

The Role of Acromioplasty for Rotator Cuff Problems

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KEYWORDS

• Acromioplasty • Subacromial decompression • Impingement syndrome • Rotator cuff repair

KEY POINTS

- Acromioplasty is a well-described technique used for a variety of rotator cuff pathologies, with a rapid rise in its use over the past several years.
- There are 2 competing theories regarding rotator cuff pathology— intrinsic and extrinsic— that either support or limit the potential benefits of acromioplasty.
- Acromioplasty may be an effective treatment option for subacromial impingement refractory to conservative therapy.
- The utility of acromioplasty at the time of rotator cuff repair has come into question, with new studies showing no significant benefit.
- Further studies with long-term follow-up are required to determine the efficacy of acromioplasty for impingement syndrome and during rotator cuff repair.

INTRODUCTION

In 1972, Neer first described acromioplasty and reported on its utility in treating chronic impingement syndrome.¹ He postulated acromial morphology as the initiating factor leading to dysfunction of the rotator cuff and eventual tearing.^{1,2} This tenet is the basis for the extrinsic theory of rotator cuff degeneration and has had a profound impact on surgical practice, with several investigators advocating for concomitant acromioplasty during surgical repair of rotator cuff tears.^{3–6} According to Neer's original description of the acromioplasty procedure, the anterior edge and undersurface of the anterior acromion is removed as well as the coracoacromial ligament. Since then, various

modifications have been proposed. For example, in 1987, Ellman⁷ described an arthroscopic technique to accomplish coracoacromial ligament release, resection of the anterior acromion undersurface, and bursal débridement, which he termed, *arthroscopic subacromial decompression (SAD)*. McCallister and colleagues⁸ as well as Matsen and Lippitt⁹ described a “smooth and move,” which involves an extensive bursectomy and smoothing of the undersurface of the acromion without altering acromial morphology. A potential complication of acromioplasty is postoperative avulsion of the deltoid origin due to its weakening by the procedure.^{1,10} In order to avoid this, the smoothing procedure does not involve resection or release of the coracoacromial ligament.

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In contrast to the extrinsic theory, the intrinsic theory of rotator cuff pathology proposes that abnormalities of the rotator cuff occur secondary to intratendinous degeneration or tendinosis, which in turn results when eccentric tensile overload occurs at a rate greater than the ability of the cuff to repair itself.³ According to this perspective, acromioplasty as a form of treatment fails to address the aforementioned primary problem of intratendinous degeneration.

Recent epidemiologic studies have clearly demonstrated a rapid rise in the number of acromioplasty procedures performed in the United States on an annual basis. Vitale and colleagues¹¹ reviewed the records from the New York Statewide Planning and Research Cooperative System (SPARCS) ambulatory surgery database from 1996 to 2006 and the American Board of Orthopaedic Surgery (ABOS) database from 1999 to 2008 to identify patients who had an acromioplasty. The investigators found a 254.4% increase in the SPARCS group versus 142.3% in the ABOS group for the number of acromioplasties over their respective time-periods. Yu and colleagues¹² reviewed the records of 246 patients identified from the Rochester Epidemiology Project, cataloging medical records of residents in Olmsted County, Minnesota, who had an isolated acromioplasty performed between 1980 and 2005. They found a 575.8% increase over this time period, further demonstrating the widespread popularity of this procedure. Although there are many possible explanations for the observed increase in the annual number of acromioplasties, there is a need to evaluate whether this observed rise is associated with sound clinical indications supported by high-level clinical evidence.

At the present time, the 2 most common indications for performing an acromioplasty are subacromial impingement refractory to nonoperative care and during arthroscopic or open rotator cuff repair. The purpose of this article is to summarize and review the current evidence regarding the efficacy of acromioplasty both for subacromial impingement syndrome (SAIS) and during arthroscopic repair of rotator cuff tears.

ACROMIOPLASTY FOR MANAGEMENT OF SUBACROMIAL IMPINGEMENT SYNDROME

Rotator cuff disease with subacromial impingement has been described in 3 stages: stage 1, acute inflammation and either tendonitis or bursitis; stage 2, chronic inflammation with or without degeneration; and stage 3, full rupture of the cuff.¹³ Subacromial impingement occurs

when the normal sliding mechanism, while lifting the arm, is disrupted by compression of the soft tissues between the coracoacromial arch and the greater humeral tuberosity.¹⁴ Patients complain of pain over the anterolateral shoulder, radiating down the lateral humerus.¹⁵ They also report pain when laying on the affected extremity, often-times awakening them at night. Activities of daily living, such as combing hair or reaching for an item in a cupboard, are painful. Neer and Hawkins tests are 2 provocative examination maneuvers that are highly sensitive but not specific to subacromial impingement. Combined, they have a negative predictive value of 90%.¹⁶

