CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

PATIENT INFORMATION — IN DEPTH

Suture Anchors and How Repairs Are Held to Bone

What is it

A suture anchor is a small device that holds stitches into bone. It solves a problem that stitches alone cannot: you can sew soft tissue to soft tissue, but you cannot sew soft tissue to bone. The anchor provides something for the stitches to hold on to.

Almost every repair in the shoulder uses them. When a rotator cuff tendon is reattached, when a torn labrum is put back onto the rim of the socket, when a ligament is reattached after a dislocation — in each case an anchor is placed into the bone and its stitches are passed through the tissue and tied down.

The anchor is not what holds the repair together in the long run. It holds the tissue still against the bone for the weeks it takes the two to knit together biologically. Once healing has happened, the join is living tissue, not hardware.

What it's made of

Anchors have been made from several different materials over the years, and the field has moved through them in a fairly clear sequence.

The earliest were **metal** — usually titanium. They held extremely well but stayed in the bone permanently and showed up on every X-ray afterwards, which made later imaging harder to interpret.

Bioabsorbable anchors followed, made from polymers designed to dissolve over a few years. The intention was sound, but some of the early materials broke down unpredictably and could leave a cavity in the bone or provoke inflammation.

PEEK — a strong medical-grade plastic — is widely used now. It does not dissolve, but it does not show up on X-ray and its stiffness is closer to bone than metal is.

All-suture anchors are the newest, and are now in widespread use in the shoulder. There is no rigid body at all: a small sleeve of suture material is passed into a narrow hole and then tightened so that it bunches up and grips inside the bone. The hole needed is considerably smaller than for a solid anchor, so much less bone is removed.

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The stitches themselves have changed as much as the anchors. Modern sutures are braided from an extremely strong polyethylene fibre, and are now stronger than the tendon they hold.

How your surgeon uses it

Anchors are used in several quite different shoulder operations, and what the surgeon is trying to achieve is not the same in each.

ROTATOR CUFF REPAIR

Here the job is to hold a broad, flat tendon down onto an equally broad area of bone — the footprint — so the two can knit together across that whole surface.

There is more than one reasonable way to arrange this, and practice differs between surgeons. A **single-row** repair places one line of anchors along the edge of the bone where the tendon should sit. A **double-row** or **suture-bridge** construct adds a second row further down the bone, so the stitches from the inner row are carried outwards and tensioned over the tendon, pressing a broad surface flat against the bone rather than holding it at a few points.

The second arrangement is thought to favour healing, and it does produce fewer retears on follow-up scans — but as the evidence below sets out, that advantage shows up more reliably on the scan than in how shoulders actually feel. Which is used depends on the size and shape of the tear, the quality of the bone and tendon, and the judgement and training of the individual surgeon.

LABRAL REPAIR

The labrum is a rim of cartilage around the edge of the shoulder socket. It is not being held onto a flat surface but reattached to the edge of one, so the anchors are smaller and are placed around the rim of the socket, usually three or four of them, with the stitches passed around the labrum to draw it back against the bone.

This is the repair done for shoulder instability after a dislocation, where the labrum has been torn off the front of the socket. The socket is small and the bone is thin, so anchor size and how much bone each one takes up matter more here than almost anywhere else in the shoulder — which is part of why all-suture anchors have been taken up readily for this operation.

BICEPS TENODESIS (LOOP AND TACK)

Sometimes the long head of biceps tendon is detached from inside the joint and reattached to the arm bone a little lower down. The requirement is different again: not spreading a tendon over a surface, and not restoring a rim, but holding one cord-like tendon securely at a single point while it heals into the bone.

One straightforward way to do this is often called **loop and tack**. A stitch is passed around the tendon and locked onto itself, so it grips the tendon like a noose rather than relying on the thread pulling through tendon fibres. That loop is then tacked down to the bone with a single small anchor.

The alternative approach wedges the tendon into a drilled socket with a screw. Loop and tack avoids drilling a socket of that size, so less bone is removed, and the grip on the tendon comes from the looped stitch rather than from compression against a screw.

A NOTE ON KNOTS

In any of these repairs, the stitches may be tied in knots, or held by a locking mechanism built into the anchor so that no knot is needed. Both are in routine use, and the evidence does not favour either.

