J Shoulder Elbow Surg (2017) ■■, ■■–■■

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

ORIGINAL ARTICLE

# Anterior deltoid reeducation for irreparable rotator cuff tears revisited

**Edward H. Yian, MD[a], Jeffrey F. Sodl, MD[a], Emil Dionysian, MD[a], Alberto G. Schneeberger, MD[b,*]**

[a]*Department of Orthopaedics, Southern California Permanent Medical Group, Anaheim, CA, USA*
[b]*Endoclinic Zürich, Klinik Hirslanden, Zürich, Switzerland*

**Background:** A previous study introduced a method of conservative treatment of irreparable rotator cuff tears (RCTs) using a rehabilitation program (anterior deltoid reeducation [ADR]). The purposes of this study were to present our experience with ADR and to compare our results with those of the previous study.

**Methods:** Thirty consecutive elderly patients with irreparable RCTs were prospectively enrolled and taught how to perform the home-based ADR program for a period of 3 months. Clinical and radiographic evaluations were determined at the first visit. Clinical follow-up was available after 9 and 24 months. Failure of the ADR program was defined as abandonment of the ADR program because of pain and/or a patient's decision to undergo surgery at any time or a less than 20-point improvement in the American Shoulder and Elbow Surgeons score at last follow-up.

**Results:** Of the 30 patients, 9 did not complete the 3-month ADR program because of pain. Of the 21 patients who completed the ADR program, 3 were not satisfied with the outcome and went on to undergo surgery. Eighteen of the 30 patients completed the program and had a follow-up at 24 months. Among these 18 cases, there were significant mean improvements between pre-ADR and follow-up outcome scores among all variables ($P < .005$). However, 6 of these 18 patients did not have an improvement in the American Shoulder and Elbow Surgeons score by at least 20 points. Overall, the ADR program had a success rate of only 40%.

**Conclusion:** A 3-month ADR program had limited success to treat irreparable RCTs. We could not reproduce the high rate of satisfactory results of 82% found in a previous study.

**Levels of evidence:** Level IV; Case Series; Treatment Study



**Keywords:** Deltoid; massive rotator cuff tear; rehabilitation; nonoperative treatment; elderly; conservative treatment; shoulder

Elderly patients with chronic rotator cuff tears (RCTs) can present with significant pain and disability. Massive irreparable RCTs pose a challenge to the treating orthopedic surgeon because of the limited success of many nonoperative treatment modalities and inconsistent results with reconstructive

Approval authority: Kaiser Permanente Southern California Institutional Review Board (No. 5393).

*Reprint requests: Alberto G. Schneeberger, MD, Endoclinic Zurich, Klinik Hirslanden, Witellikerstrasse 40, Zürich CH-8032, Switzerland.

E-mail address: ags@schulter-ellbogen.ch (A.G. Schneeberger).

1058-2746/$ - see front matter © 2017 Journal of Shoulder and Elbow Surgery Board of Trustees. All rights reserved.
http://dx.doi.org/10.1016/j.jse.2017.03.007

surgical options.[4,6,16,17] Although reverse total shoulder arthroplasty (TSA) has shown reliable improvement of shoulder function and pain, there remain medical risks with surgery in this aged population.[3,7] Anterior deltoid rehabilitation has been proposed as an alternative treatment in part to counter the altered biomechanics in a rotator cuff–deficient shoulder.[14]

The role and value of this specific method of nonoperative treatment has not been clearly defined. Although anterior deltoid rehabilitation has been shown to be helpful in the short term, specifically in the debilitated elderly population, little is known about the durability of its benefits and effects on functional outcomes.[14] In certain patients, nonoperative treatment may be successful as the definitive treatment, whereas in others, it may ultimately fail and lead to surgical options. Clinically, it would be helpful to estimate the probability and degree of improvement when counseling patients. It is important to understand what potential improvements a patient may expect with this type of treatment and identify key prognostic factors that can facilitate patient decision making with the surgeon.

The hypothesis of this study was that anterior deltoid reeducation (ADR) would provide significant improvement in patient outcome measurements after 2 years' follow-up. In addition, it was the aim of this study to compare our findings with those of a previous study by Levy et al,[14] who presented a high success rate at 9 months. We also searched for prognostic factors to identify those patients who are more likely to succeed with the ADR protocol.

