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Outcome Comparison of Open Surgery and Arthroscopic Surgery in Treating Lateral Epicondylitis: A Meta-Analysis

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ABSTRACT

Introduction: Lateral Epicondylitis (LE), or tennis elbow, is a degenerative tendinopathy of the extensor carpi radialis brevis (ECRB) causing lateral elbow pain, most common in adults aged 40–55 years. It results from repetitive wrist extension and forearm supination, leading to overuse and microtears. Diagnosis is clinical, supported by imaging when needed. Surgical treatment is reserved for refractory cases, with open and arthroscopic techniques being the main options. Arthroscopy offers faster recovery and better pain control but may require longer operative time. This meta-analysis compares outcomes of open and arthroscopic surgery for LE, focusing on pain, function, operative duration, and return-to-work time.
Methods: This study following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. Multiple databases were searched for studies that compared functional outcomes of open surgery versus arthroscopic surgery for lateral epicondylitis with a minimum 12 months follow-up. The outcome investigated were VAS, ROM, Grip Power (kg), Qdash Score, complication rate, and operative time.
Result: Six studies were included for the quantitative meta-analysis. The analyses revealed that there were no significant difference in VAS (MD = 0.17; 95% CI, −0.25 to 0.59; p = 0.43) ROM (MD = -0.19; 95% CI, −1.56 to 1.18; p = 0.78), Grip Power (kg) (MD = 1.62; 95% CI, −1.60 to 4.83; p = 0.32), QDash score (MD = 1.27; 95% CI, −0.56 to 3.09; p = 0.17), and complication rate (MD = 0.36; 95% CI, 0.09 to 1.46; p = 0.15) after 12 months follow-up between arthroscopy and control group. Meanwhile, the operative time needed was significantly lower in control group compared to the arthroscopy group (MD = 17.77; 95% CI, 2.03 to 33.50; p = 0.03).
Conclusion: This study concluded that there was no significant difference in term of outcome between arthroscopy and open surgery in managing lateral epicondylitis. However, open surgery took a shorter operative time compared to arthroscopy.

Keywords: *Open Surgery, Arthroscopic, Lateral Epicondylitis, Tennis Elbow.*

INTRODUCTION

Lateral Epicondylitis (LE) or also known as "tennis elbow" is a disease that characterized by pain that most often involves the extensor carpi radialis brevis (ECRB) in the lateral epicondyl.[1,2] Tennis elbow is usually experienced by novice tennis players who play backhands with one hand, but this

disease can also be found without a previous history of playing tennis.[2,3,4]

Based on epidemiological data, lateral epicondylitis occurs around 3.4 per 1000. Lateral epicondylitis occurs equally in women and men with an age range of 40 to 55 years.[1,5,6] The incidence of lateral epicondylitis is often related to overuse injury and strain due to activities involving repetitive gripping movements or extension of the wrist, radial deviation and/or supination of the forearm.[7]

Lateral epicondyltis is characterized by pain in the lateral part of the elbow and usually spread to the forearm. The quality of the pain can increase when lifting an object or shaking hands and morning stiffness in the elbows.[1,8,9] Tenderness can also be elicited by palpation over the front of the lateral epicondyle and performing provocative maneuvers such as Maudsley's test and Mill's sign. An ultrasound or MRI may be performed to confirm the diagnosis.[1]

One of the treatments for lateral epicondylitis is through the open surgery technique which has been carried out since 1979 with an improvement rate of 97% and only 2 failures among 88 procedures. The emergence of minimally invasive surgical techniques, namely arthroscopic surgery, in 1990 and continues to develop today.[10] There are several advantages of the arthroscopic technique, including restoring functional quality more quickly and reduced pain more effectively.[11] Apart from that, arthroscopic surgery also has disadvantages such as a longer operating time.[12,13] This study aims to compare the outcomes between open surgery and arthroscopic surgery in the treatment of lateral epicondylitis by looking at several indicators such as Visual Analog Scale (VAS), Quick Disabilities Arm, Shoulder and Hand (QuickDASH), time of surgery and return to work through the utilization of meta-analysis.

