

Proximal Humerus Fixation (ORIF)

Proximal Humerus Fracture Fixation (Locking-Plate ORIF) – Post-operative Rehabilitation: Evidence

Topic scope: Post-operative rehabilitation after **open reduction and internal fixation (ORIF) of a proximal humerus fracture with a locking (angular-stable) plate and screws**. This page covers the evidence behind the phased rehabilitation program – early protected/passive motion, deferred active and resisted motion, and graded strengthening – and the surgical-outcome facts that shape it. It does **not** cover the separate pathways of non-operative fracture management, intramedullary nailing, hemiarthroplasty or reverse total shoulder arthroplasty, although the operative-versus-non-operative debate is summarised because it frames who is offered this operation at all.

Defining principle of the rehab here (mobilise early, protect the tuberosities): A locking plate is an angular-stable construct – the screws lock into the plate, so the fixation holds even in osteoporotic bone without relying on bone-to-screw friction. Because that stability is present from day one, this protocol now permits early active (and active-assisted) shoulder elevation in a pain-free range for stable fixation, consistent with the early-active-motion RCT evidence (Loew 2025), rather than holding the shoulder passive-only for six weeks. The element still keyed to biological healing is rotation and rotator-cuff loading: where the tuberosity fragments to which the rotator cuff attaches are part of the fracture, active/resisted rotation and cuff work are held back until those fragments unite, whereas where the tuberosities are uninvolved or solidly fixed the surgeon may clear cuff loading sooner. The brake is therefore biological, not mechanical – the plate is strong immediately – and it is now selective (rotation/cuff), not a blanket movement ban. Progression of cuff loading remains governed by fracture stability and radiographic healing, not the calendar. This places the protocol close to the early-active-movement end of the spectrum while still being more tuberosity-aware than a pure debridement/decompression, and far less tuberosity-dependent than a fracture arthroplasty, where healing of the tuberosities to the prosthesis dictates a slower, stricter cuff-loading timetable.

The operation

A proximal humerus fracture is a break of the upper end of the arm bone, near the shoulder. In ORIF the fragments are realigned (reduced) and held with a pre-contoured locking plate on the outer surface of the bone, fixed with multiple locking screws into the humeral head. Where the **tuberosities** (the bony knobs carrying the rotator-cuff attachments) are part of the fracture, they are reduced and secured to the plate, often reinforced with heavy sutures through the cuff. The plate provides immediate mechanical stability; the rehabilitation then protects the *biological* healing of the fracture and the tuberosity fragments.

Evidence by theme

1. MODERN LOCKING PLATES PERMIT EARLY ACTIVE MOTION – SUPPORTED BY RCT EVIDENCE AND ADOPTED HERE FOR STABLE FIXATION

The historical “restrictive” protocol kept the arm immobilised with no active movement for ~6 weeks, with passive limits of flexion to ~90°, external rotation to ~20° and internal rotation to the belly. The rationale for early motion is to prevent the shoulder stiffening (adhesive capsulitis is a recognised complication of these fractures) while still protecting the bone. Because an angular-stable locking plate is mechanically strong from day one, early *active* elevation can be permitted for stable fixation; the element kept keyed to biological healing is rotation and rotator-cuff loading, because that is what pulls on the tuberosity fragments.

The more aggressive question – can patients move *actively* from the start? – has now been tested. A **prospective randomised controlled trial** (Loew et al., *J Orthop*, 2025) compared a conventional 4-week sling-immobilisation group against an **early functional group with no movement or force restrictions** after locking-plate ORIF (both groups avoided heavy lifting and impact for 3 months). At **24 months there was no significant difference** in DASH or Constant score: Constant score averaged **81.3 (conventional) vs 78.4 (early functional)**, with relative Constant score 89.8% of the uninjured side in both groups – i.e. **early active motion was non-inferior**. *Moderate (single RCT)*. This is consistent with the broader signal that early intensive mobilisation yields similar outcomes to conventional later mobilisation after operative treatment. In line with this evidence, **Dr Hirpara’s protocol now permits early active elevation in a pain-free range for stable fixation**; the literature still has **no consensus** on the optimal regimen, so the one element kept deliberately cautious and keyed to radiographic healing is **active/resisted rotation and rotator-cuff loading**, because that is the movement that stresses the healing tuberosity fragments.

2. POST-OPERATIVE PROTOCOLS ARE HIGHLY HETEROGENEOUS, BUT CONVERGE ON SHORT IMMOBILISATION AND EARLY PASSIVE ROM

The best summary of practice is a **systematic review of 45 cohorts (40 articles, 3,507 patients, 3,519 fractures)** (Budharaju et al., *Shoulder Elbow*, 2024). Across studies:

- **Sling immobilisation averaged 3.1 weeks** (most commonly 3 weeks; range 0–6).
- **Passive ROM began at ~0.9 weeks** on average (most commonly at 2 days).

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- **Active ROM began at ~2.5 weeks** on average (most commonly at 3 weeks).
- **Strengthening began at ~5.5 weeks** on average (most commonly at 6 weeks).

