

# Evaluation of Functional Outcome of Arthroscopic Rotator Cuff Repair Using Southern California Orthopedic Institute Technique

## Abstract

**Background:** The number of anchors and modality of fixation to be used has been a point of debate in the arthroscopic management of rotator cuff repair. Southern California Orthopedic Institute (SCOI) technique has shown better anatomical healing of tendons using single-row anchors. In this study, we evaluated the functional outcomes of arthroscopic rotator cuff repair using the SCOI technique, in Indian population. **Materials and Methods:** Thirty two patients (16 males and 16 females) were included in the study, and underwent an arthroscopic repair of small-to-medium-sized rotator cuff tear, at a single institution, for 12 months. Postoperatively, patients were evaluated using UCLA score and Constant-Murley score, and range of motion was analyzed and documented using photographs. **Results:** Mean age was 57.06 years, and the most common cause of cuff tear was a traumatic degeneration. Mean UCLA score improved from preoperative 8.75 to postoperative 31.79, at 12 months, with the  $P < 0.001$ . Similarly, mean Constant-Murley score improved from preoperative 20.66 to postoperative 81.31, at 12 months, with  $P < 0.001$ . **Conclusion:** We conclude that the SCOI single-row technique proves to be a good and effective modality of treatment in the arthroscopic management of small-to-medium-sized rotator cuff tears. In Indian population, considering cost-effectiveness, single-row repair of rotator cuff tears using SCOI technique can be an interesting option in its management.

**Keywords:** Cost-effectiveness, rotator cuff, single-row repair, Southern California Orthopedic Institute technique

**Nilesh Kamat,  
Ankur Parikh,  
Parth Agrawal**

Department of Orthopaedics,  
Jehangir Hospital, Pune,  
Maharashtra, India

## Introduction

The rotator cuff is one of the dynamic stabilizers of the shoulder. The rotator cuff disease is one of the most commonly encountered degenerative conditions by orthopedic surgeons in day-to-day outpatients department. Few studies have documented that tear in rotator cuff increases with advancing age. The frequency of full-thickness tears of rotator cuff range from 7% to 40%.<sup>1</sup> Factors affecting surgical outcomes have important functional and financial ramifications, for the patient and for society. A number of methods have been described for rotator cuff repair, which provides strong initial fixation, mobility, and relief from pain.

Single-row constructs, traditionally done with anchors placed in the linear manner from anterior to posterior on greater tuberosity, offers excellent clinical results, despite modest healing rates. Double row constructs have been designed to address

issue of incomplete healing and retears, utilizing both medial and lateral row anchors, which, in theory, provide better fixation and coverage of footprint for rotator cuff to heal. Nevertheless, several biomechanical analysis have shown that there is no difference in clinical outcomes, with possible exception in large to massive tears.<sup>2,3</sup>

The purpose of this study was to evaluate the functional outcomes after arthroscopic single-row repair of full-thickness rotator cuff tears, using the Southern California Orthopedic Institute (SCOI) technique.<sup>4</sup>

## Materials and Methods

This study was performed prospectively. 32 patients (16 male and 16 female patients), with small-to-medium-sized full-thickness rotator cuff tears, were operated and followed up for up to 12 months, to evaluate their functional outcomes in a single institute between May 2015 and April 2017. We included patients from 40 to 80 years age, with Grade CI and

### Address for correspondence:

Dr. Ankur Parikh,  
Jehangir Hospital, 32, Sassoon  
Road, Pune - 411 001,  
Maharashtra, India.  
E-mail: ankurparikh309@gmail.  
com

### Access this article online

**Website:** www.ijoonline.com

**DOI:**  
10.4103/ortho.IJOrtho\_444\_17

### Quick Response Code:



**How to cite this article:** Kamat N, Parikh A, Agrawal P. Evaluation of functional outcome of arthroscopic rotator cuff repair using southern california orthopedic institute technique. Indian J Orthop 2019;53:396-401.

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CII (SCOI)<sup>5</sup> rotator cuff tears, diagnosed either on magnetic resonance imaging or arthroscopically. Patients with partial thickness tears, large or massive tears (Grade CIII and CIV SCOI classification), Grade 3 retraction (Patte classification),<sup>6</sup> Grade 3 or 4 fatty infiltration (Goutallier classification)<sup>7</sup> along with other pathologies of the shoulder, were excluded from our study [Figure 1].