METHODS

Search Strategy

This meta analysis following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).[14] Literature search was performed comprehensively to gather a full-length, peer-reviewed paper in English on evaluation of Open Surgery vs Arthroscopic Surgery for Lateral Epicondylitis. The literature was searched through PubMed, Google Scholar, Science Direct and Cochrane Library using Boolean operators with the following keywords "Lateral Epicondylitis," "Open Surgery" OR “Open Release,” and "Arthroscopic Surgery." We used PRISMA guidelines in this review. The formula diagram of PRISMA is shown in Figure 1 below. We found six journals for this review on inclusion criteria.

Inclusion Criteria

The author uses a logic grid method with the PICO approach to search for suitable keywords. Any studies that evaluated Open Surgery vs Arthroscopic Surgery for Lateral Epicondylitis published in English were included in this review. The clinical outcomes assessed by the subjective Visual Analog Scale (VAS), Quick Disabilities Arm Shoulder and Hand (QuickDASH), Time of Surgery and Return to work with minimum 1 year follow-up. Due to limited number of research comparing both procedures, there was no limitation in patient demographics. Studies that failed to meet inclusion criteria such as (1) studies that were not written in english, (2) the studies that not reported either of these clinical outcomes score such as Visual Analog Scale (VAS), Quick Disabilities Arm Shoulder and Hand (QuickDASH), Time of Surgery and Return to work (3) Studies that had follow-up of less than 1 year.

Quality Evaluation

The class of evidence on each study was categorized into class I, II, III and IV, each for good quality RCT, moderate to poor quality RCT and cohort study, moderate to poor quality cohorts and case-control studies and case series, respectively. The Oxford Center for Evidence-based Medicine produced criteria for assessing research

quality and bias risk, the GRADE Working Group defined perspicacity, and the Agency for Healthcare Research and Quality sanctioned the study (AHRQ).

