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The Nirschl procedure versus arthroscopic extensor carpi radialis brevis débridement for lateral epicondylitis

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Background: The Nirschl technique and arthroscopic débridement are common surgical procedures for chronic lateral elbow tendinopathy. The purpose of this study was to compare outcomes following the use of these techniques to treat chronic lateral elbow tendinopathy.
Methods: We retrospectively reviewed 59 elbows of 55 patients who did not improve after conservative treatment. Twenty-nine elbows of 26 patients were treated with the Nirschl procedure (Nirschl group), and 30 elbows of 29 patients were treated with arthroscopic débridement (arthroscopy group). Outcomes were assessed subjectively with the quick Disabilities of the Arm, Shoulder and Hand questionnaire and the visual analog scale (VAS) for pain in 3 domains (overall pain, pain at rest, and pain during hard work) and objectively with pain-free grip strength.
Results: The Nirschl and arthroscopy groups showed significant improvements in subjective and objective outcomes at a mean of 28.5 months and 31 months, respectively ($P < .05$). No significant between-group differences were found in postoperative outcomes, including quick Disabilities of the Arm, Shoulder and Hand questionnaire scores; pain-free grip strength; and VAS scores for overall pain and pain at rest ($P > .05$). However, a small but significant difference was found in the postoperative VAS score for pain during hard work (1.6 ± 1.3 for Nirschl group vs 2.2 ± 2.0 for arthroscopy group, $P = .042$).
Conclusions: Both techniques are comparable and highly effective for treating chronic recalcitrant lateral elbow tendinopathy. Although the Nirschl technique provides slightly superior pain relief during hard work, the effect size is very small and the difference does not appear to be clinically important.
Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

Keywords: Tennis elbow; Nirschl; open surgery; arthroscopy; comparative study; DASH

Lateral elbow tendinosis (LET) is a degenerative condition occurring at the bone-tendon interface of the extensor carpi radialis brevis (ECRB) origin at the lateral epicondyle.[4] Its natural course is considered self-limiting.[28] However, a substantial proportion of patients with this condition have pain and disability even after 1 year of various conservative treatments.[6,25] Patients with a symptom duration greater than 6 months or who receive local steroid injections have been found to have a poor potential for spontaneous recovery[5,6,25,28] and have a greater risk of undergoing surgical treatment.[25] Thus, surgery is considered in patients with a symptom duration greater than 6 months and with

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persistent severe pain despite conservative treatment for more than 3 months.

The Nirschl procedure is time-tested and one of the most widely used methods for surgical treatment of chronic recalcitrant LET.[16] The arthroscopic technique is another useful option that was developed more recently.[3] The advantages of the arthroscopic technique are that it is minimally invasive, is able to address concomitant intra-articular pathology, and provides early functional recovery and effective relief of pain.[26] However, clinical outcomes after Nirschl and arthroscopic tennis elbow débridement have not been directly compared with validated measures.

The purpose of this retrospective study was to compare outcomes after the Nirschl and arthroscopic techniques for the treatment of chronic LET using validated outcome assessment measures. The null hypothesis was that the Nirschl and arthroscopic techniques were equally effective.

Methods

This was a retrospective comparative study of the Nirschl procedure and arthroscopic débridement for the treatment of chronic LET. We searched our institutional database for patients who underwent surgical treatment for chronic LET by a single surgeon from January 2008 to June 2014. The indications for surgery for LET were failure of conservative therapy for more than 3 months, symptom duration longer than 6 months, and persistent severe pain (visual analog scale [VAS] pain score ≥5). We made the diagnosis of LET when tenderness to palpation at the ECRB origin of the lateral epicondyle and the Thomsen test were positive. We routinely examined patients with LET with palpation of the soft spot and the radiocapitellar joint line and with the lateral pivot-shift test to rule out lesions that mimic LET, such as radiohumeral plica syndrome or posterolateral rotatory instability. We used imaging studies, including radiography and ultrasonography, to rule out joint or bony lesions and to confirm degenerative changes at the ECRB origin. The exclusion criteria were the presence of concomitant elbow lesions likely to affect elbow function (fracture or ligament injuries at the ipsilateral elbow, moderate to severe osteoarthritis of the elbow joint with large osteophytes and/or joint space narrowing visible on plain radiography, and elbow joint stiffness) and a follow-up period shorter than 12 months after surgery.