## Patients and methods

From June 2009 to June 2010, 31 consecutive patients with a minimum age of 55 years and the diagnoses of chronic irreparable RCTs, were prospectively enrolled after patient consent. One patient died during the course of the study and was excluded. There were 19 female and 11 male patients enrolled in the study. The average patient age was 74 years (range, 55-89 years). The other exclusion criteria were prior fracture malunion, cancer or metastatic lesion to the shoulder, traumatic reparable RCT, or shoulder symptoms for less than 6 months before study enrollment.

Shoulder function was determined using the American Shoulder and Elbow Surgeons (ASES) score. The Subjective Shoulder Value (SSV)[5] and the visual analog pain scale (from 0 to 10) were assessed. Strength was evaluated using a handheld strength measurement dynamometer (Lafayette Digital Dynamometer; Lafayette Instrument, Lafayette, IN, USA). If 90° of forward elevation could not be reached (pseudoparalysis), the strength was considered to be 0 kg.[2] Range of motion (ROM) was measured in forward elevation in the scapular plane. Abduction strength, ROM, the SSV, and the ASES score were determined at the first visit and after 9 and 24 months of follow-up. RCT tendon involvement and the radiographic Hamada score[8,21] were determined at the first visit.

All patients had clinical, radiographic, and magnetic resonance imaging confirmation of a massive (involving at least 2 tendons), chronic, irreparable RCT. All patients had grade 3 retraction (according to the Patte classification)[18] and Goutallier grade 4 fatty infiltration of the torn supraspinatus and/or infraspinatus muscles. Those with subscapularis or teres minor tears had at least grade 3 fatty infiltration.[9] The Hamada classification was grade 1 in 4 cases, grade 2 in 11, grade 3 in 3, grade 4a in 7, grade 4b in 5, and grade 5 in 0. Glenohumeral arthritis was present in 12 shoulders. All patients had pain and significant functional weakness for at least 6 months before presentation, as well as medical comorbidities that made them high-risk surgical candidates.

The exercise protocol using the ADR program has been previously described by the Reading Shoulder Unit, Reading, UK.[14] Instruction was performed by a physician in the clinic, and a copy of the instructions with diagrams was given to the patients. Patients were allowed to take nonsteroidal anti-inflammatory medications or pain medications during the rehabilitation process, if needed. Similar to the protocol established in a prior study, pain could be controlled with a single subacromial injection of local anesthetic and long-acting steroid only at the beginning of the study at the discretion of the physician.[14] Ten patients received a steroid injection. After the initial visit, the patients were seen at the following intervals: 6 weeks, 3 months, 9 months, and 24 months. Patient compliance with the ADR program was assessed by asking the patients if they had performed the home-based exercise program 3 to 5 times a day at the 6-week follow-up and 3-month follow-up visits. Photographic documentation of ROM was collected at time 0, at 9 months, and at 2 years for each patient.

Failure of the ADR program was defined as patient abandonment of the protocol because of pain and/or a patient's decision to undergo subsequent surgery (as recommended by Itoi[11]) or a less than 20-point improvement in the ASES score at final follow-up (as recommended by Kwon et al[13]). We analyzed whether there was a statistically significant difference between pre- and post-ADR measurements including pain, ROM, strength, SSV, and ASES score for those patients who completed the rehabilitation program. We then analyzed whether gender, age, and the pre-ADR factors—such as pain score, ROM, SSV, ASES score, pseudoparalysis, number of rotator cuff tendons involved, involvement of subscapularis or teres minor, presence of glenohumeral arthritis, and Hamada grade—could predict a successful outcome for the ADR program after 2 years.

### Statistical analysis

Statistical analysis was performed using GraphPad Prism software (version 7; GraphPad Software, San Diego, CA, USA) and SPSS software (version 21; IBM, Armonk, NY, USA). To detect a difference at the .05 level of significance with 90% power while using a difference in SD of 25, we calculated that 19 patients were sufficient or, assuming a 35% dropout rate, 30 patients were sufficient. The Fisher exact test was used to analyze a possible association of pre-ADR factors with a successful outcome at 2 years. One-way repeated-measures analysis of variance was used to analyze differences between the variables at the beginning of the study, after 9 months of follow-up, and after 2 years of follow-up. These analyses were limited to those patients who finished the study without dropout. All statistical tests were 2 sided; the level of significance was set at $P < .05$.

## Results

Only 21 of 30 patients were compliant. The 9 noncompliant patients were not able to complete the ADR program because