RESULTS

Figure 1. Flow Diagram based on PRISMA

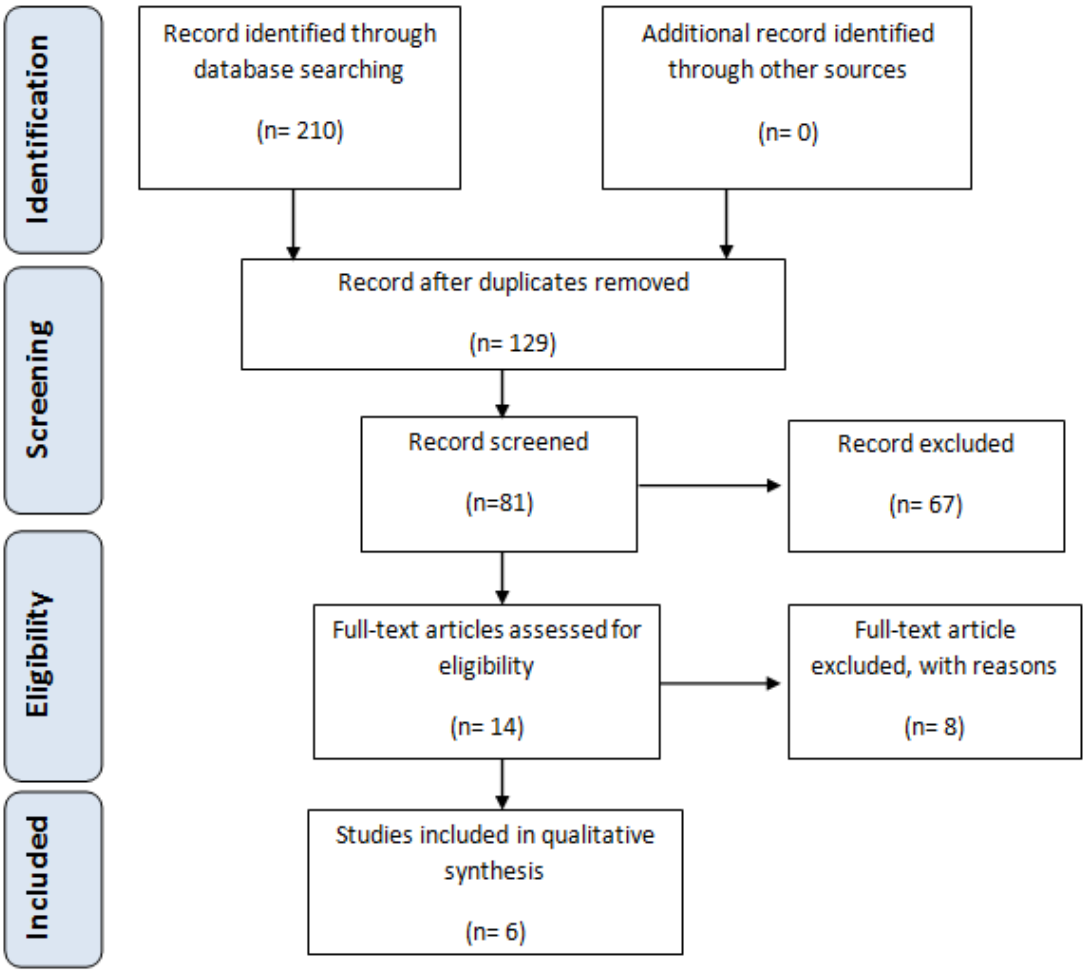


Table 1. List of included studies

No.	Reference	Year	Country	Journal	Study design	Level of evidence
1.	Lee J., et al[15]	2017	Republic of Korea	The Journal of Arthroscopic and Related Surgery	Prospective Randomized Trial	I
2.	Kundu B., et al[16]	2022	India	International Surgery Journal	Prospective Cohort	II
3.	Solheim E., et al[17]	2013	Norway	The Journal of Arthroscopic and Related Surgery	Case Control Study	III
4.	Clark T., et al[18]	2018	Canada	The Journal of Arthroscopic and Related Surgery	Lower Quality RCT	II
5.	Kwon B., et al[19]	2017	Republic of Korea	Journal of Elbow and Shoulder Surgery	Retrospective Cohort	III
6.	Alameda S., et al[20]	2021	Spain	Journal of Elbow and Shoulder Surgery	Retrospective Cohort	III

Table 2. Characteristic Patient of included studies

No	Reference	Total Sample	Mean age (Age range in year)	Male	Female
1.	Lee J., et al, 2017	46 OS: 22 AS: 24	 OS: 51.59 ± 5.75 AS: 51.25 ± 8.57	19	27
2.	Kundu B., et al, 2022	30 OS: 15 AS: 15	 OS: 41.267 ± 5.934 AS: 41.533 ± 7.070	15	15
3.	Solheim E., et al, 2013	305 OS: 80 AS: 225	 OS: 46 (SD, 8) AS: 46 (SD, 8)	153	152
4.	Clark T., et al, 2018	75 OS: 37 AS: 38	 OS: N/A AS: N/A	N/A	N/A
5.	Kwon B., et al, 2017	55 OS: 26 AS: 29	 OS: 51.8 (41-75) AS: 49.3 (36-74)	40	15
6.	Alameda S., et al, 2021	47 OS: 27 AS: 20	 OS: 46.05 (SD, 8 years) AS: 47.44 (SD, 8 years)	22	25

Table 3. Summary of outcome

No	Reference	Study Comparison	Follow up duration (Month)	Outcome
1.	Lee J., et al, 2017	Open vs Arthroscopic	24 months	VAS, Time of Surgery
2.	Kundu B., et al, 2022	Open vs Arthroscopic	16 months	VAS, Time of Surgery, Return to work
3.	Solheim E., et al, 2013	Open vs Arthroscopic	36 months	Quick DASH
4.	Clark T., et al, 2018	Open vs Arthroscopic	12 months	VAS, Time of Surgery
5.	Kwon B., et al, 2017	Open vs Arthroscopic	24 months	VAS, Quick DASH
6.	Alameda S., et al, 2021	Open vs Arthroscopic	12 months	VAS, Quick DASH