Operative procedures

The choice of the surgical technique was made according to the surgeon's discretion. The arthroscopic procedure was performed in a modified fashion from the description of Baker et al.[3] After receiving general or regional anesthesia, the patient was placed in the lateral decubitus position, with the arm supported by a side bar and the elbow at 90° of flexion. The elbow was prepared and draped, and the tourniquet was inflated. After marking of landmarks and joint distention with a 20- to 25-mL saline solution injection, the proximal anteromedial portal was established as a viewing portal at approximately 2 cm proximal to the medial epicondyle and 1 cm anterior to the medial intermuscular septum. A 2.9-mm, 30° arthroscope (Linvatec, Largo, FL, USA) was introduced through the viewing portal, and the proximal anterolateral portal was established as a working portal under arthroscopic visualization using the outside-in technique at the level of the proximal margin of the capitellum. Joint distension was achieved with gravity inflow. We inspected the elbow joint for capsule changes, cartilage degeneration, and other pathologic lesions, such as radiohumeral plica or posterolateral rotatory instability. The lateral joint capsule was released from the proximal and lateral margins of the capitellum using a 3.5-mm shaver (Linvatec) until the undersurface of the ECRB tendon was visualized (Fig. 1, *A* and *B*). Then, we advanced the arthroscope laterally and proximally and followed the ECRB tendon to its attachment site to the lateral epicondyle (Fig. 1, *C*). Tendinosis is typically located at the ECRB insertion site to the lateral epicondyle and looks like lint, with the loss of a shiny surface and parallel bundles of fibers. The ECRB tendon origin was then removed using a 2.4-mm, 30° radiofrequency ablation device (ArthroCare, Sunnyvale, CA, USA). Removal was begun from the proximal and anterior edge of the ECRB footprint on the lateral epicondyle and progressed in the posterior and distal directions, while being limited anterior to the midline of the radial head to avoid injuries to the lateral collateral ligament.[8] The ECRB tendon was distally retracted after ablation (Fig. 1, *D* and *E*). We then used a 3.5-mm shaver to remove remnant tendinosis and calcified tissue from the retracted ECRB tendon and the lateral epicondyle. Decortication of the lateral epicondyle was not performed. We removed the radiohumeral plica if it was symptomatic. The skin was repaired, and a bulky compressive dressing was applied.

Open surgery was conducted following the description of Nirschl and Pettrone.[19] Under general or regional anesthesia and with tourniquet control, the patient was placed in the supine position. An approximately 4- to 5-cm-long oblique incision was made just anterior to the lateral epicondyle. At the deep fascial layer, an interval between the extensor carpi radialis longus (ECRL) and extensor digitorum communis (EDC) tendons was visually identified, incised, and spread. The ECRB tendon was identified under the EDC tendon and was inspected for typical degenerative changes. We were able to identify tendon degeneration visually in all open surgery cases, and we sharply excised the tendon about 1 cm in length, including the degenerated part, from its insertion to the lateral epicondyle. A scratch maneuver with a No. 15 scalpel blade was used to remove remnant degenerated tendon at the anterior EDC.[7] The ECRL fascia was then repaired to the EDC fascia with No. 3-0 absorbable sutures to cover the defect created after the excision of the ECRB origin. After insertion of a Silastic drain (Sewoon medical, Seoul, Korea), the wound was repaired layer by layer, and a bulky compressive dressing was applied.

Postoperative rehabilitation

The same rehabilitation protocol was applied to both the open surgery (Nirschl) group and the arthroscopic surgery group. Active-assisted range-of-motion exercises for the elbow started 1 day after surgery. The bulky compressive dressing was changed to a light dressing 2 days after the operation, and the sutures were removed 2 weeks after surgery. We encouraged patients to use their arms in daily activities and slowly progress to more difficult tasks as long as the pain was tolerable.