What to expect

The anchors stay in. They are not removed once healing is complete, and they do not need to be. Removing them would mean another operation and would take bone with them.

They will not set off airport scanners. All-suture and PEEK anchors contain no metal at all. Even titanium anchors are far too small to trigger a walk-through detector.

You can have an MRI. Anchors in current use are MRI-safe. Metal anchors can cause a local blur on the image near the anchor, which is one of the practical advantages of the newer materials — the scan is easier to read if your shoulder ever needs imaging again.

They are not what limits your recovery. The anchor is secure from the moment it is placed; it is the tendon-to-bone healing that takes months, and that is what your sling and rehabilitation timeline are protecting. Recovery follows the timeline of the operation itself, so see the page for your specific procedure.

Occasionally an anchor can loosen or pull out, most often in soft bone. This is uncommon, and it is one of the reasons the choice of anchor is matched to the quality of your bone.

What the evidence says

The honest summary is that anchors work well and that the differences between the various types and techniques are smaller than the amount written about them would suggest.

All-suture anchors hold as well as solid anchors in testing and in patients, while removing less bone — which is the main reason for the shift towards them. Comparisons of the newer suture tapes against conventional round sutures have not shown a clear clinical advantage, despite a sound theoretical case for them. Tying knots and using knotless designs give much the same result.

Double-row repairs do appear to improve the chance of the tendon healing to bone on a follow-up scan, but that has not translated into a clear difference in how shoulders feel and function. That gap between what the scan shows and what the patient reports is a recurring theme in shoulder surgery.

The materials story is the one place where the evidence is genuinely one-sided: the early bioabsorbable anchors produced meaningfully more problems than what replaced them, which is why they are largely no longer used.

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If you want the detail — how anchors developed, what the sutures are actually made of, and how all this compares with the older technique of passing stitches through tunnels drilled in the bone — that is in the section below.

In more depth

This section goes further than you need for your own treatment decisions. Anchors are worth the extra reading because they are the clearest example in shoulder surgery of engineering outrunning biology: over four decades the fixation has become far stronger, and the thing that fails has moved each time — from the stitch, to the anchor, to the tendon itself.

THE PROBLEM ANCHORS SOLVE

Sewing tendon to tendon is straightforward. Sewing tendon to bone is not, because bone will not hold a stitch — the thread simply cuts through the surface.

The original solution was **transosseous repair**: drill tunnels through the bone and pass the sutures through them, so the thread is anchored around a bridge of solid bone rather than gripping its surface. Done open, this was the standard for decades and it worked.

Arthroscopy is what displaced it. Through keyhole portals you cannot reliably drill and thread a tunnel across a piece of bone you can only see from one side. The anchor exists because it lets a surgeon achieve fixation from a single direction, through a portal — not because it was shown to be better than tunnels.

That distinction matters, because the comparison has since been done. Biomechanically, anchor fixation produces **less gap formation under cyclic loading** than transosseous repair, with **no significant difference in ultimate load to failure** [1]. And now that arthroscopic techniques have been developed to recreate bone tunnels without an implant, the clinical comparison is available too: arthroscopic transosseous repair gives **comparable clinical and structural outcomes** to anchor repair, its only measured advantage being slightly better recovery of abduction [2].

So the tunnel was never really beaten. It was made impractical by the shift to keyhole surgery, and it is now partly returning.

FOUR GENERATIONS OF ANCHOR

Metal. The first anchors were titanium or stainless steel, and they held superbly. Their drawbacks were downstream: they stay in the bone permanently, and they scatter on later imaging, which matters in a joint likely to be scanned again.

Bioabsorbable. Polymer anchors designed to dissolve over a few years followed, and the shift was rapid and near-total — a 2007 review describes a **major shift from metallic to bioabsorbable** anchors, attributing it to higher complication rates with metal [3].

That verdict did not entirely survive contact with the polymers themselves. The early poly-L-lactic-acid materials degraded slowly and unpredictably, and could provoke inflammation, leave a fluid-filled cavity in the

bone, or shed fragments into the joint. The more measured assessment a few years later was that bioabsorbable anchors remain **safe and reproducible**, with complications amounting to **a fraction of the total implanted** – while emphasising that **meticulous insertion technique** is what keeps them that way [4]. Both reviews stress the same specific point: the anchor must be **sunk below the level of the cortex**, because a proud anchor abrades whatever passes over it [3].