Table 4. Characteristics of Outcome of Studies

No	Study References	Outcome Measure			
		VAS	Quick DASH	Operative Time (minutes)	Return to work
1.	Lee J et al., 2017	OS: 1.50 ± 1.29 AS: 1.41 ± 1.14	N/A	OS: 15.6 ± 3.6 AS: 41.4 ± 5.2	N/A
2.	Kundu B et al., 2022	OS: 0.8 ± 1.082 AS: 1.067 ± 0.884	N/A	OS: 25.133 ± 2.356 AS: 34.867 ± 4.257	OS: 13.933 ± 1.624 AS: 7 ± 1.254
3.	Solheim et al., 2013	N/A	OS: 17.8 (SD, 19.4) AS: 11.6 (SD, 15.6)	N/A	N/A
4.	Clark T et al., 2018	OS: 30.6 ± 4.9 AS: 26.9 ± 4.2	N/A	OS: 22.5 (SEM, 1.3) AS: 34.0 (SEM, 2.9)	N/A
5.	Kwon B et al., 2017	OS: 1.1 ± 1.0 AS: 1.1 ± 1.8	OS: 9.4 ± 7 AS: 12.6 ± 18.3	N/A	N/A
6.	Alameda S et al., 2021	OS: 5.2 AS: 5.7	OS: 19.4 AS: 19	N/A	N/A

We screened the literature to report a relevant results based on inclusion and exclusion criteria which were downloaded full articles that met the criteria to evaluated for quality assessment and underwent data extraction. A total of 210 studies were obtained upon

executing the search strategy, 129 were excluded based on duplication and 48 were excluded based on title screening. Further 67 articles were excluded after reading the abstract. Full text of remaining 14 articles were reviewed. Out of these, 8 articles were excluded upon full-text review and leaving 6 articles to be included in qualitative and quantitative meta-analysis (Figure 1).

The results of the meta-analysis indicated that there were no significant differences in the Visual Analog Scale (VAS) scores between the arthroscopy and control groups after 12 months of follow-up, with a mean difference (MD = 0.17, 95% CI= −0.25 - 0.59; p = 0.43) (Figure 2). Similarly, there was no significant difference observed in ROM (MD = -0.19, 95% CI= −1.56 - 1.18; p = 0.78) (Figure 3). This result implies that the improvement in joint mobility was comparable between the two treatment options, reinforcing the idea that arthroscopic intervention did not enhance ROM outcomes relative to the control group. In terms of grip power, the analysis result (MD= 1.62, 95% CI= −1.60 - 4.83; p = 0.32), indicating that grip strength improvements were not significantly different between the arthroscopy and control groups (Figure 4). The QuickDASH (QDash) score, which measures disability in upper extremities, also showed no significant difference (MD= 1.27, 95% CI= −0.56 - 3.09; p = 0.17). This indicates that both groups experienced similar levels of functional improvement, and the use of arthroscopy did not significantly enhance the quality of life or functional abilities in this domain (Figure 5). The complication rate was assessed (MD= 0.36, 95% CI= 0.09 - 1.46; p = 0.15), suggesting that adverse events were comparable between the two groups (Figure 6). This finding indicates that the safety profiles of arthroscopy and the control treatment were not significantly different after the 12-month follow-up period. However, we found that the operative time was significantly shorter in the control group compared to the arthroscopy group (MD= 17.77, 95% CI= 2.03 - 33.50; p = 0.03) (Figure 7). This significant finding suggests that the control treatment required less time to perform, which may have implications for surgical efficiency and resource utilization.