Outcome assessments

An independent examiner conducted all preoperative and postoperative assessments. Subjective assessments included the pain VAS

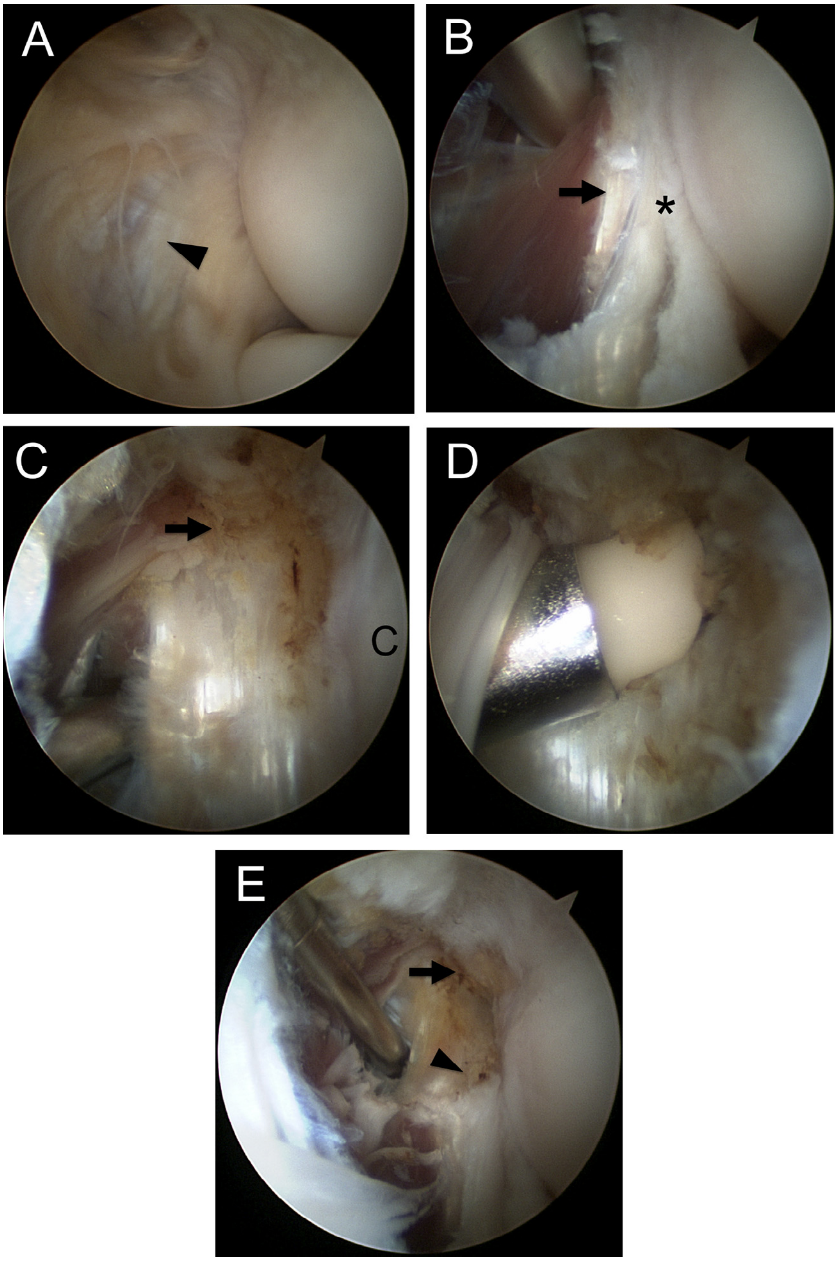

Figure 1 Arthroscopic débridement in a 51-year-old woman with chronic recalcitrant tennis elbow. Arthroscopy was performed on the left elbow with the patient in the lateral decubitus position. (**A**) A linear tear is seen at the lateral joint capsule along the path of the extensor carpi radialis brevis (ECRB) tendon (*arrowhead*). (**B**) The ECRB tendon (*arrow*) is exposed after capsular débridement. It is partially obscured by the radial collateral ligament (*asterisk*). The arthroscope was advanced laterally and proximally following the ECRB tendon to identify the ECRB insertion to the lateral epicondyle. (**C**) The ECRB origin (*arrow*) is located near the proximal-lateral edges of the capitellum (C). (**D**) Removal of the ECRB origin is performed with a radiofrequency ablation device. (**E**) The ECRB footprint (*arrow*) and proximally retracted ECRB tendon (*arrowhead*) are now seen.