### Operative procedure

All the patients were operated in lateral decubitus position, under general anesthesia and interscalene block, with shoulder in 45° abduction and 15° of forward flexion [Figure 2]. Diagnostic arthroscopy was performed using posterior and anterior portals 15-point anatomy review, described by Snyder.<sup>8</sup> After assessing appropriate glenohumeral anatomy, subacromial bursoscopy was performed using the same portal. The posterolateral viewing portal was established by an outside-in technique. Adequate subacromial decompression was performed through the lateral portal using a motorized shaver, burr, and the radiofrequency device [Figure 3]. After the tear was

classified, accessory portals were created laterally, to insert the anchors in correct angle (Deadman angle), and anteriorly to easily bring the sutures through the tendon [Figure 4]. The first anchor was placed in the footprint approximately 5 mm lateral from the articular cartilage margin [Figure 5]. The second anchor was inserted 10–12 mm anterior or posterior, in the same distance from the articular cartilage margin. The sutures were passed through the rotator cuff tendon approximately 10–15 mm medial to the edge of rotator cuff tear, with the distance of 5–6 mm between the stitches using the EXPRESSEW III device [Figure 6]. The number of anchor was dependent on the length of the tear. The tying of the knots was done from posterior to anterior direction. We preferred a “sliding Duncan knot”<sup>9</sup> for primary fixation, and then five half hitches for locking mechanism of the base knot [Figures 7 and 8]. At the end, marrow vents were created using a 3 mm awl to create a “Crimson Duvet” effect [Figure 9].<sup>10</sup>

Once the rotator cuff tear was identified, it was repaired using the SCOI technique. Three important steps of

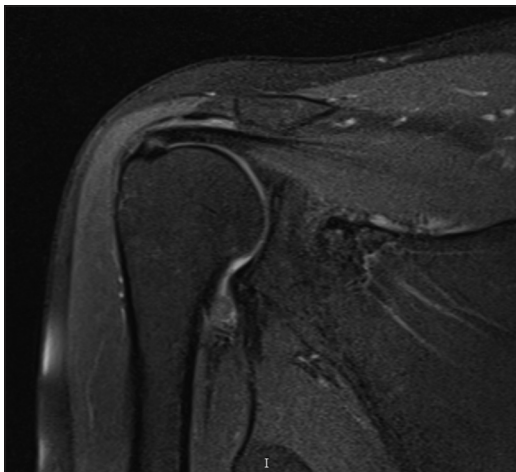


Figure 1: Preoperative magnetic resonance imaging signifying rotator cuff tear

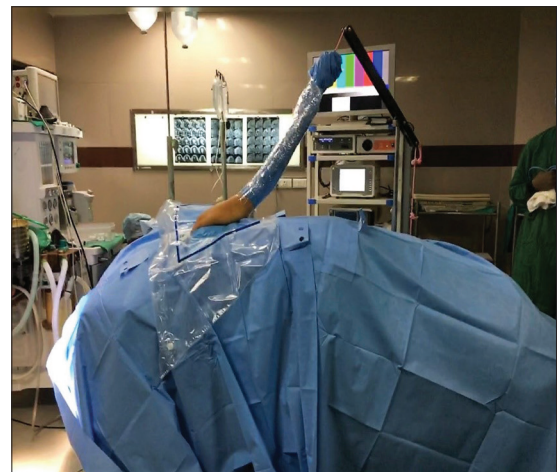


Figure 2: Lateral decubitus position of patient for shoulder arthroscopy with arm suspended by a shoulder traction pulley in 45° abduction



Figure 3: Visualization of rotator cuff tear from posterior portal through subacromial side



Figure 4: Positioning the pilot hole to at Deadman's angle (approximately 45°) just lateral to the articular cartilage of proximal humerus