Figure 2. Postoperative VAS score analysis between arthroscopy and open surgery

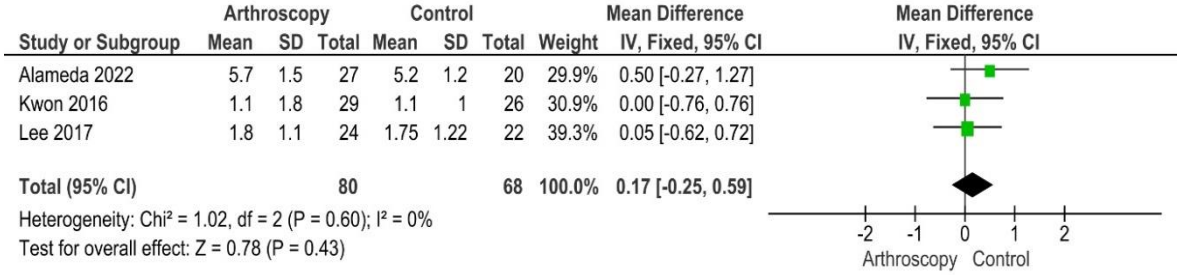


Figure 3. Postoperative ROM analysis between arthroscopy and open surgery

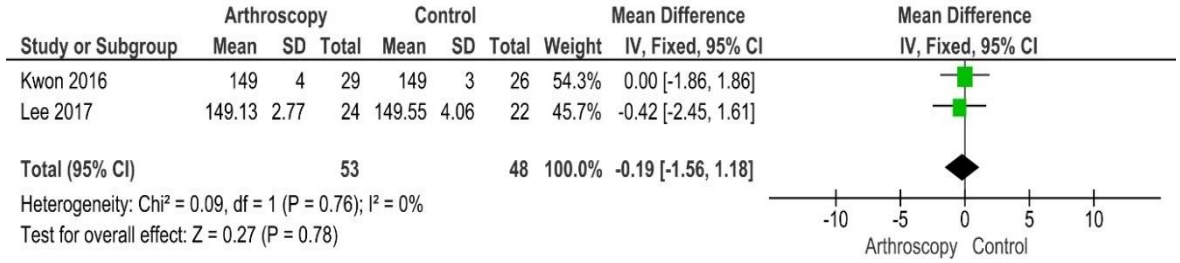


Figure 4. Postoperative Grip Strength (kg) analysis between arthroscopy and open surgery

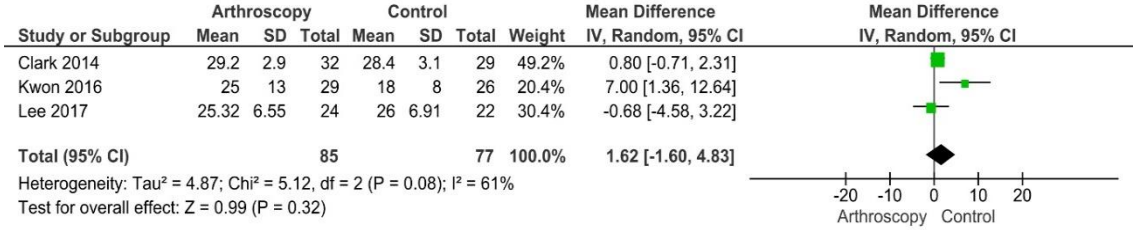


Figure 5. Postoperative Qdash score analysis between arthroscopy and open surgery

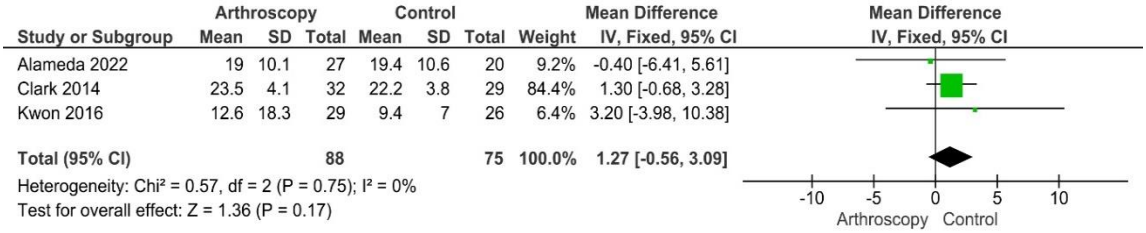


Figure 6. Postoperative complication rate analysis between arthroscopy and open surgery