in 3 domains (overall pain, pain at rest, and pain during hard work) and the quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) questionnaire. Objective assessments included pain-free grip (PFG) strength. The VAS was used for assessing pain on 3 occasions: overall pain in the past week, pain at rest, and pain during hard work. Patients were asked to mark their level of pain on a 10-cm scale that ranged from 0 to 10, with 0 indicating no pain and 10 indicating the worst pain imaginable. The QuickDASH is a shortened, 11-item questionnaire developed from the 30-item, full-length Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.[12] The QuickDASH has been validated in various upper-extremity conditions and shows psychometric properties and precision for measuring disability severity similar to those of the full-length DASH.[1,17] The QuickDASH score ranges from 0 to 100, with higher scores representing worse disability. A QuickDASH score of less than 20 points is considered to indicate the absence of functional disability.[30] PFG strength is the grip force generated at the onset of pain, and it is a useful outcome measure for tennis elbow.[33] For measurement of PFG strength, the patients were seated with their elbows at full extension and wrists and forearms in a neutral position, and they were asked to grip a Jamar dynamometer (Patterson Medical, Warrenville, IL, USA) until pain developed at the lateral elbow. PFG strength was measured 3 times at 30-second intervals and averaged. The overall outcomes after surgery were rated as excellent (<20 points), good (20-39 points), fair (40-60 points), or poor (>60 points) based on QuickDASH scores.[30]

Statistical analysis

All data were shown to have a normal distribution as determined by the Kolmogorov-Smirnov test. We used the paired *t* test to compare VAS scores for pain, QuickDASH scores, and PFG strength between the preoperative and postoperative measurements within a group and the Student *t* test to compare these variables between the Nirschl and arthroscopy groups. We used the Fisher exact test to compare the percentage of excellent outcomes between groups. The significance level was set at $P < .05$. A post hoc power analysis was performed with a *t* test as a model for our study. We used a minimal clinically important difference (MCID) for the QuickDASH score to calculate the sample size. A sample size of 19 patients per group was necessary to achieve a statistical power of 80% for detecting an MCID of 13.4 points in the QuickDASH score.[32]

Results

We identified a total of 67 consecutive patients. Of these, 12 patients were excluded because of a short follow-up period in 9 patients and lateral ulnar collateral ligament insufficiencies in 3 patients, for whom the lateral collateral ligament reconstruction was performed along with the Nirschl procedure. Thus, 59 elbows in 55 patients were included in the study cohort. The Nirschl group included 29 elbows of 26 patients, and the arthroscopy group included 30 elbows of 29 patients. The Nirschl group consisted of 19 men and 7 women with a mean age of 51.8 years (range, 41-75 years). The arthroscopy group included 21 men and 8 women with a mean age of 49.3 years (range, 36-74 years). There were no significant differences in demographic and clinical characteristics between the groups ($P > .05$, Table I). Preoperative assessments of elbow function showed a high level of pain and functional disability in both groups, but group differences were not significant for any of the subjective and objective evaluations ($P > .05$, Table II).

Both groups showed a significant and large improvement for all outcome measures after surgery, and no significant differences were found between the Nirschl and arthroscopy groups regarding QuickDASH scores or PFG strength. Postoperative VAS scores were also similar for overall pain and pain at rest (Table III). However, pain during hard work decreased more in the Nirschl group than in the arthroscopy group (1.6 ± 1.3 vs 2.2 ± 2.0, $P = .042$). Regarding overall outcome ratings based on QuickDASH scores, the Nirschl group showed excellent outcomes in 22 patients (84.6%) and good outcomes in 4 (15.4%) whereas the arthroscopy group showed excellent outcomes in 22 patients (75.9%), good outcomes in 5 (17.2%), and poor outcomes in 2 (6.9%). The percentage of patients with excellent outcomes was not significantly different between the groups ($P = .510$). The average time for return to work was 10.2 ± 4.1 weeks for the Nirschl group and 8.7 ± 3.4 weeks for the arthroscopy group ($P = .146$).

