair Precautions and Development of a Remote Rehabilitation System

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INTRODUCTION: Rotator cuff tears are the primary cause of shoulder disability in adults. In the United States, rotator cuff tears result in over 4.5 million physician visits, 250,000 surgical procedures, and healthcare costs between $3-$12 billion annually[1-3]. Rotator cuff tears are often remedied through a surgical procedure, a rotator cuff repair (RCR). Following RCR, the goals of early post-op rehabilitation (0-6 weeks) are to protect the repair and safely progress shoulder motion. RCR recovery often requires six months of rehabilitation, but due to this prolonged recovery period patients can exhaust their insurance allotted visits, or face financial burden from copays, and treatment may be cut short. Understanding the rehabilitation process, motion precautions, and desirable features to include in a remote rehabilitation system for RCR rehabilitation will allow for the development of such a system for use in the early phases of recovery. The goal of this study was to utilize a Delphi survey method to identify expert consensus on range of motion (ROM) precautions following RCR and identify desirable features of a remote monitoring system for RCR rehabilitation.

METHODS: An expert panel of 12 physical therapists and 12 orthopaedic surgeons participated in a Delphi study to identify consensus in rotator cuff rehabilitation and desirable features to include in a remote monitoring system for rehabilitation. Question themes included ROM precautions following RCR, remote rehabilitation system monitoring abilities, usage, clinician and patient interfaces, and access. Panelists were identified based on their clinical expertise in the rehabilitation of shoulder injuries, specifically rotator cuff repairs. All panelists consented to participate in this IRB exempt study and were blinded to the other panelists and their responses for the study duration. Panelists were presented with three rounds of iterative surveys distributed via an emailed link. The first round consisted of seventeen free response questions and panelists provided detailed responses via free text. Responses were independently coded for common thematic content by two investigators (AP and MR) and any disagreements were resolved by a third team member (AD). Responses reported by ≥50% of panelists were identified as the modal response, and responses reported by ≥25% of panelists were identified as the second-tier response. For Round two, panelists were presented with the same seventeen questions and the modal responses from Round 1. Panelists were asked to agree or disagree with the response. If the panelist disagreed, they were presented with the second-tier response and asked to agree or disagree. If the panelist disagreed with the second-tier response; they were provided a free text option to enter their response. Round 2 responses were coded for thematic content and modal and second tier-responses were adjusted as needed. Questions that received consensus (≥75% agreement) were removed from the question pool. For Round 3, questions that did not receive the 75% consensus threshold were presented to panelists in the same manner as Round 2.

RESULTS: Twelve questions reached consensus (≥75% agreement) after the second round; the remaining five questions reached consensus in the third round. In the first round all twenty-four panelists responded to all seventeen questions. In the second round, twenty-two panelists responded to all questions, and one panelist responded to the first twelve questions. For round three, twenty-one panelists responded to the remaining five questions. Modal responses and agreement rates can be found in Table 1 below.

DISCUSSION: The responses of this study serve to establish a consensus among expert physical therapists and orthopaedic surgeons regarding post-RCR precautions, remote rehabilitation system monitoring abilities, usage, clinician and patient interfaces, and access. Round 1 had a 100% response rate, Round 2 had a 95% response rate, and Round 3 had a 88% response rate. Consensus (≥75% agreement) was achieved on all questions within three rounds. Panelists were able to identify ROM precautions following RCR, along with timeframes for safely increasing motion. Related to the development of a remote RCR rehabilitation system, panelists identified desirable shoulder movement to monitor, and a time frame for device usage during rehabilitation. Panelists were able to reach agreement on the layout of both the clinician and patient interface, along with favorable methods for accessing the system as clinicians. A limitation of this study is that the survey was completed online which does not allow for clarification of questions or responses.

SIGNIFICANCE/CLINICAL RELEVANCE: This study identified expert consensus related to precautions and rehabilitation treatment following RCR and served to identify desirable features and functionalities to include in the development of a remote monitoring system for rehabilitation.

REFERENCES: [1] Colvin et al. 2012. J Bone Joint Surg. Am; [2] Amini et al. 2015. Orhtop Res Rev; [3] Oh et al. 2007. Clin Orthop Relat Res

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IMAGES AND TABLES:
Table 1. Modal responses grouped by question theme and agreement rates.

ROM Precautions (agreement = 93%)
ROM precautions depend on the repair/surgery, but usually ROM performed within modified range, typically starting off with PROM before progressing to AAROM or AROM
ROM precautions are in place for 3-8 weeks
Passive ROM activities start between 1- 4 weeks post-op depending on surgery/repair
Active assistive ROM activities start between 4-8 weeks post-op depending on surgery/repair
Active ROM activities start between 6-8 weeks post-op depending on surgery/repair
System Monitoring Abilities (agreement = 87%)
System should monitor glenohumeral flexion, rotation (internal and external), and abduction
Measuring scapulothoracic rhythm is important and helpful, but not critical
Tracking patient compliance is desirable
System Usage (agreement = 95%)
The patient should use the system before surgery for familiarization and potentially address pre-op limitations/restrictions
The patient should use system for 4-12 weeks or until symmetric motion is restored
The patient should use system when performing HEP, and at least 1-3 times per week
System Clinician Interface (agreement = 98%)
Clinician should see compliance and performance metrics related to frequency of use, ROM, and ROM progress
Clinicians should be able to visualize quantitative details about ROM in a graph format
System Patient Interface (agreement = 89%)
Patient should be able to see current ROM, ROM goals, and progress towards goals
Patients should be able to visualize real time ROM during exercise performance displayed on a chart or graph
System Access (agreement = 98%)
Clinician should be able to access system through both web portal and the smartphone app
The web portal should be easily used when on a laptop or computer in the clinic. An app should be developed for use outside the clinic or as a more portable option within clinic.