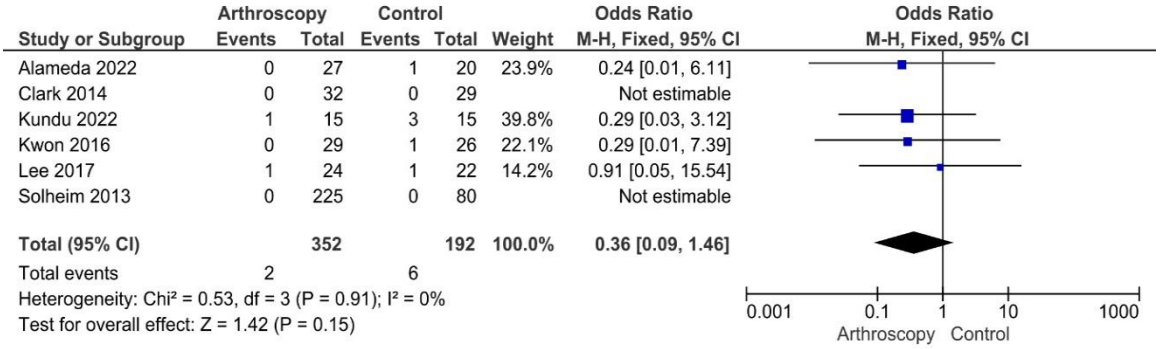
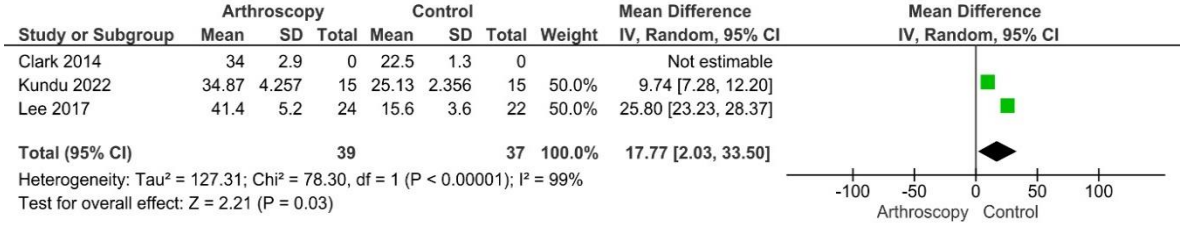


Figure 7. Operative time analysis between arthroscopy and open surgery



DISCUSSION

Lateral epicondylitis, or tennis elbow, is a degenerative condition of the extensor carpi radialis brevis (ECRB) tendon, which can result in significant pain and functional impairment. Pain relief is one of the primary goals of surgery for lateral epicondylitis. The meta-analysis revealed no significant difference in Visual Analog Scale (VAS) scores between arthroscopy and open surgery, with a mean difference (MD) of 0.17 (95% CI, −0.25 to 0.59; p = 0.43). This suggests that both surgical approaches are equally effective in reducing pain associated with lateral epicondylitis over a 12-month follow-up period. The similarity in pain outcomes challenges the assumption that arthroscopy, being less invasive, would provide better postoperative pain relief due to reduced soft tissue disruption. Instead, this finding implies that both techniques address the underlying pathology of degenerative tendinopathy with similar efficacy.

The comparable pain outcomes may be explained by the fact that both techniques involve similar procedures to remove the diseased tendon tissue and stimulate healing. Despite the less invasive nature of

arthroscopy, it appears that the choice of surgical technique does not translate into a clinically meaningful difference in pain levels. Previous studies have suggested that pain outcomes in lateral epicondylitis surgery are influenced more by the extent of tendon degeneration and the success of the rehabilitation protocol rather than the specific surgical technique used.[21,22] Therefore, in terms of pain relief, either approach appears to be equally viable.

Range of motion (ROM) is an essential indicator of functional recovery after surgery, particularly for individuals with lateral epicondylitis, whose condition may limit movement due to pain and stiffness. The analysis found no significant difference in ROM between the two surgical groups (MD = -0.19; 95% CI, −1.56 to 1.18; p = 0.78), indicating that both arthroscopy and open surgery restore or maintain joint mobility equally well.

This result aligns with the pathophysiology of lateral epicondylitis, which primarily involves the tendon rather than the joint.[23] Since the primary target of surgical intervention is the degenerated portion of the ECRB tendon, joint structures are not directly impacted, allowing for similar postoperative ROM recovery.[24] Moreover, ROM outcomes may be heavily influenced by postoperative rehabilitation protocols, which tend to be similar across both surgical approaches. Therefore, the lack of difference in ROM suggests that the surgical technique does not play a major role in determining postoperative mobility, and both open and arthroscopic approaches can be considered equally effective in this regard.[16]