PEEK. A high-performance thermoplastic that is radiolucent, non-degrading, and closer to bone in stiffness than metal is. It is now the standard solid-anchor material, and is worth a section of its own below.

All-suture. The current generation abandons the rigid body entirely. A sleeve of suture material is passed through a small drill hole and then tensioned so that it deforms and locks against the inner wall of the bone.

Across the design generations the raw numbers improved sharply – newer anchors showed **markedly increased load-to-failure strengths** – with the important caveat that an anchor which fails by **pulling out at low load risks becoming a loose body inside the joint** [5].

WHAT PEEK ACTUALLY IS

Polyether ether ketone is a semi-crystalline thermoplastic from the polyaryletherketone family. It is not a plastic in the everyday sense: it is used in aerospace and in spinal implants, it melts around 340°C, it tolerates repeated steam sterilisation, and it is chemically inert in the body.

Three properties explain why it displaced both metal and the early absorbables as a solid-anchor material.

It is radiolucent. PEEK does not show on X-ray and produces no scatter on CT or MRI. A shoulder repaired with PEEK anchors can be imaged afterwards and read cleanly – a genuine advantage in a joint that may well be scanned again.

Its stiffness is close to bone. PEEK's elastic modulus is in the region of cortical bone, where titanium's is roughly ten times higher. A very stiff implant in less stiff bone concentrates stress at the interface; matching the modulus more closely spreads it.

It does not degrade. Unlike the absorbable polymers it replaced, PEEK does not break down, so there is no resorption phase during which the anchor weakens or the body reacts to its breakdown products.

WHAT PEEK DOES TO BONE, WHICH IS NOT NOTHING

The natural assumption is that an inert, non-degrading material provokes no biological response. The imaging evidence complicates that.

Perianchor cysts – fluid-filled cavities in the bone immediately around the anchor – occur with every anchor type. Comparing all-suture, bioabsorbable and PEEK anchors across **213** repairs, cysts formed in **10.8%** of cases overall, with **no significant differences between the three materials** in clinical scores, retear rates or perianchor bone reaction [6].

A more granular comparison is less flattering to PEEK. Across **73** repairs, despite both being non-absorbable, **all-suture anchors produced less osseous reaction than PEEK** – with the authors concluding that anchor choice should weigh not only initial fixation strength but the **post-operative biological response** [7].

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The reassuring part is what those cysts appear to mean. Around PEEK anchors specifically, cyst formation **stabilises by six months** and shows **no association with functional scores or with retear** [8]. So this is a radiographic finding rather than a clinical problem – which matters mainly because it will be reported on your scan and can look alarming.

Where it does have consequences is revision. Anchorless transosseous repair, which leaves no implant at all, **avoids peri-implant cyst formation entirely** – and the authors argue the real advantage is in **the prospect of additional surgery**, where undisturbed bone gives more options [9]. That is the same bone-stock argument that drives the move to all-suture anchors, arrived at from a different direction.

WHY ALL-SUTURE ANCHORS WON ON BONE, NOT ON STRENGTH

The intuition is that a soft anchor must be weaker than a solid one. It is not. All-suture anchors have **similar or better mechanical properties than regular anchors**, with a low-profile design that **preserves bone tissue**, and clinical series show satisfactory results with low complication rates [10].

The real argument for them is the hole. A solid anchor needs a socket sized to its body; an all-suture anchor needs a hole roughly half the diameter. In the greater tuberosity – where the bone is often soft, and where a revision may one day need somewhere fresh to place fixation – how much bone was removed the first time is a genuine consideration.

The clinical evidence supports using them where it matters most. Double-row suture-bridge cuff repair using **all-suture anchors for the medial row** produced **similar excellent outcomes** to the same repair using solid medial-row anchors [11].

They are not free of the cyst phenomenon either – around **40%** of patients after double-row suture-bridge repair with all-suture anchors, with a **low anchor insertion angle** and a **large mediolateral tear** identified as risk factors [12]. That insertion-angle finding is a technical point with a practical edge: how the anchor is aimed is something the surgeon controls.

THE SUTURE BECAME THE STRONGEST PART, AND THAT MOVED THE PROBLEM

The less visible revolution is in the thread. Modern sutures are braided from ultra-high-molecular- weight polyethylene – the FiberWire class of materials – and the result is a suture substantially stronger than the tissue it passes through.

