CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

# Scaphoid Fixation

## Scaphoid Fixation — Fracture Fixation Outcomes & Post-operative Rehabilitation (Headless Compression Screw ± Bone Graft)

**Topic scope:** post-operative rehabilitation after **internal fixation of a scaphoid fracture with a buried headless compression screw** — percutaneous or open, for an **acute** fracture or for a **nonunion** (the latter usually with **bone graft**, e.g. distal-radius cancellous or vascularised graft). This is a *fixation of a slow-healing bone*, not a soft-tissue repair: rehabilitation is paced by **bone union** rather than by tendon/ligament healing windows, and the central tension is between the early-motion advantage that rigid screw fixation buys and the scaphoid's biological tendency to heal slowly and, when neglected, to fail to unite.

> *Defining principle of the rehab here: the scaphoid has a tenuous retrograde blood supply (it fills from distal to proximal), so it heals slowly and the proximal pole is at risk of delayed union, nonunion and avascular necrosis. A headless compression screw compresses and stabilises the fracture, which is what permits earlier protected wrist motion than a cast alone and earlier return to work/sport in suitable fractures. But the construct does not change the bone's biology: grip, loading and contact sport remain union-gated — held back until the surgeon confirms healing, commonly on CT. Progression is therefore fixation- and fracture-dependent: a stable, screw-fixed acute waist fracture mobilises early; a proximal-pole fracture, a nonunion, or a bone-grafted case is treated more cautiously. The hand therapist follows the plan for the specific fracture and fixation.*

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# A. FIXATION OUTCOMES (acute fixation, and nonunion fixation with graft)

Headless compression screw fixation is a reliable operation with high union rates; the principal debates are *who* should be fixed acutely (vs cast) and how aggressively to mobilise, not whether the screw works.

- **Headless compression screws give high union rates and earlier mobilisation.** Internal fixation of scaphoid fractures with headless compression screws achieves high union in both non-displaced and displaced fractures, with the added benefits of **earlier mobilisation and earlier return to work and sport** compared with cast treatment [Fowler & Ilyas, *Hand Clin* 2010; Fowler & Hughes, *Clin Sports Med* 2015]. *Moderate (narrative/technique reviews + cohort).*
- **Percutaneous screw fixation unites faster than cast for acute waist fractures.** A randomised trial of 60 acute scaphoid-waist fractures found percutaneous Acutrak screw fixation reached union significantly faster than cast immobilisation (**~9.2 vs ~13.9 weeks**), with a trend to fewer nonunions [Bond et al., *J Bone Joint Surg Br* 2008]. *Moderate–strong (RCT, single-centre).*
- **But surgery vs cast for minimally displaced waist fractures gives equivalent long-term function at the cost of more complications.** The pragmatic multicentre **SWIFFT** RCT (bicortical, ≤ 2 mm displaced waist fractures) found **no meaningful difference in wrist function** between early surgical fixation and cast immobilisation (with fixation reserved for the cast fractures that failed to unite), while **surgery carried more complications.** Systematic reviews/meta-analyses concur: surgery favours union but raises complication risk, with ROM, grip and arthritis rates not significantly different [Dias et al., SWIFFT, *Lancet* 2020; Alshryda et al., *The Surgeon* 2012; Modi et al., *Injury* 2009; Rhemrev et al., *Injury* 2009]. *Strong (RCT + SRs).*
- **Nonunion fixation with bone graft restores union in most cases but heals slower.** Scaphoid nonunions treated with screw fixation and bone grafting (non-vascularised distal-radius, vascularised distal-radius, or two-screw constructs) achieve union in the large majority, with proximal-pole and avascular cases the hardest. Acute fixation unites ~100% vs chronic/nonunion ~87% in pooled experience [Garcia et al., *J Hand Surg Am* 2014; Ribak et al., *Int Orthop* 2009; Kim et al., *Orthop Traumatol Surg Res* 2018; Wu et al., *Bone Joint J* 2022; Simonian & Trumble, *JAAOS* 1994]. *Moderate (cohort/SR).*
- **The elite/competitive athlete is a distinct decision.** Early screw fixation is often favoured in athletes to compress the fracture, shorten immobilisation and enable earlier (often splinted) return to play, accepting the surgical risk for the time advantage [Belsky et al., *Hand Clin* 2012; Fowler & Hughes, *Clin Sports Med* 2015]. *Moderate (expert/cohort).*

# B. REHABILITATION / THERAPY EVIDENCE

The rehab questions are (1) how soon to mobilise the wrist after rigid fixation, (2) when to permit loading/grip, and (3) when to confirm union and clear sport. The evidence supports **early protected motion under the**

**screw** but keeps strengthening and sport **union-gated**, with proximal-pole/nonunion cases handled more conservatively.

