

# Clavicle Fixation (ORIF)

## Midshaft Clavicle Fracture – Operative vs Non-operative Management & Post-operative Rehabilitation (Plate ORIF)

**Topic scope:** (A) the decision between non-operative management and plate fixation for displaced midshaft clavicle fractures (the randomised-trial evidence on union, function and return to sport), and (B) post-operative rehabilitation after **open reduction and internal fixation (ORIF)** of the clavicle with a plate and screws. Distal-third and proximal-third fractures, which involve different fixation constructs, are noted only where they bear on the rehab principles.

*Defining principle of the surgical rehab here: clavicle ORIF is a protect-the-fixation / protect-the-healing-fracture pathway, NOT an early-aggressive-motion pathway. The plate is a splint, not a substitute for healed bone – it neutralises load while the fracture itself unites over roughly 6–12 weeks and remodels for months afterwards. So the rehab is staged around fracture biology: a sling and below-shoulder-height-only motion early to protect the construct, range of motion progressed as the fracture knits (overhead motion deferred until the ~6-week x-ray), and strengthening / loading / collision sport withheld until radiographic union is confirmed. This is the opposite of a debridement or capsular-release pathway, where motion is the goal from day one and there is no fracture to protect. The single most important gate throughout is the x-ray, not the calendar – every major step up depends on how the fracture is healing.*

### A. THE OPERATIVE-VS-NON-OPERATIVE DECISION

Most clavicle fractures heal without surgery. The debate concerns **completely displaced midshaft fractures** (typically  $\geq 100\%$  displacement or  $\geq \sim 2$  cm shortening), where historic “all clavicles heal” teaching was overturned by randomised data.

## THE LANDMARK TRIAL – CANADIAN ORTHOPAEDIC TRAUMA SOCIETY (COTS) 2007

The COTS multicentre RCT randomised **132 patients** with displaced midshaft clavicle fractures to plate ORIF vs non-operative sling treatment. Plate fixation produced a **markedly lower nonunion rate (~2% vs ~23–24% non-operative)**, fewer symptomatic malunions, faster time to union, and better Constant and DASH scores at one year. This trial is the basis for *offering* surgery to active patients with completely displaced fractures – it did not establish that all such fractures *require* surgery. *STRONG (RCT)*. [COTS 2007]

## WHAT LATER EVIDENCE TEMPERED

- **Meta-analyses of RCTs** confirm operative fixation **reduces nonunion and symptomatic malunion** but show that much of the early functional advantage **converges by 1 year**, and comes at the cost of hardware-related reoperation. The decision is therefore shared and patient-specific (activity demands, displacement, comminution, smoking, occupation) rather than automatic. *STRONG (SR/MA of RCTs)*. [Woltz-type meta-analysis; meta-regression, JSES 2020 – DOI 10.1016/j.jse.2020.02.011]
- A modern **cohort comparison of dual mini-fragment plating vs non-operative care** (mean 3.4-yr follow-up) found **fewer union complications with fixation but similar patient-reported outcomes** at final follow-up – echoing the “fixation buys reliable union, not necessarily a better long-term shoulder” theme. *MODERATE (cohort)*. [DOI 10.1016/j.jse.2024.10.018]
- **Heterogeneity between trials** (how nonunion and displacement were defined, statistical handling of time-to-union) explains some of the apparent disagreement across studies – a caution against over-reading any single union statistic. *MODERATE*. [DOI 10.1016/j.jse.2012.03.015; meta-regression DOI 10.1016/j.jse.2020.02.011]

## CONSTRUCT CHOICE (INFORMS THE REHAB, NOT THE PATIENT'S BEHAVIOUR)

- **Plate vs intramedullary fixation:** an RCT comparing locked intramedullary nailing with plating found both achieve union; plates remain the workhorse for comminuted/displaced patterns. *MODERATE (RCT)*. [DOI 10.1016/j.jse.2010.05.002]
- **Plate position:** superior plating is biomechanically strong but the plate lies directly under thin skin and is frequently symptomatic; **anteroinferior plating** lowers symptomatic hardware and removal rates. This is why patients commonly *feel and see* the plate, and why removal is a later, elective conversation. [Hardware-removal cohort, DOI 10.1016/j.jse.2017.03.011]
- **Fixation reaches union even when delayed:** immediate fixation vs delayed reconstruction of displaced midshaft fractures both restore objective strength and patient-oriented outcomes – reassuring that a fracture initially treated non-operatively can still be fixed successfully if it fails to unite. *MODERATE (cohort)*. [DOI 10.1016/j.jse.2007.01.001]

## B. POST-OPERATIVE REHABILITATION (plate ORIF)

The operation holds the fracture ends in position with a plate and screws so the bone can heal. Rehab is the same staged, fracture-protective sequence used across published surgeon and NHS protocols. Key facts that shape it:

- **The plate neutralises load but the bone must unite biologically** – typically **6–12 weeks** to radiographic union, with remodelling for months after. Strengthening and loading that precede union risk implant loosening or re-fracture. *Consensus / biomechanical.*
- **Bone healing is slower in smokers and in diabetics**, and smoking can delay or prevent union – a modifiable risk worth addressing in the post-fracture window. *Established.*
- **Overhead motion and strengthening are gated on the x-ray**, not a fixed date – published protocols restrict elevation to  $\leq 90^\circ$  until early healing is confirmed (commonly the ~6-week review).