No complications were reported except for 1 case of mild limitation of the flexion-extension arc in the Nirschl group. We did not encounter any patients with posterolateral rotational instability in either group during the postoperative follow-up. No patient in either group changed his or her job because of elbow pain. Arthroscopic findings were as follows: We found a capsular lesion of type I as described by Baker et al[3] in 15 patients, type 2 in 11 patients, and type 3 in 3

Table I Demographic and clinical characteristics

Measures	Nirschl group (n = 26)	Arthroscopy group (n = 29)	*P* value
Age (range), y	51.8 (41-75)	49.3 (36-74)	.111
Female sex, n	7 (27%)	8 (28%)	.6
Manual laborer, n	9 (36%)	9 (31%)	.493
Height, cm	160.5 ± 8.3	162.8 ± 7.8	.322
Weight, kg	62.6 ± 10.7	61.8 ± 11.5	.824
Smoker, n	6 (23%)	8 (27.5%)	.764
Involved arm (R:L:B), n	16:7:3	25:3:1	.132
Dominant hand, n	21 (91%)	28 (96%)	.090
Duration of symptoms (range), mo	18.5 (7-36)	16.1 (6-96)	.561
Local steroid injection, n	29 (100%)	26 (86.7%)	.112
Follow-up (range), mo	28.5 (12-78)	31 (12-64)	.533
Other upper-extremity conditions, n	12 (46%)	10 (34%)	.272
Workers' compensation, n	0	0	

B, bilateral; L, left; R, right.

Table II Comparison of preoperative elbow function

Outcomes	Nirschl group	Arthroscopy group	*P* value
VAS score			
Overall pain	7.3 ± 1.6	6.9 ± 1.8	.778
Pain during hard work	8.0 ± 1.6	8.7 ± 1.1	.429
Pain at rest	5.5 ± 2.0	3.8 ± 2.2	.127
QuickDASH score	53.8 ± 17.4	47.3 ± 17	.167
PFG strength, kg	5 ± 4	7 ± 9	.609
PFG strength, %	26.4 ± 20.8	24.3 ± 28	.831
F-E arc, °	150 ± 3	147 ± 10	.295

Data are presented as mean ± standard deviation.
F-E, flexion-extension; PFG, pain-free grip; QuickDASH, quick Disabilities of the Arm, Shoulder and Hand questionnaire; VAS, visual analog scale.

Table III Comparison of postoperative elbow function

Outcomes	Nirschl group	Arthroscopy group	*P* value
VAS score			
Overall pain	1.1 ± 1.0	1.1 ± 1.8	.08
Pain during hard work	1.6 ± 1.3	2.2 ± 2.0	.042
Pain at rest	0.7 ± 0.9	0.8 ± 1.6	.604
QuickDASH score	9.4 ± 7	12.6 ± 18.3	.408
PFG strength, kg	18 ± 8	25 ± 13	.115
PFG strength, %	80.7 ± 24	93.9 ± 16	.109
F-E arc, °	149 ± 3	149 ± 4	.803
Excellent outcome*	22 (84.6%)	22 (75.9%)	.510

Data are presented as mean ± standard deviation unless otherwise indicated.
F-E, flexion-extension; PFG, pain-free grip; QuickDASH, quick Disabilities of the Arm, Shoulder and Hand questionnaire; VAS, visual analog scale.
* Number of patients with QuickDASH score of less than 20.

patients. We encountered 1 patient with an asymptomatic hypertrophied radiohumeral plica, but we did not remove it. This patient showed an excellent outcome at 17 months after surgery. We found osteoarthritis at the radiohumeral or ulnohumeral joint in 15 of 30 elbows: Grade 1 (softening) lesions according to the classification system of the French Society of Arthroscopy[10] were present in 3 elbows, and grade 2 (superficial fibrillation) lesions were observed in 12.

Discussion

We found that the Nirschl and arthroscopic techniques achieved highly effective and comparable outcomes for the treatment of chronic recalcitrant LET in this study. Although the Nirschl technique provided significantly superior improvement in pain relief during hard work, the effect size was very small and the difference did not appear to be clinically important.

The most widely used open techniques for LET have been the Nirschl technique and open tenotomy.[13] However, most of the previous studies compared outcomes of arthroscopic techniques with those of open tenotomy. To our knowledge, only the study by Szabo et al[31] included the Nirschl procedure for comparison with arthroscopic techniques. They found no significant differences in pain scores, Anderson-Carson scores, or complication rates between the Nirschl procedure (41 patients), percutaneous ECRB release (24 patients), and arthroscopic débridement modified from Baker et al[3] (44 patients) at a mean follow-up of 48 months. These findings are consistent with those of our study. On the other hand, results from studies comparing the outcomes of open tenotomy with those of arthroscopic débridement are somewhat heterogeneous. Peart et al[23] compared the outcomes of 46 patients who underwent arthroscopic débridement with those of 29 patients who underwent open release, and they found no significant differences in good to excellent results as judged by the criteria of Verhaar and colleagues. Rubenthaler et al[24] also found no significant differences in subjective pain scores, scores for pain elicited by provocative tests, and Roles-Maudsdey scores in a study comparing 20 patients who underwent endoscopic tenotomy and 10 patients who underwent open tenotomy. In contrast, in a study of 80 patients who underwent open tenotomy and decortication and 225 patients who underwent arthroscopic débridement, Solheim et al[30] reported that the latter provided significantly better improvement according to QuickDASH scores and a higher percentage of elbows with excellent outcomes than did the former. However, the difference in QuickDASH scores between the 2 techniques may not be clinically relevant because the difference was smaller than the MCID for QuickDASH scores.[30]