Initial conservative management for SAIS includes nonsteroidal antiinflammatory drugs, physical therapy (PT), and corticosteroid injections. Few studies have looked at each of these modalities separately to determine their respective efficacy. Desmeules and colleagues¹⁷ performed a systematic review evaluating the effectiveness of PT in treating impingement syndrome. In their review of 7 studies, they found that evidence did not support PT as an effective modality. More recently, however, Hanratty and colleagues¹⁸ performed a systematic review and meta-analysis that included 16 studies (4 high quality, 7 medium quality, and 5 low quality) regarding PT in patients with subacromial impingement. They concluded that there was strong support for exercise in decreasing pain and improving function at short-term follow-up. There was also moderate evidence that exercise results in short-term improvement in mental well-being and a long-term improvement in function.

The current belief is that SAD is the gold standard surgical treatment. Several studies, however, have brought this into question. Brox and colleagues^{19,20} (level 4, grade B-C) compared the outcomes of patients with stage 2 impingement, dividing them into 3 groups—PT, SAD, and placebo. They found that PT and SAD were each better than placebo but found no difference between the PT and SAD groups at 6 and at 30 months. Haahr and colleagues²¹ (level 4, grade C) performed a randomized control study with 1-year follow-up comparing exercise to SAD. They found no statistically significant difference in the mean change in Constant scores between groups at 3, 6, and 12 months or in the Project on Research and Intervention in Monotonous Work (PRIM) scores (aggregated pain and dysfunction score) at 12 months. Rahme and colleagues²² (level 4, grade C) compared open SAD to a physiotherapy regimen. At 6 and 12 months, there was no statistically significant difference between groups. Thus, these 3 studies, albeit of low quality, found

no difference between SAD and conservative therapy.²³

More recently, Ketola and colleagues²⁴ (level 1) performed a 2-year randomized controlled trial (RCT) comparing a supervised exercise program with arthroscopic acromioplasty followed by a supervised exercise program, with the main outcome measure self-reported pain on a visual analog scale (VAS). Although both groups showed an improvement, there was no statistically significant difference in the degree of improvement between groups on the VAS nor in secondary outcome measures of disability, pain at night, shoulder disability questionnaire score, number of painful days, and proportion of pain-free patients. The investigators note, however, that it seemed the operative group recovered faster in all parameters when assessed from the initiation of the treatment. At this time, the evidence does not seem to support acromioplasty over therapy and exercise and places in question its status as the gold standard of treatment of SAIS.

A study by Magaji and colleagues²⁵ (level 3) investigated the efficacy of SAD in patients with SAIS refractory to conservative therapy for 6 months. They found that patients with all of the following 4 criteria were excellent candidates for SAD: pain in the shoulder with overhead activity or in the midarc of abduction; a repeatedly positive Hawkins test; temporary pain relief (minimum 2 weeks) after subacromial steroid injection; and radiologic evidence of impingement with sclerosis, cysts, or osteophytes at the greater tuberosity and acromion. Perhaps the key to obtaining successful outcomes with surgical intervention lies in using strict criteria for identifying appropriate patients for SAD—that is, patients who have failed a prolonged nonoperative regimen for a minimum of 6 months, including supervised physical therapy, injections, and activity modification.

ACROMIOPLASTY DURING ARTHROSCOPIC ROTATOR CUFF REPAIR

There several pros and cons associated with performing an acromioplasty during arthroscopic rotator cuff repair. Advantages of performing an acromioplasty include improved arthroscopic visualization and ability to control bleeding in the subacromial space as well as an increase in the local concentrations of growth and angiogenic factors, potentially improving the healing environment.^{26,27} Possible disadvantages include weakening of the deltoid origin, a risk of anterosuperior instability in the presence of a failed rotator cuff or irreparable tear,^{28,29} and adhesions between the raw exposed bone on the undersurface

of the acromion and the underlying tendon can form, which in turn can limit smoothness, motion, comfort, and range of motion.^{30–32}

Traditionally, acromioplasty has routinely been performed as part of a rotator cuff repair. This stems from Neer's extrinsic theory of subacromial impingement. In the late 1990s, however, the intrinsic theory began to take hold, postulating that overuse and injury to the rotator cuff initiates as cascade that leads to narrowing of the subacromial space and a secondary impingement.³ A recent systematic review by Seitz and Michener,³³ looking at ultrasonographic measurement of the subacromial space in patients with rotator cuff tears, seems to support this theory. Using 5 studies, they found that individuals with full-thickness cuff tears had a statistically significant decrease in the acromiohumeral distance compared with normal patients and even those with SAIS. This suggests that the pathoanatomy of cuff disease results in a secondary impingement and that perhaps addressing the cuff disease alone may secondarily ameliorate the impingement effect.