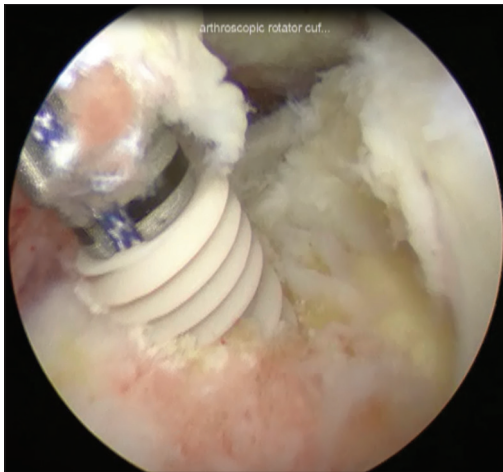


Figure 5: Inserting a suture anchor through the pilot hole

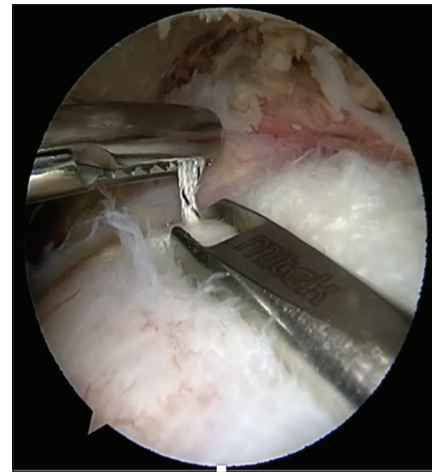


Figure 6: Passing the anchor sutures across the rotator cuff tendon

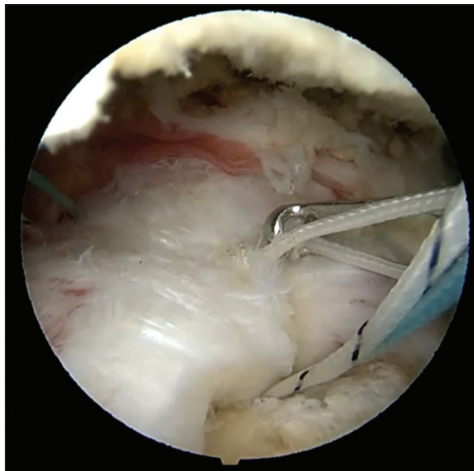


Figure 7: Tying the knot with knot pusher



Figure 8: Southern California Orthopedic Institute configuration in repair

Southern California Orthopedic Institute technique include

- (a) A single row of triple-loaded suture anchor(s)
- (b) Insertion of anchor near medial edge of anatomical neck at a 45° dead man angle, using an accessory portal
- (c) Microfracture punctures are created in the tuberosity bone lateral to the anchors, which enables bone marrow elements to flow out, to cover and nourish the healing tendon by creating a “Crimson Duvet.”<sup>10</sup>

The steps for performing the SCOI Row technique<sup>4</sup> are consistent, reproducible, and reliable, and have given, we believe, the best possible chance for healing without unnecessary surgical morbidity and cost.

### Postoperative rehabilitation

The physiotherapy regime is divided into four phases:<sup>11</sup>

#### Phase I-rest

First 4 weeks, only Scapular Setting exercises shoulder shrug, scapular retraction and pendulum exercise - were advised along with ipsilateral hand, wrist and elbow

active range of motion exercises. No forceful stretching or mobilization was performed. Extreme abduction and external rotation were not done to avoid stressing the repair. Supervised passive range of motion were advised in all planes.

#### Phase II-active-assisted movement and active range of motion exercises

Initiated between postoperative 4<sup>th</sup> and 8<sup>th</sup> weeks. Along with passive range of motion active-assisted range of motion exercises were encouraged in all planes. As patients tolerated, active range of motion exercises were started.

#### Phase III-strengthening period

Initiated between postoperative 12<sup>th</sup>–16<sup>th</sup> weeks. Rotator cuff strengthening exercises with theraband were initiated. Normal activities were encouraged.

#### Phase IV-sport-specific rehabilitation activities

Initiated between postoperative 16<sup>th</sup>–18<sup>th</sup> weeks, and was characterized by advanced strengthening, a transition to sport-specific rehabilitation activities, and muscular



endurance training for return to maximum tensile strength. Shoulder exercises such as internal and external rotation were performed in increasing functional positions by changing the angle of shoulder abduction. Exercises from Phase III were advanced by altering force, speed, angles, and decreasing the amount of stability. Advanced closed kinetic chain and plyometrics were initiated at the end of this phase, progressing toward sport-specific strengthening. Patient goals, age, tissue integrity, and size of cuff repair were carefully considered before progressing exercises at the end of Phase IV.

## Results

The functional outcomes were evaluated using UCLA score<sup>12</sup> and Constant-Murley score<sup>13</sup> postoperatively, at 6 weeks, 3, 6, and 12 months, and compared with preoperative scores [Figure 10a-d].

In our study, the most common age group was 51–60 years, with mean age 57.06 years. Second-most common age group was 61–70 years [Figure 11]. The most common cause of cuff tear was atraumatic (59.4%), because of age-related degeneration [Figure 12].



Figure 9: Crimson duvet

Mean UCLA score improved from preoperative 8.75 to postoperative (12 months) 31.79 out of 35, and mean Constant-Murley score improved from preoperative 20.66 to postoperative (12 months) 81.31 out of 100 [Figure 13]. According to UCLA score grading, 93.1% cases had good to excellent functional outcome, and according to Constant-Murley score grading, 75.86% cases had satisfactory to good outcome, and 17.24% cases had excellent functional outcome [Figure 14]. In both gradings, there was no poor outcome case, and fair outcomes were noted in 6.89% cases.