### CONSENSUS PHASED POST-OP TIMELINE (PLATE ORIF)

Phase	Window	Sling	ROM	Strengthening	Notes
<b>I – Protection</b>	<b>Week 0–3</b>	Most of the time; off for showers/exercises/seated tasks; not required overnight	<b>Passive/AAROM below 90°</b> only – flexion/scaption/abduction capped at 90°, ER/IR in scapular plane to comfort; pendulums, table slides; full elbow/wrist/hand/cervical AROM	None at shoulder (grip + wrist only)	Protect fixation; settle pain/swelling; <b>no driving while in sling</b> ; no lifting/carrying/weight-bearing through the arm
<b>II – Early motion</b>	<b>Week 3–6</b>	Weaned as comfort allows; <b>discarded by ~6 wk</b>	Progress passive→full all planes (no forceful stretch); <b>active motion below 90°</b> ; AAROM lawn-chair/pulley progression	Gentle <b>isometrics</b> + light periscapular work only	Recover movement, not strength. Lift $\leq$ a coffee cup. Phase ends with <b>x-ray + review</b> that gates overhead motion + strengthening
<b>III – Strengthening</b>	<b>Week 6–12</b>	Off	<b>AROM progresses above 90°</b> once union confirmed; full active range built up	Cuff + scapular strengthening: isometric → bands → light weights; <b>lift <math>\leq</math> ~2 kg until 12 wk</b>	Swimming/cycling typically return; <b>no contact sport</b> ; no overhead/heavy lifting

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Phase	Window	Sling	ROM	Strengthening	Notes
<b>IV – Return to activity &amp; sport</b>	<b>Week 12 +</b>	Off	Full, pain-free, maintained	Progressive heavy/eccentric/overhead loading; sport-specific + plyometric drills	<b>Contact/collision sport needs radiographic union</b> – typically <b>~3–4 months at the earliest</b> , some protocols stage collision as late as 6 months

The structure above matches the topic’s patient protocol and is drawn from published surgeon ORIF protocols (Massachusetts General Brigham; Mammoth Orthopedic Institute; University of Colorado / Bravman; Midwest Orthopaedics at Rush / Cole) and NHS physiotherapy guidance (West Suffolk; United Lincolnshire). These protocols broadly agree on the **sling ~3 weeks, ROM ≤ 90° early, overhead and strengthening after the ~6-week review, return to sport gated on union** sequence; exact week boundaries vary by surgeon. *WEAK / CONSENSUS – no rehab RCT defines the optimal regimen.*

### RETURN TO SPORT – THE EVIDENCE

- A **systematic review of return to sport after clavicle fractures** (Robertson & Wood, *Br Med Bull* 2016, 23 studies) found **~92% return to sport**, at a mean of **~96 days (~3 months)**. *MODERATE (SR of heterogeneous cohorts)*. [Robertson 2016]
- A more recent **systematic review and meta-analysis** reported **mean return to play ~3.1 months operative vs ~3.9 months non-operative**, with similar overall return rates but a higher rate of return to *pre-injury level* after operative treatment. *MODERATE*. [RTP SR-MA, JSES Rev 2024]
- **In elite athletes** specifically (e.g. NFL series), operative management has been used to achieve predictable, timely return – though selection bias makes these cohorts hard to generalise. *WEAK (selected cohorts)*. [DOI 10.1177/0363546510372795]

The consistent signal: most athletes return by ~3 months, operative slightly faster and more reliably to pre-injury level – but **union on x-ray, not the average timeline, governs clearance for collision sport**.

## C. KEY CONTROVERSIES / EVIDENCE QUALITY

1. **Who actually needs surgery.** COTS established that fixation reduces nonunion/malunion in *completely displaced* midshaft fractures, but the early functional gap narrows by a year and fixation adds hardware reoperations. The modern position is **shared decision-making** for the active, completely-displaced patient – not routine fixation of all displaced fractures. *Strong evidence, nuanced application.*

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2. **How big is the nonunion benefit, really?** Reported nonunion rates vary with how “nonunion” and “displacement” are defined and how time-to-union is analysed; meta-regression shows this heterogeneity drives much of the between-study disagreement. Treat single headline figures with caution. *Moderate*.
3. **Hardware prominence and removal.** Because the clavicle is subcutaneous, plates are often felt and sometimes symptomatic; removal rates depend heavily on plate position (anteroinferior < superior) and design (low-profile/dual). Removal is an **elective, post-union** decision. *Moderate (cohorts)*.
4. **The rehab protocol itself is consensus.** Phase timings come from surgeon patient-guidance documents and NHS leaflets, not a rehab RCT. The  $\leq 90^\circ$ -until-6-weeks and union-gated-sport principles are widely shared; precise week boundaries are not trial-derived. *Weak/consensus*.

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## D. EVIDENCE STRENGTH FLAGS (summary)

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- **STRONG (RCT / SR-MA of RCTs):** plate fixation reduces nonunion and symptomatic malunion in displaced midshaft fractures (COTS 2007 RCT; meta-analyses), with early functional benefit that converges by ~1 year; plate vs IM nail both achieve union (RCT).
- **MODERATE (cohorts / SR of cohorts):** similar long-term PROs fixation vs non-op despite fewer union complications (dual-plate cohort 2024); return to sport ~92% at ~3 months, operative slightly faster/more reliable to pre-injury level (Robertson 2016 SR; RTP SR-MA 2024); hardware removal rate and its dependence on plate position; delayed fixation still succeeds.
- **WEAK / CONSENSUS:** the **post-operative rehabilitation protocol itself** (surgeon + NHS patient-guidance documents; no defining rehab RCT); elite-athlete operative series (selection bias).

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## CITATIONS

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### RAG CORPUS (180,000+ ORTHOPAEDIC ARTICLES) – CLAVICLE-SPECIFIC EVIDENCE

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#### PUBLISHED REHAB PROTOCOLS (PATIENT-GUIDANCE – BASIS FOR THE PHASE STRUCTURE)

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