Testing whether a cuff repair without acromioplasty would still show significant improvement, McCallister and colleagues⁶ (level 4) performed 96 consecutive full-thickness rotator cuff repairs without acromioplasty as part of a prospective cohort study. They looked at self-assessment of shoulder function with the Simple Shoulder Test and general health status with the Short Form-36 questionnaire. Of the 61 patients who participated in the study with a minimum 2-year follow-up, statistically significant improvement in shoulder comfort and function was noted, thereby bringing into question whether acromioplasty did improve outcomes.

Several high-level studies have attempted to investigate whether acromioplasty is a necessary part of a rotator cuff repair. Gartsman and O'Connor³⁴ (level 1) performed a prospective RCT comparing rotator cuff repair with acromioplasty versus without with a minimum of 1-year follow-up. They found no statistical difference in the American Shoulder and Elbow Surgeons (ASES) shoulder scores between groups, with the conclusion that acromioplasty does not affect functional outcome after cuff repair.

Milano and colleagues³⁵ (level 1) evaluated the role of SAD in rotator cuff repair in a prospective RCT of 80 patients divided equally between groups with a minimum 2-year follow-up. They found no difference either in the Constant score, which was normalized for age and gender, or in the Disabilities of the Arm, Shoulder and Hand (DASH) and Work-DASH scores. Thus, they also

concluded that SAD did not alter outcomes of rotator cuff repair.

MacDonald and colleagues³⁶ (level 1) compared functional and quality-of-life indices and rates of revision surgery in arthroscopic rotator cuff repair with and without acromioplasty in a prospective RCT. They used the Western Ontario Rotator Cuff Index (WORC) score as the primary outcome and the ASES score as a secondary outcome. Also reviewed were the numbers of revision surgeries required. No difference was found in the WORC or ASES scores at any time point. They did find a strong trend, however, in the number of patients who required reoperation in the nonacromioplasty group ($P = .05$).

Combining these 3 prospective RCTs as well as an unpublished RCT,³⁷ Chahal and colleagues³⁸ conducted a level 1 systematic review and meta-analysis evaluating the role of SAD in full-thickness rotator cuff repairs in 373 patients. A quantitative synthesis demonstrated no significant difference in functional outcomes (Constant and ASES scores) or the rate of reoperation in the first 2 years after surgery.

Most recently, Shin and colleagues³⁹ (level 2) performed a randomized comparative study investigating the role of acromioplasty at the time of arthroscopic rotator cuff repair in patients with small- to medium-sized tears. They found no significant difference in range of motion or VAS, ASES, Constant, and University of California, Los Angeles, scores between groups. There was also no statistically significant difference in the rate of rotator cuff repair failure as assessed by postoperative MRI.

At this time, the American Academy of Orthopaedic Surgeons clinical practice guidelines for the treatment of rotator cuff tears do not recommend routine acromioplasty during rotator cuff repair.⁴⁰ Based on the best available evidence today, the authors fully endorse that there are no benefits in measured outcomes at up to 2 years after surgery; however, the long-term effects of performing or not performing an acromioplasty at the time of rotator cuff repair are not known. It may be possible that certain groups do benefit from acromioplasty (eg, acquired type 3, lateral downslope). Larger well-designed RCTs will allow investigators to perform the appropriate subgroup analyses to address these issues.

SUMMARY

Long-term follow-up with stratification for acromion type and workers' compensation status is required to determine the efficacy of acromioplasty for impingement syndrome and during

rotator cuff repair. Furthermore, in the setting of SAIS, there are no studies comparing SAD with combined injection (cortisone and platelet-rich plasma) and PT regimens. For both of the aforementioned clinical indications for acromioplasty, outcome measures of interest should be uniformly reported and include a disease-specific quality-of-life measure (WORC), a generic patient-reported outcome measure (DASH, ASES, or Constant score), objective deltoid strength measurement, and postoperative imaging to evaluate acromial morphology, rotator cuff healing, and the presence of anterosuperior escape in the setting of failed or new rotator cuff tears.

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