The authors emphasised **substantial variability regardless of management**, concluded that this heterogeneity limits cross-study comparison, and noted that **early mobilisation may produce superior function** – supporting consideration of *shorter* immobilisation. The synthesis page’s “~3 weeks in the sling, then wear” reflects this averaged convention, not a trial-proven optimum. *Moderate for the descriptive pattern; weak/consensus for any specific timetable.*

3. PROGRESSION IS GOVERNED BY FRACTURE STABILITY AND HEALING, NOT THE CALENDAR – BECAUSE OF THE TUBEROSITIES AND BIOLOGICAL COMPLICATIONS

The locking plate is strong immediately; what limits the rehab is the bone. Two facts anchor the “wait-for-healing” rule:

- **Tuberosity / cuff loading.** When the tuberosities are part of the fracture, loading the rotator cuff (forced/resisted external rotation and resisted cuff work) too early risks displacing fragments before they unite. This is the explicit reason the early phases keep rotation cautious and defer cuff loading until healing, even though early active elevation in a pain-free range is permitted; where the tuberosities are uninvolved or solidly fixed, the surgeon may clear cuff loading sooner.
- **The major complications of locking-plate ORIF are largely biological and mechanical, and several are loading- and reduction-sensitive.** A systematic review (Thanasas / Brorson-class series) reports the commonest complications as **intra-articular screw perforation (~9–12%), varus collapse (~6.8%),** loss of reduction, **avascular necrosis of the humeral head (~4.6%, reported range 0–15%),** subacromial impingement (~5%), adhesive capsulitis (~4%), nonunion (~1.5%) and deep infection (~1.4%). Screw perforation and avascular necrosis frequently coincide, because a head that collapses or undergoes AVN lets fixed-length locked screws migrate into the joint. *Moderate (pooled observational series).*

This complication profile is why progression waits on radiographs: premature loading risks tipping a borderline reduction into varus collapse or screw cut-out. Some surgeons even advocate **early planned plate removal** to avoid secondary screw penetration once the head shows AVN/collapse (Dimitriou et al., *J Orthop*, 2019) – a salvage strategy, not part of routine rehab, but it illustrates how mechanical and biological failure interact.

4. WHO IS OFFERED ORIF AT ALL – THE OPERATIVE-VERSUS-NON-OPERATIVE DEBATE (PROFHER AND AFTER)

The single most influential trial is **PROFHER** (Rangan et al., *JAMA*, 2015; 250 patients, 32 UK centres, displaced fractures involving the surgical neck): surgery showed **no important difference** in Oxford Shoulder Score versus sling-based non-operative care over 2 years, and was more expensive. The **5-year follow-up** (Handoll/Keding et al., *Bone Joint J*, 2017) **confirmed no significant difference** in shoulder function or quality of life persisting to 5 years. A smaller RCT in **displaced 3-part fractures in the elderly** (Fjalestad et al., *J Shoulder Elbow Surg*, 2012) similarly found no functional advantage to internal fixation over non-operative care in that group, and a **systematic review and meta-analysis** (Beks et al., *J Shoulder Elbow Surg*, 2018) found no clear superiority of operative treatment across observational and randomised data combined. *Strong (multiple RCTs + SR-MA).*

The clinical upshot – and the reason this matters to a rehab page – is that **ORIF is selectively indicated**, typically in younger patients, in fractures where reduction and stable fixation are achievable and worthwhile, and where the alternative (non-operative care or arthroplasty) is judged less favourable. The decision is individualised; “difficulty in decision-making” for displaced fractures is itself documented as affecting outcomes (Okike et al., *J Shoulder Elbow Surg*, 2018). Patients should understand that being offered ORIF is a considered judgement, not an automatic consequence of the fracture.

5. ADJACENT REHABILITATION EVIDENCE (NON-OPERATIVE IMMOBILISATION DURATION)

Although it concerns *non-operatively* treated fractures, a relevant **randomised controlled trial** (Tanji et al., *J Bone Joint Surg Am*, 2021) compared **1 versus 3 weeks of immobilisation** and supports the broad theme that **earlier movement is at least as good as longer immobilisation** for many proximal humerus fractures. It does not directly govern the post-ORIF protocol but reinforces the same direction-of-travel away from prolonged slings. *Moderate (RCT, non-operative population)*.

