



Operative and Nonoperative Treatment of Pediatric Medial Epicondyle Fractures in Athletes: A Systematic Review

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Abstract

It is still not clear what the most effective treatment is for fractures of the medial epicondyle in young athletes since fixation, although it helps to achieve bony healing, may lead to problems related to the implant. We conducted a search of PubMed/MEDLINE and PubMed Central up to 13 September 2026. Returning to the sport at the previous level was the main outcome measure. We also looked at return time, function, the occurrence of nonunion, range of motion, symptoms involving the ulnar nerve, and the need for additional surgery. The groups of athletes were considered apart from the more general comparative evidence.

Three cohorts of athletes consisted of 91 patients. In a propensity-matched comparison, 92.9 per cent of the patients in each of the treatment groups returned to the sport they had previously been playing, with the same return times and at a similar competitive level. All 14 of the overhead athletes in the smaller group returned irrespective of the treatment received. In the series which included only operative treatment, 28 out of the 29 overhead athletes had returned after an average of seven months. A randomized trial with 334 children found that there was no clinically important improvement in function at one year, even though further operations and higher costs were incurred. The higher rate of radiographic union following surgery was not consistently associated with better function or greater participation in sport.

In the case of a fracture that is generally stable and only moderately displaced without any fragment being incarcerated, the fact that the athlete is able to participate in sport alone is not a sufficient reason for carrying out routine surgical fixation. Treatment without surgery will nevertheless allow a high rate of return to sporting activities. Surgery may, however, be considered when there is objective instability, when there is a reliably measurable considerable displacement, or when there is a significant valgus deformity in the dominant arm, on the condition that the family is made aware of the possibility of needing further surgery later on.

Keywords: medial epicondyle; pediatric elbow; athlete; return to sport; fixation; nonoperative treatment

1. Introduction

Fractures of the medial epicondyle frequently take place in children involved in sports. The fragment includes the common origin of the flexor and pronator muscles as well as the humeral attachment of the ulnar collateral ligament. Because of this anatomical arrangement there is a special concern in activities such as throwing, gymnastics, wrestling, and others which place stress on the medial elbow in a valgus position.

Fixation not only reestablishes the correct position of the fragments but also greatly improves radiographic evidence of union. The fact is that bony union is an indirect indicator of the result that is important to the athlete. A great many children are able to achieve pain-free function following nonoperative management even if they have fibrous healing or obvious nonunion. Moreover, operative treatment also subjects the children to the risks of implant prominence, irritation of the ulnar nerve, the need for repeated anesthesia, and in some cases hardware removal.

We looked at the return to athletic activity following surgery and following non-surgical treatment, interpreted the groups of athletes in light of the results from randomized studies, and investigated whether the advantage of the union leads to a significant benefit in sports.

Methods

Search and eligibility

The search was carried out on PubMed/MEDLINE and PubMed Central up to 13 September 2026 by combining the terms medial epicondyle and medial epicondylar fracture with child, pediatric, adolescent, fixation, operative, nonoperative, athlete, sport, throwing, baseball, gymnastics, return to play and return to sport. Additionally, the references from the eligible articles and recent systematic reviews were examined.

The studies included patients who were skeletally immature and had an acute fracture of the medial epicondyle, with outcomes being described according to the treatment given. We included series that focused on athletes in order to look directly at sport participation. In cases where this could be determined, open fractures, fragmented pieces that were incarcerated, and nerve entrapment were separated out from the preference-sensitive comparison since these generally require surgical intervention.

Outcomes and extraction

The primary endpoint was returning to the same sport at the same competitive level as before the injury; the other endpoints were time taken to return, validated functional scores, pain, valgus stability, symptomatic nonunion, radiographic union, loss of motion, ulnar-nerve dysfunction, implant removal, and other operations. We divided planned removal from that which was due to surgical complications.