The majority (93.75%) of patients had no complications. On the other hand, 3.125% ( $n = 1$ ) had pull out of anchor because of nonadherence to strict postoperative protocol, and aggressive unsupervised exercises. Another 3.125% ( $n = 1$ ) had superficial skin infection, which was managed conservatively with dressing and oral antibiotics on outpatient department basis, without any further consequences. We did not encounter any case of cuff retear, and no case of postoperative shoulder stiffness was noted.

## Discussion

The rotator cuff is a dynamic stabilizer of the glenohumeral joint, and its repair is a necessity to reestablish normal kinematics of the shoulder. Earlier treatment modalities consisted of open and mini-open techniques, but it is quite clear that arthroscopic management of rotator cuff tears has become the standard technique, globally, for the treatment of such lesions. Open repair technique and mini-open repair technique have several disadvantages, such as loss of anterior deltoid function, and higher postoperative pain.

Still, open repair does not allow the patient to be involved in a postoperative accelerated rehab protocol if that is the choice of the surgeon.

Arthroscopic repair of rotator cuff tear has led to decrease in immediate postoperative pain, decreased surgical insult to the deltoid, and decreased postoperative stiffness. Thus, results increased considering functionality, work,



Figure 10: (a) A case 58 years/male with right side full thickness rotator cuff tear showing range of movement and strength at 12 months' postoperative followup. Flexion and External rotation. (b) Abduction. (c) Internal rotation. (d) Muscle power testing (2 kg)

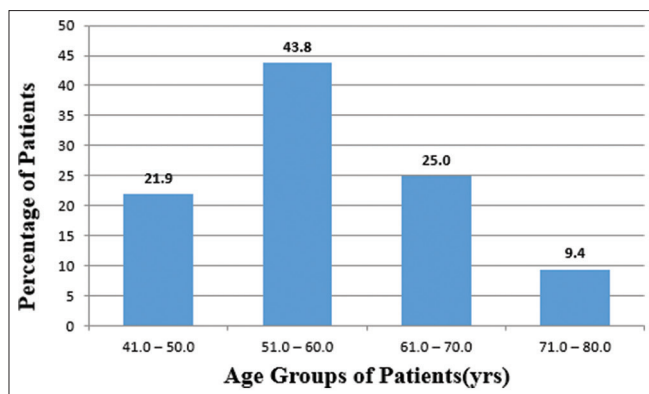


Figure 11: Age distribution

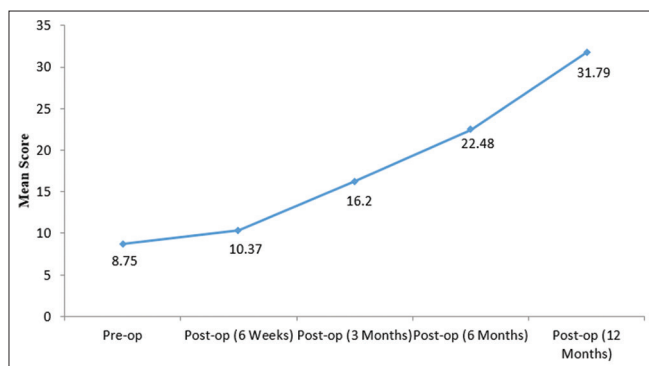


Figure 13: Distribution of UCLA mean score

and patient satisfaction. The present study documents are experienced with arthroscopic repair of full-thickness tears of the rotator cuff.

The mean age of patients was 57.06 years (range 41–77 years) in this study. In the study by Gartsman *et al.*,<sup>14</sup> the average age of patients at the time of operation was 60.7 years (range 31–82 years).

In this study, we found that the majority of rotator cuff tears were atraumatic (59.4%), similarly like in studies by Tempelhof *et al.*,<sup>15</sup> and by Milgrom *et al.*,<sup>16</sup> which show that degeneration is the most common cause of rotator cuff tears.

In this study, UCLA scoring was categorized into preoperative and postoperative, with the preoperative mean value of 8.75 (standard deviation [SD] 3.27) and postoperative mean value of 31.79 (SD 1.99), with the  $P < 0.001$  with paired  $t$ -test, and was considered significant. Gartsman *et al.*<sup>14</sup> noted in 73 patients 12.4–31.1 points. In 2014, Kumar *et al.*<sup>1</sup> observed in 25 patients, mean UCLA score increased from the preoperative 15.84 to postoperative 30.28 points. Burks *et al.*<sup>17</sup> noted in 20 patients 12.1–28.6 points.