The Nirschl technique provided significantly better pain relief during hard work than did arthroscopic débridement in this study. However, the difference does not seem to be clinically important because the effect size was small and not related to a significant change in patient-perceived disability. In fact, this finding was somewhat unexpected, and we think it is probable that some kind of bias, such as selection bias, might have been unintentionally present in this study, resulting in a type I error. Another explanation may be differences in residual tendinosis. The key component of successful surgery for tennis elbow is to remove the tendinosis completely.[11] Removal of tendinosis is straightforward with the Nirschl technique, and adding a scratch maneuver allows for more complete removal of the remnant degenerated tissue.[7] In contrast, arthroscopic removal of the tendinosis at the ECRB origin is more challenging because visualizing the full extent of the ECRB insertion at the lateral epicondyle using a 30° arthroscope is limited. The ECRB origin is located in the extracapsular and far lateral space, obscured by the radial collateral ligament,[2] and the proud capitellum is in the way. Although 100% of the ECRB origin was shown to be arthroscopically resected in one cadaveric study,[29] Cummins[9] reported that residual tendinopathy was frequently observed on histologic examination after arthroscopic débridement, and patients with residual tendinopathy showed poorer outcomes in their ratings for worst level of pain. Thus, residual tendinopathy might have been more frequent in the arthroscopy group, resulting in a higher pain score during hard work in our study. Recently, use of a 70° arthroscope has been shown to provide full visualization of the ECRB insertion,[2] suggesting possible improvement in arthroscopically addressing tendinosis at the ECRB origin.

Arthroscopy is minimally invasive and thus considered to provide an earlier return to the premorbid level of activity compared with that for open surgery.[2] Time to return to work is highly variable across studies, ranging from 6 days to 8 weeks after arthroscopic débridement,[3,14,15,21-24] probably because it can be affected by various socioeconomic factors such as job type, company size, or industry claim rates.[27] One recent prospective study reported that the return to full occupational activity took 5.5 weeks for office workers and 8.2 weeks for manual workers.[20] Peart et al[23] reported that arthroscopic débridement provided an earlier return to work (1.7 months) than did open ECRB release (2.5 months). Likewise, we found a similar trend for a shorter time to return to work in the arthroscopy group, but the difference did not reach statistical significance. On the other hand, Rubenthaler et al[24] found no significant differences in time to return to work between endoscopic (3.3 weeks) and open (3 weeks) ECRB tenotomy. Similarly, Othman[21] reported that return to work took 3 weeks for both the arthroscopy and percutaneous release groups.

A strength of this study is that the data were collected per routine protocol at each visit and thus detailed data could be obtained preoperatively and postoperatively regarding the subjective and objective condition of the patients, which enabled us to avoid the risk of recall bias. Second, we used a validated instrument for measuring patient-perceived disability, the QuickDASH. The QuickDASH has been validated in various upper-extremity conditions.[1,17,18,32] Use of a validated outcome measures make it easier to compare, compile, and analyze data across studies.

There are several limitations in this study. First, biases related to the retrospective nature of this study exist. Second, this study included a small number of patients, which makes a study vulnerable to both type I and type II errors. However, the number of patients was higher than the minimum number of patients required for this study to have at least 80% power to detect the MCID for QuickDASH scores.

Conclusions

Both the Nirschl and arthroscopic techniques were highly effective and comparable to each other for treating chronic recalcitrant LET. Although the Nirschl technique provided significantly superior pain relief during hard work, the difference did not seem to be clinically important. Either of the 2 techniques could be chosen at the surgeon's discretion for treating chronic recalcitrant LET.

Disclaimer

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