Risk of bias and synthesis

For the randomized evidence we used the RoB 2 criteria and for the nonrandomized comparisons we applied the ROBINS-I criteria. The process of selecting a treatment is susceptible to confounding since factors such as displacement, instability, injury of the dominant arm and sporting goals can affect the choice. We did not combine the athlete-specific primary endpoint because only one of the matched studies provided a usable direct comparison and the definitions varied between the different reports.

Results

Study selection and evidence base

The targeted strategies yielded 159 distinct records indexed in PubMed. Three main groups of athletes, including 91 participants, fulfilled the sport-specific screening criteria. The broader body of evidence included the multicenter randomized SCIENCE trial, retrospective comparisons, a population-based cohort, and studies relating to long-term outcomes and complications.

Table 1 Athlete-specific evidence on return to sport

Lawrence et al. 2013	20 athletes, including 14 in overhead sports	14 operative; 6 nonoperative	All overhead athletes resumed sport at the next suitable level;	Small groups; treatment reflected injury, laxity, and displacement
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			DASH scores were excellent in both groups	
Axibai et al. 2020	42 matched upperextremity athletes	14 operative; 28 nonoperative	Same-sport return was 92.9% in both groups, with similar level and timing	Retrospective moderatedisplacement cohort; confounding remains
Youth overhead series 2021	29 overhead athletes, mainly baseball players	Fixation only	28 of 29 returned; mean return time seven months; mean KJOC score 93	Selected patients and no nonsurgical comparator

Return to sport

When the athletes were directly compared, no advantage in returning to sport was found with fixation. In the matched group, 13 of the 14 athletes who had surgery and 26 of the 28 who did not have surgery went back to playing the same sport; their return times and competitive levels were also similar. A smaller study carried out earlier also reported a satisfactory return in both groups.

The series indicates that selected athletes who have had overhead injuries can successfully return to sport; 28 out of 29 had resumed it after an average of seven months. However, since there is no nonsurgical comparison available and important associated injuries have been excluded, the series is unable to show that the treatment has any advantage.

Randomised and comparative evidence

The SCIENCE trial involved 334 children aged between 7 and 15 years who were treated at 59 hospitals. For the group receiving nonsurgical care, the mean PROMIS Upper Extremity score at one year was 53.1, whereas it was 54.3 for those who received fixation. The adjusted difference was 1.57 points (95% CI -0.01 to 3.14), which was below the pre-specified four-point threshold for clinical importance. It therefore follows that routine fixation is unlikely to result in a meaningful functional improvement among the population eligible for the trial.

In the group given surgery, further operations were noted in 24 patients and in three patients in the group receiving nonsurgical treatment. Surgical treatment cost approximately £2,435 more per patient and was found to have a 0% probability of being cost-effective at the thresholds examined. The finding was not substantially affected by an initial elbow dislocation; incarcerated fragments had been excluded.

Table 2 Principal comparative evidence

SCIENCE trial 2026	334 randomized children	No clinically important PROMIS difference at one year	More subsequent surgery and higher cost with fixation	Supports nonsurgical care for eligible nonincarcerated fractures
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Grahn et al. 2021	81 fractures	QuickDASH, MEPS, strength, stability, and motion did not favor surgery	All 41 nonsurgical patients returned; six of 40 surgical patients reduced activity	Nonrandom treatment assignment may bias comparison
Axibal et al. 2019	44 matched patients	Recovery, therapy needs, and complications were similar	Moderately displaced fractures	Treatment choice did not distinguish functional recovery
Prospective nonoperative cohort 2021	34 nonsurgical patients	Long-term scores and clinical stability were excellent	Extension loss related to displacement and associated lesions	No comparator; high valgus demands may matter
Long-term ORIF cohort 2021	39 survey respondents	Excellent PROMIS scores and little pain	Symptomatic implant removal in 41%; sensory ulnar complaints in 18%	Good function accompanied by a substantial reoperation burden

Union and symptomatic nonunion

The likelihood of achieving visible bony union is greatly increased by fixation. A meta-analysis carried out in 2026 found union rates of 97% following surgery and 46% following conservative immobilization. Although comparative studies and the trial did not identify a corresponding clinically significant improvement in function. A radiographic nonunion has clinical relevance when it causes pain, instability, neurological symptoms, or impaired performance.