Phased post-operative timeline (consistent with the synthesis page)

Phase	Window	Sling	Shoulder motion	Strengthening	Governing rule
I – Protection & early passive motion	Weeks 0–6	Full-time ~3 weeks, then weaned; off for exercises/hygiene; not in bed	Early active-assisted/ active elevation permitted in a pain-free range from the outset (supine-start → upright); passive as needed; pendulums; elbow/wrist/hand active. ER kept to a gentle ~30–40° default; rotation cautious – defer active/resisted cuff work until tuberosities heal (surgeon-guided)	None at the shoulder (deltoid/periscapular isometrics as comfort allows)	Protect fixation + tuberosities; settle pain/swelling
II – Regaining active movement	Weeks 6–12	Discarded by the 6-week review at the latest	Active-assisted → active in all planes (supine-start elevation); submaximal cuff/deltoid isometrics once healing confirmed	Light elbow/scapular work; no resisted cuff work until union (typically not before 8–12 weeks)	Radiographic healing at the ~6-week review gates active motion

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Phase	Window	Sling	Shoulder motion	Strengthening	Governing rule
III – Strengthening	~Months 3–4½	Off	Full active ROM in all planes, including behind-the-back	Graded bands → light free weights (~0.5–2 kg) for cuff, deltoid, scapula	Union confirmed; symptom-guided load progression
IV – Return to full activity	~4½–6 months	Off	Full, with dynamic/overhead drills as relevant	Heavier resistance, compound + sport/work-specific	Return-to-task agreed with surgeon/physio, not the calendar

The phase **boundaries are individualised at Dr Hirpara’s reviews on the basis of X-ray healing** – this is the operative consequence of the “stability- and healing-governed, not calendar-governed” principle.

Key controversies / evidence quality

- 1. Early active versus delayed (protected) mobilisation after ORIF.** A single RCT (Loew 2025) found unrestricted early active motion non-inferior to 4-week immobilisation at 24 months, and the broader literature leans toward shorter immobilisation. **The protocol here aligns with that early-active-motion evidence:** early active and active-assisted elevation in a pain-free range is permitted for stable fixation, rather than holding the shoulder passive-only for six weeks. Because there is still **no consensus** and **no large confirmatory trial** (protocols remain heterogeneous – Budharaju 2024), the protocol keeps one deliberate, evidence-aware caution: **active/resisted rotation and cuff loading** is keyed to radiographic tuberosity healing rather than released wholesale on day one. *Moderate evidence, unsettled.*
- 2. Operative versus non-operative treatment of displaced fractures.** PROFHER (2015) and its 5-year follow-up (2017), plus an elderly-3-part RCT (Fjalestad 2012) and a meta-analysis (Beks 2018), found **no clear functional benefit of surgery on average** – which is why ORIF is selectively, not routinely, offered. The trials enrolled broad/older populations; the subgroup most likely to benefit from fixation (younger patients, good bone, reconstructable head-preserving fractures) is exactly where this operation is concentrated. *Strong evidence overall; subgroup benefit remains debated.*
- 3. The post-operative rehab protocol itself is consensus/expert.** No high-level RCT defines the optimal phase structure, ROM limits or strengthening onset after ORIF. The timings here are drawn from published surgeon protocols and the systematic-review averages, individualised at review. *Weak/consensus.*

Evidence-strength flags (summary)

- **STRONG (RCT / SR-MA):** operative versus non-operative equivalence on average for displaced fractures (PROFHER 2-yr JAMA 2015 + 5-yr Bone Joint J 2017; Fjalestad 2012 RCT; Beks 2018 SR-MA).
- **MODERATE (single RCT / pooled series):** early active motion non-inferior to immobilisation after ORIF at 24 months (Loew 2025 RCT); 1-vs-3-week immobilisation non-operatively (Tanji 2021 RCT); locking-plate complication profile – screw perforation, varus collapse, AVN, etc. (pooled observational series); descriptive practice pattern of short sling + early passive ROM (Budharaju 2024 SR of 45 cohorts).
- **WEAK / CONSENSUS:** the specific **phased rehabilitation timetable** after ORIF (no defining rehab RCT; published surgeon protocols + systematic-review averages; progression individualised by radiographic healing).

Citations

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- Difficulty in decision making in the treatment of displaced proximal humerus fractures: the effect of uncertainty on surgical outcomes. *J Shoulder Elbow Surg.* 2018. DOI: 10.1016/j.jse.2017.09.033

LITERATURE (URLS)

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- Budharaju A, Hones KM, Hao KA, et al. Rehabilitation protocols in proximal humerus fracture management: a systematic review. *Shoulder Elbow.* 2024;16(4):449–458. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11437559/> (45 cohorts; sling 3.1 wk, passive 0.9 wk, active 2.5 wk, strengthening 5.5 wk; early mobilisation may improve function)
- Rangan A, et al. (PROFHER). Surgical vs nonsurgical treatment of adults with displaced fractures of the proximal humerus: the PROFHER randomized clinical trial. *JAMA.* 2015;313(10):1037–1047. <https://pubmed.ncbi.nlm.nih.gov/25756440/> (250 patients; no important difference in Oxford Shoulder Score at 2 years)
- Complications associated with locking plate of proximal humerus fractures (systematic review of complication rates). PMC. <https://pmc.ncbi.nlm.nih.gov/articles/PMC5858203/> (screw perforation ~9–12%, varus collapse ~6.8%, AVN ~4.6%)
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PUBLISHED REHABILITATION PROTOCOLS (PATIENT-GUIDANCE – BASIS FOR THE PHASE STRUCTURE)

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