In our study, Constant scoring was categorized into preoperative and postoperative, with the preoperative mean value of 20.66 (SD 11.17) and postoperative mean value of 81.31 (SD 8.44), with the  $P < 0.001$  with paired  $t$ -test,

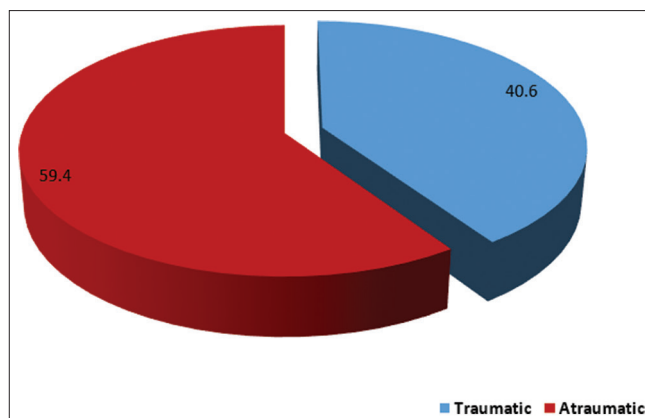


Figure 12: Mode of injury

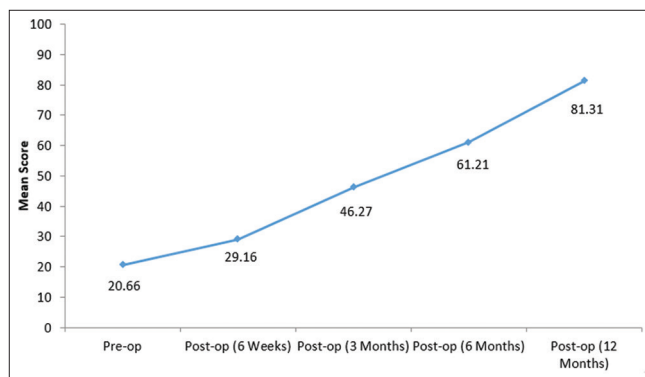


Figure 14: Distribution of Constant-Murley score

and was considered significant. Gartsman *et al.*<sup>14</sup> noted in 73 patients 41.7–83.6 points. Burks *et al.*<sup>17</sup> observed in 12 patients, mean Constant score increased from the preoperative 44.1 to postoperative 77.8 points.

We did not encounter any case of infection or re-tear, as the duration of followup was constrained. That was a limitation of this study. Still, we have not compared our results with a double-row repair technique, in same tears, and in the same scenario.

Other advantages of arthroscopic single-row repair include less implant cost, less operative time, less technical difficulties, and less occupancy of space in proximal humerus by anchors. The additional advantages of the SCOI row technique over other single-row repair methods are:

1. SCOI row technique provides low tension repair, as the placement of anchors are on medial edge, just lateral to the articular cartilage. Thus, decreasing the chances of late complication like partial articular supraspinatus tendon avulsion lesion or full thickness tear
2. Crimson Duvet increases healing potential at repair site [Table 1].

## Conclusion

Arthroscopic repair for full-thickness supraspinatus tears is a good and effective modality of treatment, with

**Table 1: Comparison of results of present study with previous studies**

Study/particulars	Present study	Gartsman <i>et al.</i> <sup>14</sup>	Kumar and Jadhav <sup>1</sup>	Burks <i>et al.</i> <sup>17</sup>
Mean age (years)	57.06	60.7	50.48	56
Number of patients	32	73	30	20
Followup (months)	12	12	11.72	12
UCLA score				
Preoperative	8.75	12.4	15.84	12.1
Postoperative	31.79	31.1	30.28	28.6
<i>P</i>	<0.001	0.001	<0.001	<0.001
Constant score				
Preoperative	20.66	41.7	Not	44.1
Postoperative	81.31	83.6	reported	77.8
<i>P</i>	<0.001	0.001		<0.001

minimal complication rate, and although the double-row repair technique claims to be biomechanically superior, with greater healing rate, it does not have functional advantages over single-row repair.<sup>18,19</sup> Thus, considering the cost of implants among Indian population, single-row repair of supraspinatus tear, using SCOI technique, can be a good option in arthroscopic management of small-to-medium-sized full-thickness supraspinatus tears.

#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patient understands that name and initials will not be published, and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

#### Financial support and sponsorship

This study is not supported by any grant whatsoever from any institute or organization or company.

#### Conflicts of interest

There are no conflicts of interest.

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