Motion and rehabilitation

In a 2025 multicenter cohort of 202 patients, full motion was recorded in 71% after surgery and 56% after nonsurgical care. In adjusted analysis, immobilization duration was the sole independent predictor: each additional week reduced the likelihood of full motion. The presence of implant problems places a considerable strain on patients following surgery. In a long-term group of patients who had the procedure carried out, 41% had the hardware removed because of symptoms. Another study involving 151 patients found that the use of larger 4.5-mm screws and washers was associated with a higher rate of symptomatic removal. Symptoms relating to the ulnar nerve after surgery were usually temporary but still constituted a recurring complication. The randomised trial provides strong evidence showing that there is no clinically significant functional benefit from carrying out routine fixation in the cases of nonincarcerated fractures that it included. Less certainty can be placed on the sport-specific effects: the groups of athletes were small and based on retrospective data, used inconsistent definitions of competitive level, and were influenced by treatment selection. The evidence strongly recommends surgery when radiographic union is achieved, gives moderate support for further procedures, and does not prove that one method is better than the other for returning to the previous sport. When the athlete groups and the results from the randomized trial are considered together, there is no basis for deciding to operate just because a child takes part in sports. In many cases, stable fractures with moderate displacement can be managed non-surgically and the child can still return to the same sport, and some overhead athletes also fare well after having their bones fixed. However, the studies currently available have not demonstrated that achieving anatomical union on its own leads to better recovery in terms of competitiveness. Athletes also do well after fixation. Existing studies have not shown that achieving anatomical union independently improves competitive recovery.

This does not mean that all athletic situations have been settled. The study did not include

incarcerated fragments and complex fractures, and the groups of athletes were too small to establish the most suitable treatment for an elite dominant arm thrower who has obvious valgus instability. Although reconstructing the anatomy might be an appropriate course of action in that case, the final decision will have to be based on the individual findings and preferences.

Clinical implications

It is suitable to use a non-surgical approach in the case of a stable elbow which is eligible and does not have fragment incarceration, nerve entrapment, or unacceptable alignment. Simply taking part in sports does not alter this evaluation. Fixation should be considered if the instability can be reproduced, if there is considerable displacement as shown on an appropriate standard view or a cross-sectional study, if dominant-arm valgus loading is particularly demanding, or if the family prefers bony union after the risks associated with implant removal have been discussed.

Rehabilitation also has an effect on the process of recovery; the longer someone is immobilised, the more likely they are to have residual stiffness. Approval to return to sport should be based on pain-free movement, on restored strength, on the ability to tolerate sport-specific valgus stress, and on a gradual re-introduction to throwing or to loading; mere radiographic union is not enough.

Limitations

The number of studies involving athletes was small and diverse, which meant that it was not reasonable to produce a combined estimate that was specific to sport. The searches included the literature indexed in PubMed as well as the citation chains; in order to prepare a submission, the review should also include Embase, SPORTDiscus, Scopus, and Web of Science. The criteria for inclusion differed, and the observational comparisons did not adequately take into account instability, measured displacement, injuries involving the dominant arm, or the competitive level. There are still no long-term randomized studies on sport outcomes.

Conclusion

Routine fixation is not supported solely to improve athletic return after a pediatric medial epicondyle fracture. In stable fractures without an incarcerated fragment, nonsurgical management yields sport and functional outcomes comparable to fixation while avoiding implant morbidity. Surgery improves radiographic union but increases the need for subsequent procedures. Prospective sport-specific follow-up is needed for elite dominant-arm athletes with objective valgus instability.

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