- **Rigid screw fixation permits earlier protected wrist motion than cast-alone.** The mechanical rationale is that compression across the fracture confers stability, allowing the wrist to begin gentle motion while the bone unites; reported acute-fixation pathways start gentle mobilisation early with a ~2-week wound/therapy review and ~6-week radiographic check [Fowler & Ilyas, *Hand Clin* 2010; Fowler & Hughes, *Clin Sports Med* 2015]. *Moderate (technique/expert).*
- **Union is the gate for loading — and it is slow and imaging-confirmed.** Reported time to union ranges **~7–16 weeks** depending on healing criteria, fracture site and population (athletes vs general), and CT is frequently used to confirm union before clearing loading and sport because plain films overestimate healing [Ecker, *Hand Clin* 2017 (scaphoid union); Fowler & Hughes, *Clin Sports Med* 2015]. *Moderate.*
- **Proximal-pole fractures, nonunions and grafted cases progress more slowly.** The proximal pole's poor vascularity means later union and a more cautious return; arthroscopic and open grafting series for nonunion report union but over longer timeframes [Wu et al., *Bone Joint J* 2022; Shih et al., *J Orthop Surg Res* 2023; Garcia et al., *J Hand Surg Am* 2014]. *Moderate (cohort).*
- **Percutaneous/antegrade technique is a safe route that supports the early-motion pathway.** The percutaneous antegrade approach minimises soft-tissue insult and supports the earlier-mobilisation rationale in suitable fractures [Weinberg et al., *Injury* 2009]. *Moderate (cohort).*

## RECOVERY TRAJECTORY (EXPECTED, EVIDENCE-ANCHORED)

| Phase | Window | Restraint | Hand use / therapy focus | Strength / load | Notes |
|---|---|---|---|---|---|
| **I – Protected early motion** | **Week 0–2** | Wrist splint/ short cast; no wrist loading | Immediate active finger/thumb/ elbow/shoulder ROM; oedema control; wound review ~2 wk | None through the wrist | Hand kept supple; scaphoid undisturbed |
| **II – Protected wrist mobilisation** | **Week 2–8 (union-gated)** | No grip/ loading; avoid end-range/forced extension | Gentle active wrist flexion-extension and deviation in pain-free range; gradual progression; forearm rotation; scar massage once healed | No resisted/ grip work | For *stable, screw-fixed acute waist* fractures. **Proximal-pole/ nonunion/ grafted: immobilise longer, mobilise later** |
| | **After confirmed union** | | Grip/putty → progressive resisted wrist/ | | Contact/load sport union-gated, typically |

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| Phase | Window | Restraint | Hand use / therapy focus | Strength / load | Notes |
|---|---|---|---|---|---|
| **III – Strengthening & return** | **(commonly ~8–12 wk acute waist; later for proximal pole/ nonunion)** | Restrictions lifted on union | forearm → loaded & sport-specific | Graded to symmetrical grip | **not before ~3–4 months**, later for high-risk fractures; CT often confirms union |

*(Phase windows are typical guides for a stable screw-fixed acute waist fracture, not trial-derived deadlines; proximal-pole, nonunion and bone-grafted fixations are paced more conservatively by the surgeon and hand therapist.)*

# C. KEY CONTROVERSIES / EVIDENCE QUALITY

1. **Screw fixation vs cast for the *acute* minimally displaced waist fracture.** Fixation unites faster (Bond RCT: ~9 vs ~14 weeks) and returns athletes/workers sooner, but SWIFFT and meta-analyses show **equivalent long-term wrist function with more complications from surgery** for minimally displaced waist fractures. The defensible position is selective fixation (displacement, proximal pole, high-demand athlete/worker, patient preference) rather than routine surgery for every undisplaced waist fracture [Dias SWIFFT *Lancet* 2020; Bond *JBJS Br* 2008; Alshryda *Surgeon* 2012; Modi/Rhemrev *Injury* 2009]. *Strong evidence of functional equivalence; moderate on the complication trade-off.*
2. **Early motion vs continued immobilisation after fixation.** Rigid compression is the rationale for earlier protected wrist motion than cast-alone, and reported pathways mobilise early – but there is no high-certainty trial defining the *optimal* mobilisation schedule, so timing is **surgeon/ therapist protocol** and fracture-dependent. *Weak–moderate (mechanism strong, scheduling consensus).*
3. **When is it united – and what confirms it.** Time to union is wide (~7–16 weeks) and plain radiographs overestimate healing; **CT is commonly used to confirm union** before clearing loading and sport, which is the true gate for progression [Ecker *Hand Clin* 2017]. *Moderate.*
4. **Return-to-sport timing.** Union-gated and fracture-dependent; competitive athletes may return earlier in a protective splint/cast at surgeon discretion, accepting risk, whereas proximal-pole and nonunion cases return later. Reported real-world return is typically **months**, not weeks [Belsky *Hand Clin* 2012; Fowler & Hughes *Clin Sports Med* 2015]. *Moderate (expert/cohort).*
5. **Nonunion and proximal-pole biology.** The retrograde blood supply drives delayed union, nonunion and AVN risk; grafting (cancellous, corticocancellous, or vascularised) addresses biology but lengthens the timeline. Persistent pain or doubtful union warrants reassessment rather than more loading [Garcia *JHS Am* 2014; Ribak *Int Orthop* 2009; Kim *OTSR* 2018; Wu *BJJ* 2022; Simonian & Trumble *JAAOS* 1994]. *Moderate.*

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# D. EVIDENCE STRENGTH FLAGS (summary)

- **STRONG (RCT / SR):** equivalent long-term wrist function from surgery vs cast for minimally displaced acute waist fractures, with more complications from surgery (SWIFFT + meta-analyses); faster union with percutaneous screw fixation than cast (Bond RCT, ~9 vs ~14 weeks).
- **MODERATE:** high union rates and earlier mobilisation/return with headless compression screws; nonunion union rates with screw + bone graft (acute ~100% vs chronic ~87%); wide ~7–16-week union window and CT confirmation of union; athlete-specific early/splinted return.
- **WEAK / CONSENSUS:** the specific **early protected-motion, union-gated phase schedule** (mechanistically rationalised by rigid compression; exact timings are surgeon/hand-therapist protocol and fracture-dependent, not trial-derived); precise return-to-sport months.

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