Grip strength, a critical function affected by lateral epicondylitis, is often compromised due to the involvement of the extensor muscles in the forearm. The meta-analysis found no significant difference in grip strength between the two surgical groups (MD= 1.62, 95% CI= −1.60 - 4.83; p = 0.32). This result suggests that both surgical methods offer similar improvements in grip power following the procedure. The similarity in grip strength outcomes can likely be attributed to the fact that both arthroscopic and open surgeries aim to address the same underlying pathology of tendon degeneration.[25] The techniques involve either debridement or release of the damaged tendon, which, in turn, alleviates the pain that impairs grip function.[26,27] Additionally, postoperative grip strength recovery is largely dependent on rehabilitative exercises that target muscle strengthening. Given the standardized postoperative care for both approaches, it is reasonable to conclude that neither surgical method confers an advantage in restoring grip strength.[18]

The Quick Disabilities of the Arm, Shoulder, and Hand (QDash) score is a widely used tool to assess functional outcomes in patients with upper extremity conditions. The meta-analysis showed no significant difference in QDash scores between arthroscopic and open surgery (MD= 1.27, 95% CI= −0.56 - 3.09; p = 0.17). This finding indicates that both surgical techniques result in comparable improvements in function and quality of life for patients after surgery. This result suggests that patients treated with either open or arthroscopic surgery experience similar degrees of functional recovery, including the ability to perform daily activities involving the arm and hand. The lack of difference in QDash scores can be explained by the fact that the primary goals of both procedures relieving pain, removing damaged tissue, and restoring tendon function are achieved through different surgical techniques but lead to similar clinical outcomes.[24] Thus, when considering functional recovery alone, both methods appear to provide equivalent benefits.

One of the critical concerns in any surgical procedure is the risk of complications. The meta-analysis showed no significant difference in complication rates between the two groups (MD = 0.36; 95% CI, 0.09 to 1.46; p = 0.15). This result suggests that both arthroscopic and open surgeries have comparable safety profiles with regard to postoperative complications. Complications in lateral epicondylitis surgery may include

infection, nerve damage, persistent pain, and stiffness.[25,28,29] The comparable complication rates indicate that neither technique poses a greater risk to patients, which is an important consideration in surgical decision-making. While it is often presumed that arthroscopy, being minimally invasive, would have a lower complication rate, this analysis does not support that hypothesis. Thus, from a safety perspective, both procedures can be considered equally safe for treating lateral epicondylitis.

The only significant difference between the two surgical approaches was operative time. The meta-analysis found that open surgery was significantly faster than arthroscopy (MD= 17.77, 95% CI= 2.03 - 33.50; p = 0.03). This suggests that open surgery is a more time-efficient procedure compared to the arthroscopic technique. The longer operative time for arthroscopy can be attributed to the need for precision in navigating the joint space and performing debridement through small incisions.[30] In contrast, open surgery provides direct access to the affected tendon, allowing for quicker debridement and repair. The increased operative time for arthroscopy may have implications for operating room efficiency, healthcare costs, and surgeon preference, particularly in high-volume settings where time is a limiting factor.[31] Despite this, the longer operative time of arthroscopy may be justified by its perceived advantages, such as smaller incisions and less postoperative pain, although these benefits were not significant in this analysis.

The findings of this meta-analysis have several clinical implications. First, since both arthroscopic and open surgeries result in comparable pain relief, functional recovery, grip strength, and complication rates, the choice between the two should be guided by factors other than clinical outcomes alone. Surgeons may prefer open surgery in cases where time efficiency is a priority, while arthroscopy may still be favored for patients who prioritize minimally invasive techniques and their perceived cosmetic benefits. Additionally, these results suggest that postoperative rehabilitation plays a crucial role in recovery, as the improvements in function and strength seen in both groups may be more related to the quality of rehabilitation rather than the specific surgical approach. Therefore, ensuring adherence to rehabilitation protocols is likely to be more critical for optimal recovery than the choice of surgical technique.

CONCLUSION

In conclusion, this meta-analysis demonstrates that arthroscopic and open surgeries are equally effective in managing lateral epicondylitis with regard to pain relief, ROM, grip strength, functional recovery, and safety. However, open surgery offers the advantage of reduced operative time. Given the comparable clinical outcomes, the decision to perform arthroscopic or open surgery should be individualized based on patient preferences, surgeon expertise, and resource availability, rather than expected differences in clinical efficacy. Further research with longer follow-up periods may provide additional insights into the long-term outcomes of these surgical techniques.

Declaration by Authors

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