This solved one problem and created another. Repairs no longer fail by the suture snapping. They fail by the suture **cutting through the tendon**, like cheese wire – which is why so much design effort has gone into spreading the load rather than increasing strength further.

Flat **suture tape** is the direct response: a wider footprint against the tendon means lower pressure per unit area for the same tension. The theory is sound and the laboratory agrees. The patients do not, quite: although **biomechanically superior**, suture tapes showed **similar retear rates and postoperative function** to conventional round sutures [13].

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That is worth sitting with, because it is the same pattern as the anchor comparisons. Once fixation is strong enough, making it stronger stops changing the outcome — the limiting factor has become the biology of tendon healing to bone, which no implant addresses.

CONFIGURATION: WHERE THE REMAINING DIFFERENCES ARE

Single-row repair places one line of anchors at the tendon edge. Double-row and suture-bridge constructs add a second, more lateral row, compressing a broad area of tendon against bone. Across the evidence, **double-row and suture-bridge repairs have lower retear rates than single-row repair** in most tear-size categories, with **no difference between double-row and suture bridge** [14].

Knot-tying versus knotless designs show **no significant difference in retear rates** [15].

TWO WAYS A REPAIR FAILS, AND ONLY ONE OF THEM IS FIXABLE

This is the most consequential thing in this section, and it is rarely explained to patients. A cuff repair that fails does not simply "fail" — it fails in one of two patterns, and they have very different implications.

Type 1 is failure at the footprint. The tendon pulls off the bone where it was reattached, at the repair site itself. The tendon substance remains intact and still reaches the bone.

Type 2 is failure at the medial row — the tendon tears through at the suture line where the medial anchors hold it, typically at or near the musculotendinous junction, **while the tendon attached to the footprint remains healed to the bone**. On MRI this looks paradoxical: a well-healed footprint with a defect medial to it.

The original description of these patterns compared techniques directly. Suture bridge **better preserved the cuff tissue repaired to the insertion site** than single-row did — but the retears that did occur with suture bridge were **mainly at the musculotendinous junction**, whereas single-row tended to fail directly at the footprint [16]. Imaging work after double-row repair found the same signature: complete tearing **around the medial-row anchors with a well-repaired tendon on the footprint** [17].

So the stronger construct did not abolish failure. It relocated it. Pooled across techniques, **double-row and suture-bridge repairs increase the risk of medial cuff failure**, and the authors note that technique modifications can reduce it [18].

Why Type 2 is the worse problem. Two reasons, and the second is the one that matters most.

Functionally, it does worse: in a series of **373** repairs with a retear rate of **15.6%**, **type 2 failures showed significantly inferior functional outcomes** [19].

Anatomically, it is much harder to revise. A Type 1 failure leaves a tendon of full length that has simply detached — there is tissue to grasp, mobilise and reattach. A Type 2 failure has destroyed tendon substance at the medial row, so what remains is a shorter, often retracted tendon with the good, healed portion of it still fixed to the bone laterally. Revision then means working with less tendon than the original operation had, and pulling what is left further across a gap it cannot comfortably reach. In some cases direct repair is no longer possible at all, and the conversation moves to reconstruction, tendon transfer or reverse replacement.

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That asymmetry is the reason technique modifications aimed specifically at reducing medial-row strain — avoiding over-tensioning, medial knot placement, and how the medial row is loaded — receive the attention they do. Not because Type 2 is common, but because it forecloses options.

ONE CONSTRUCT, NAMED

To make this concrete, one specific construct: Dr Hirpara uses a medial row of **all-suture anchors** — the JuggerKnot (Zimmer Biomet) — placed at the articular margin, with the sutures carried laterally and secured by a lateral-row anchor, the **Quattro** (Zimmer Biomet), in the tuberosity. Other surgeons use different implants and different configurations, and this is offered as an illustration of the reasoning rather than as a recommendation.

The logic follows everything above. The medial row goes where bone quality is poorest and where sparing bone matters most, so a soft anchor with a small hole is used. The lateral row sits in better bone and takes the tensioning load, so a solid anchor is used. It is a construct assembled from the specific strengths of two generations of technology rather than a preference for either.

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